

Motor Speech Conference
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Compensation to Altered Auditory Feedback in Children with Developmental Language Disorder
C. Coughler, E. Hamel, J. Cardy, D. Purcell, L. Archibald

Developmental Language Disorder (DLD), when a child has unexpected problems with using and understanding spoken language, has been hypothesized to have an underlying auditory processing component. In auditory feedback, a speaker's perception of their own voice regulates their speech production. Vocal characteristics regulated can include voice intensity, frequency, and speed. The current study examined whether children with DLD use auditory feedback similarly to their typically developing (TD) peers to regulate their speech production. Participants aged 6-11 years completed a hearing screening, formant frequency resolution task, vowel space task, and altered auditory feedback task with first formant perturbation. Children with DLD tended to compensate more for the positive shift manipulation, and compensated less than TD children in the negative shift condition. Our findings suggest that children with DLD make atypical use of auditory feedback.

Patients with cerebellar degeneration correct for sub-categorical vowel variation even when auditory feedback is blocked.
B. Parrell, S. Nagarajan, R. Ivry, J. Houde

Patients with cerebellar degeneration (CD) are impaired in adapting their motor plans in the presence of sustained perturbations, suggesting a problem with correctly predicting the consequences of the speech motor movements. Moreover, CD patients show an increased sensitivity to externally introduced auditory errors. However, this increased feedback response has only been observed in response to large, externally introduced perturbations. Here, we test whether patients with CD patients show increased corrections for self-produced variability and how masking auditory feedback affects their production. Our results suggest that patients do correct online for self-produced errors, and to a greater degree than controls in single-word utterances. However, this increase was not observed in more realistic,

connected speech. Moreover, this response was not affected by masking noise, suggesting that auditory feedback is not critical for this corrective behavior.

Improved fluency with auditory masking in participants with left inferior frontal lesions
A. Jacks, K. Haley, T. Harmon

Recent work has demonstrated that some adults with acquired speech sound impairment increase their speech rate or decrease disfluencies while listening to masking noise. The purpose of this study was to investigate the relationship between brain lesion characteristics and speech response to auditory masking. Twenty-nine participants produced sentences under normal auditory conditions and while listening to 85 dB pink noise. Speech fluency was quantified with measures of syllable rate and duration of disfluencies, and an index of fluency response derived from summed Tau statistics. Brain lesions were traced for lesion symptom analysis and overlap. Results showed significant overlap amongst responders in left inferior frontal regions and amongst non-responders in inferior parietal and superior temporal regions. A region-of-interest based lesion symptom analysis, correcting for lesion volume, showed that damage to the Rolandic operculum was the best predictor of response to masking.

Developing an evidence-based assessment for childhood dysarthria – Test materials and age norms for auditory parameters
T. Scholderle, E. Haas, W. Ziegler

This study contributes to a feasible and valid assessment of childhood dysarthria by (1) developing child-specific materials for speech elicitation and (2) collecting norms on standard auditory criteria from typically developing (TD) children. We implemented a motivating computer game allowing for the elicitation of repetition sentences and spontaneous speech. 144 TD children and 30 dysarthric children (3-9 years) were assessed. We analyzed their speech perceptually through a standardized diagnostic tool for dysarthria in adults.

The elicitation approach was feasible. By nonlinear regressions modelling the developmental courses of the TD children, we defined ranges of impaired vs. age-appropriate performance. Speech features observed in the TD-group (e.g., breathy voice) must be evaluated with respect to age-norms in dysarthric children. Features not present in the norm group (e.g., monotony) represent age-independent indicators of dysarthria.

Effects of Dual-Focus Speech Treatment on Communication in Children With Dysarthria
E. Levy, Y. Chang, K. Hwang, A. Bahrami, A. Cerva, A. Choi, C. Kraemer, M. McAuliffe

Children with communication disorders due to cerebral palsy experience reduced social participation, yet treatment outcomes for childhood dysarthria are understudied. This study examined effects of Speech Intelligibility Treatment, a treatment designed for children with dysarthria, on communication in 17 English-speaking children with dysarthria. Post-treatment changes in communicative-participation as measured by the FOCUS© outcome tool, and effects on intelligibility, as measured by blinded listeners' ease-of-understanding ratings and orthographic transcription-accuracy, were investigated. Finally, the relationship between change in communicative-participation and intelligibility was assessed. Following this intensive speech-treatment program, children with dysarthria exhibited significant improvements in communicative-participation, but intelligibility change varied. Our findings suggest that this dual-focus treatment may improve communication in some children with dysarthria.

Speech Production in Down Syndrome: Perceptual and Acoustic Results
R. Kent, H. Vorperian, J. Eichhorn, & E. Wilson

The reduced speech intelligibility in Down syndrome involves different speech subsystems and relates to multiple factors including: craniofacial and laryngeal dysmorphologies, motor impairments (hypotonia, dysarthria, apraxia of speech), phonological disorder, disfluency, and hearing loss. This study addresses the complexity by considering the subsystems of speech production keyed to various perceptual and acoustic analyses of speech. The primary purposes are (1) to develop a profile of speech disturbances, and (2) to distinguish the effects of anatomic anomalies from other concurrent disorders. Principal component and latent profile analyses indicate the severity of the perceptually rated speech dimensions to four major factors (from highest to lowest): articulation, suprasegmentals, resonance, and phonation. The perceptual results

are further interpreted with a variety of acoustic analyses, including vowel formants, voice onset time, spectral moments, and MDVP.

Intonational realization of the question-statement contrast in children with dysarthria and cerebral palsy
A. Kuschmann

Dysarthria in children with cerebral palsy (CP) is associated with suprasegmental problems. However, little is known about the children's intonation abilities beyond acoustic measures and their use of intonation to mark linguistic functions such as the question-statement contrast. This study aims to describe how this group uses intonation to mark questions and statements. Eight children with dysarthria and CP and eight typically-developing peers completed a picture description task eliciting question-statement contrasts. The utterances were analysed regarding the inventory and distribution of intonation patterns using the autosegmental-metrical (AM) framework of intonational analysis. Both groups showed a variety of intonation patterns, but they used these differently to mark questions, with the CP group employing level tones instead of rises. Despite this difference, the children with CP successfully marked the contrast using different intonation patterns for questions and statements.

Comparative diagnostic accuracy of acoustic and kinematic measures for
identifying motor speech impairment in primary progressive aphasia
C. Cordella, M. Eshghi, K. Getchell, B. Dickerson, J. Green

In the current study, we derived fifteen acoustic and kinematic measures from a battery of speech tasks to quantify motor speech function in persons with and without progressive motor speech impairment (MSI; N=29), and to compare the diagnostic value of individual speech measures. We used results from the first level of analysis to identify the measures most indicative of MSI in the pilot sample, and to evaluate the diagnostic accuracy of this subset of variables in an independent sample of individuals with primary progressive aphasia (PPA; N=30). Results from the first stage of analysis indicated that rate measures derived from a diadochokinetic (DDK) task had the highest diagnostic accuracy for identifying individuals with MSI. Second stage analyses likewise demonstrated good diagnostic accuracy for DDK rate measures in an independent sample of PPA patients, thereby motivating further investigation of DDK-derived rate measures for differential diagnosis and monitoring of MSI in PPA.

The Use of Lexical Cues in Listener Processing of Dysarthria
A. Fletcher, M. McAuliffe

Changes in the frequency of a word can dramatically affect the likelihood that it is correctly identified in adverse conditions. The number and frequency of phonologically similar words also affects word identification. Studies that measure these lexical cues have traditionally examined speech overlaid with noise, and there is little data available to quantify these effects in dysarthria.

In this study, we compare the strength of different lexical cues on listener processing of speech-in-noise and dysarthric speech. The overall intelligibility of speech samples is matched across conditions. We ask whether the frequency of a word, and the number of closely related phonological neighbors, affects word identification in the same manner across the two speaking conditions.

Results suggest that listeners are more reliant on lexical cues when listening to dysarthric speech as compared to speech-in-noise. We discuss implications for the selection of communication-based treatment strategies.

Speech Sensorimotor Impairment in Aphasia and the Role of Dorsal Stream Network
R. Behroozmand

We investigated the role of dorsal stream network in speech sensorimotor integration and its impairment in individuals with post-stroke aphasia. Aphasic and control subjects performed speech vowel production under altered auditory feedback during event-related potential (ERP) recordings. We found a significant attenuation of the N1 and P2 ERPs in aphasia vs. control. Lesion-mapping analysis revealed that the N1 attenuation was predicted by damage to a network comprising the superior temporal gyrus (STG), supramarginal gyrus (SMG), primary motor cortex (M1), supplementary

motor area (SMA), and anterior cingulate cortex (ACC). P2 attenuation encompassed a lesioned network within the M1, SMA, ACC, as well as the inferior frontal gyrus (IFG). These findings highlight the functional significance of multimodal and distributed brain regions within the dorsal stream network of the left hemisphere for speech sensorimotor integration and their impairment in individuals with post-stroke aphasia.

A comparison of two forms of intensive voice treatment for Parkinson's disease
K. Richardson, J. Huber, B. Kiefer, A. Dalton, S. Snyder

The two current, evidence-based treatments for hypophonia associated with Parkinson's disease (PD), LSVT LOUD and the SpeechVive, use high effort speech tasks to increase motor output across the speech mechanism. While LSVT LOUD and the SpeechVive share the same therapeutic target of increased vocal intensity, they differ substantially in the type of cueing used in therapy. LSVT LOUD targets louder speech using internal, self-initiated cues. The SpeechVive, in contrast, elicits louder speech using a naturalistic, external noise cue. There is evidence to suggest that internal and external forms of cueing may differentially effect motor responses and patient perceptions of physical and mental effort. The present study aims to examine the effect of treatment type on 1) speech and pause characteristics, and 2) perceptions of physical and mental effort in persons with PD. This information could lead to more efficient rehabilitation for persons with PD.

Characterizing conversational entrainment in dysarthria: Current knowledge and future directions
S. Borrie, T. Barrett, J. Liss, V. Berisha

Conversational entrainment, the tendency for communication partners to align their behavior with one another, is considered an important element of productive and fulfilling conversation. Lack of entrainment could, therefore, negatively impact conversational success, contributing to social isolation and diminished quality of life. In recent years, we have systematically expanded investigations of conversational entrainment to dysarthria, combining modeling techniques from the study of entrainment in healthy populations with comprehensive acoustic feature extraction techniques and expert clinical rating of conversation. We have found that, overall, dysarthria, disrupts the seemingly pervasive phenomenon of entrainment, and further, degree of entrainment predicts a measure of conversational success. Thus, current evidence advances entrainment deficits as an important variable in dysarthria; one which may have causative effects on the success of everyday communication.

Auditory-Motor Bases of Voice and Articulatory Impairments in Parkinson's disease
D. Abur, A. Subaciute, A. Daliri, R. Lester-Smith, A. Lupiani, D. Cilento, M. Tardiff, H. Weerathunge, C. Stepp

Individuals with Parkinson's disease (PD) show aberrant responses to both sustained and unexpected manipulations of auditory feedback for the voice and articulatory domains. However, these 'adaptive' and 'reflexive' responses have not been examined comprehensively with respect to auditory discrimination capabilities. Here we examine: 1) adaptive responses to sustained auditory perturbations; 2) reflexive responses to unexpected perturbations; and 3) auditory discrimination. All three are assessed for fundamental frequency (fo) and first formant frequency (F1) in the same speakers, those with PD and controls. Results show qualitative differences between groups. Compared to controls, speakers with PD have: 1) reduced F1 adaptive responses; 2) larger fo reflexive responses and reduced F1 reflexive responses; and 3) reduced acuity to F1, but no differences in acuity to fo. Responses will be analyzed between groups and as a function of PD severity, acuity, and speech intelligibility.

Acoustic Profiles of Speech Motor Control: Towards a Differential Diagnosis of Dysarthria Subtypes
H. Rowe, J. Green

The purpose of this study was to determine the underlying motor deficits that engender speech difficulties in persons with amyotrophic lateral sclerosis (ALS) and those with Parkinson's disease (PD). To characterize speech motor deficits, we developed a framework consisting of novel and existing acoustic measures that assesses five key components of motor performance: rate, precision, speed, consistency, and coordination. Acoustic measures were extracted from audio recordings of 18 healthy controls, 18 participants with ALS, and 18 participants with PD producing syllable sequences. Results revealed significant differences between Late Stage ALS and Late Stage PD, Early Stage ALS and Late Stage ALS, as well as Early Stage PD and Late Stage PD. This framework provides a clinically useful profile of speech motor

control that may eventually increase confidence in differential diagnosis and determining appropriate treatment targets for individuals with speech motor disorders.

Defining meaningful change in communicative participation after intervention for people with Parkinson's disease
C. Baylor, T. Eadie, M. Kapsner-Smith, D. Britton, H. Mach, J. Jin, K. Yorkston

The Communicative Participation Item Bank (CPIB) is a patient-reported measure of the extent to which communication disorders interfere with participation in daily conversational situations. The purpose of this study was to explore clinical utility of the CPIB in terms of stability over time, sensitivity to change with treatment, and clinically meaningful outcomes in adults with Parkinson's disease (PD). Twenty participants received standard-of-care speech therapy in community clinics while 26 participants who were not enrolled in therapy served as a comparison group. CPIB scores were collected pre-treatment (study enrollment) and 6 months later. Results revealed no significant change in CPIB scores over time for the non-treatment group; with statistically significant improvement in scores for the treatment group. Participant-defined targets for satisfactory outcomes were not reached for either group. Moderate-large correlations were found between participant and family proxy scores.

Autism-Centered Therapy for Childhood Apraxia of Speech
M. Beiting, E. Maas

Many children with autism spectrum disorder are late talking, and up to one third are minimally verbal. Communication difficulties frequently stem from language deficits; however, a subset of children with ASD also has speech sound disorders, including childhood apraxia of speech (CAS). This population may experience little benefit from traditional speech therapy due to frequent difficulty with imitation, eye contact, language comprehension, and behavior. Critically, there is currently a limited scientific evidence base for treatment of speech disorders specifically in these individuals; virtually all studies consider ASD an exclusionary criterion. This research examines improvements in speech production resulting from a novel treatment (Autism-Centered Therapy for Childhood Apraxia of Speech; ACT4CAS), which combines elements from best evidence-based treatments for CAS and ASD. The methodology, implementation, and results of ACT4CAS are presented.

A Novel ALS Index of Bulbar Dysfunction (ALS-IBD): Establishing Face and Content Validity
Y. Yunusova, A. Waito, C. Barnett, R. Martino, A. Abrahao, L. Zinman, J. Green

Bulbar motor dysfunction is among the most devastating consequences of amyotrophic lateral sclerosis (ALS). However, its evaluation and measurement in clinic and clinical trials remain limited. The goal of this work is to develop and validate a clinician-administered assessment tool – ALS Index of Bulbar Dysfunction (ALS-IBD), while adhering to current best practices for the development of outcome measures (i.e., the COSMIN guidelines). In this poster presentation, we aim to report on the work to-date on establishing the content and face validity of ALS-IBD through expert review of the preliminary candidate items, generated through literature review and multidisciplinary expert discussions. A representative group of clinicians (i.e., SLPs and neurologists) reviewed the ALS-IBD items and provided feedback via SurveyMonkey and cognitive interviews. A testable version of the tool will be presented and means of instrumental validation will be discussed.

Complexity-dependent modulations of beta oscillations for speech and nonspeech movements
L. De Nil, S. Isabella, C. Jobst, D. Cheyne

Beta oscillations (15-30Hz) in motor, somatosensory and parietal cortices have been shown to play a prominent role in nonspeech motor control. Evidence is mounting for similar oscillatory dynamics associated with speech production. The objective of the current study was to compare modulations in beta power prior to and during a speech and nonspeech task, at two different complexity levels. Sixteen adults performed a syllable repetition and button press task. Oscillatory patterns were recorded using magnetoencephalography. Both tasks showed the expected decrease in beta power prior to movement onset, but less so for speech. Complex movement sequences showed a significantly greater beta power reduction compared to simple sequences in both modalities. Our data point to important similarities as well as differences between speech and nonspeech movements. Implications for the study of speech processing and needs for future research will be discussed.

Contributions of Auditory and Somatosensory Feedback to Vocal Motor Control
E. Kearney, D. Smith, C. Stepp, F. Guenther

This study aims to better define the contributions of auditory and somatosensory feedback in vocal motor control. To dissociate the roles of the two systems, a laryngeal perturbation experiment was conducted with 18 native speakers of English with and without auditory masking. Responses to the laryngeal perturbation were compared to responses to an auditory (fundamental frequency; fo) perturbation experiment. The findings suggest that both auditory and somatosensory control mechanisms contribute to the magnitude and timing of the compensatory response to a laryngeal perturbation. Further, the degree of compensation varies as a function of perturbation modality (laryngeal perturbation without auditory masking > laryngeal perturbation with auditory masking > auditory perturbation). The variation in responses across participants in both experiments was not explained by fo acuity, and no relationship was found between the degree of compensation to auditory versus laryngeal perturbations.

Speech Changes within Passage Reading in Speakers with Parkinson's Disease
A. Thompson, Y. Kim

The current study investigates within-speaker variability during passage reading in speakers with Parkinson's disease (PD) and healthy controls using a multi-level auditory-perceptual, acoustic, and kinematic approach. Twenty participants (10 PD, 10 healthy controls) were asked to read the Caterpillar passage in a conversational voice. Acoustic and kinematic data were collected simultaneously using an electromagnetic articulography system. Recordings were analyzed using several local- and global- measures. Preliminary data support evidence of festinating speech in PD, with increasing movement speeds throughout the passage for speakers with PD, in contrast to stable movement speeds observed in healthy controls. Also, measures of vowel distinctiveness show reductions near the end of the passage in both speaking groups, but more drastically in healthy speakers. Perceptual, acoustic, and kinematic changes across passage reading will be discussed in detail in the presentation.

Changes in speech motor control with DTTC treatment in young children with CAS
M. Grigos, J. Case, E. Strand

Dynamic Temporal and Tactile Cuing (DTTC) is a motor-based intervention developed for young children with childhood apraxia of speech (CAS). This work evaluated the efficacy of DTTC in seven children with severe CAS (aged 30-60 months) using a single subject experimental design. Children received 6-weeks of DTTC (3x/week) with follow-up at 2-and 6-weeks post-treatment. The effects of DTTC on word production (perceptual ratings) and speech motor control (kinematic/acoustic measures) were examined. Maintenance of treatment gains and generalization to untreated words were also explored. All participants demonstrated increased accuracy and intelligibility in most treated words, with gains maintained at 6-weeks post-treatment. There was a modest effect for untreated items demonstrating potential for generalization. Duration and variability decreased pre- to post-treatment in most treated words in all participants. Findings reflect adaptability of the speech motor system in response to DTTC.

Auditory working memory training for auditory-vocal control: A multiple baseline single-case experimental design study
J. Kim, A. Roberts, C. Larson

The present study investigated the role of higher-level cognitive abilities in modulating lower-level sensorimotor control, specifically the involuntary nature of auditory-vocal pitch compensation, also known as the pitch-shift response (PSR). Five individuals participated in a multiple -baseline single-case experimental design for 18 to 30 sessions across three phases: baseline, training, and withdrawal. Neuropsychological testing was conducted prior to training in order to assess baseline cognitive abilities which may influence the efficacy of training. Visual analysis indicated that PSR latency remained relatively stable throughout the study. However, results showed that individuals who scored between -1 and -1.5 SD below average on scaled scores for neuropsychological subtests exhibited the largest reductions in PSR magnitude, which suggests that participants who score lower on cognitive tests may receive the most benefit for auditory-vocal control from cognitive training.

Are timing and variability separate indicators of speech motor control? A look across the lifespan
E. Wang, M. Grigos

The relationship between speech motor timing and variability is not fully understood. Particularly, it is unknown if timing and variability are refined during the period from young through middle adulthood. One perspective is that timing and variability are separate indicators of speech motor control. Another view is that variability is directly linked to timing, where longer duration is correlated with greater variability. To explore this area further, this research examined the extent to which timing influences speech motor variability in young and middle-aged adults. Acoustic and kinematic data were collected as participants completed a connected speech task at varied speaking rates. Measures of variability included the acoustic spatiotemporal index (STI), lip aperture STI, and phrase duration coefficient of variation. Data analyses capture the complex relationship between timing and variability as a function of age. Theoretical and clinical implications of findings are discussed.

Acoustical and Perceptual Consequences of Speech Cues in Korean-speaking Children With Cerebral Palsy
YH. Chang, P-Y. Jeong, B. Ihn, E. Ryu, M. McAuliffe, K. Hwang, HS. Sim, E. Levy

Many children with dysarthria due to cerebral palsy have reduced articulatory working space and vocal intensity. Treatment cues targeting these impairments are under-investigated, especially for children who speak languages other than English. This study examined acoustic and intelligibility changes in the speech of 8 Korean-speaking children with CP who were provided with cues targeting greater articulatory working space (“speak with your big mouth”) and cues targeting increased vocal intensity (“speak with your strong voice”) in Korean. 18 listeners rated ease of understanding of the children’s utterances. Significantly longer duration and a trend toward increased sound pressure level were observed in cued conditions. Listeners rated sentences in the cued conditions as easier to understand than in habitual condition. Comparisons of these results to cueing studies in other languages may shed light on language-independent versus language-specific effects of such treatment cues.

Clinical Value of Auditory-Perceptual Speech Measures for Detecting Mild Speech Impairments
K. Threlkeld, M. Sifford, G. Nolan, L. Heidrick, M. Kuruvilla-Dugdale

This study sought to compare transcription-based speech intelligibility and scaled speech severity to determine their clinical value for detecting mild speech impairments. Another aim was to establish the impact of listener experience on these measures. Speech Intelligibility Test sentences were read aloud by 45 speakers belonging to three groups: Parkinson’s disease (PD), older, and younger adults. The sentences were rated by two groups of four listeners each, stratified by their clinical experience. Both listener groups provided orthographic transcriptions of the sentences for intelligibility estimates. Severity estimates were obtained from ratings of overall quality via a visual analog scale. For both measures, the PD group differed significantly from the other two groups. Listener experience, driven by the inexperienced group, had a significant impact on scaled severity only. Both measures appear to be sensitive to mild speech decline in PD, but not to age-related speech changes.

An fNIRS study of speech production in children and adults
B. Walsh

The goal of this project is to document hemodynamic responses (HRs) of neural regions integral to speech production using functional near-infrared spectroscopy (fNIRS) in typically developing children and adults. fNIRS is a non-invasive, optical neuroimaging method that measures the relative concentration changes in cortical oxygenated and deoxygenated hemoglobin. We recorded over key neural components of speech production networks including inferior frontal gyrus, premotor cortex, and superior temporal gyrus. Participants were 40 school-aged children and 22 adults. We recorded HRs while participants described aloud 30 illustrated scenes randomized with 15 null (no speech) trials. We developed a GLM model to analyze channel-wise, event-related HRs as well as a time-to-peak algorithm to compare the timing of HRs across regions of interest. We will use channel-wise B values and time to peak values in ANOVAs to explore group and hemispheric differences within and between regions.

Assessing the consistency of compensation for auditory errors across error sources,
testing sessions, and changes in feedback reliability
C. Niziolek, B. Parrell

Speakers use auditory feedback to guide their speech output, although individuals differ in the magnitude of their compensatory response to apparent errors in feedback. Factors that have been proposed to account for these inter-individual differences, such as auditory and somatosensory acuity and production variability, are generally assumed to be relatively stable over time. However, little is known about the stability of the compensatory response or of the factors that influence it. Here, we test the cross-session stability of speech compensation behavior under conditions of normal feedback vs. unpredictable feedback noise. We assess compensation both to naturally-produced variability as well as to externally-induced auditory perturbations. Our results raise questions about the stability of feedback gains over time at an individual level as well as the relationship between compensation for large external perturbations and compensation for self-produced variability.

Anchoring speakers' auditory targets via playback of typical productions does not facilitate auditory-motor adaptation
E. LeBovidge, L. Max

Typical speakers monitor their speech output and, across trials, adapt to compensate for frequency-shifted auditory feedback. However, it is unknown why the extent of auditory-motor adaptation is limited (only partially compensating for the perturbation). One hypothesis is that exposure to altered feedback changes speakers' intended perceptual targets. Here, we studied (a) whether perceptual targets do indeed shift during adaptation, (b) whether playback of a speaker's most typical production before each trial prevents such target shifts, and (c) whether this playback of the typical production leads to more complete adaptation. Findings to date indicate that participants who heard their typical production played back before each trial and control participants without playback stimuli showed a similar extent of adaptation and also performed similarly on a perceptual task post-adaptation. Overall, results do not support target shifts as a limiting factor in auditory-motor adaptation.

Acoustic changes along a modified speech rate continuum
T. Knowles, S. Adams, M. Jog

Speech rate modifications, and in particular, slower rates of speech, are common therapeutic speech goals for some people with Parkinson's disease (PD). Many individuals do not, however, benefit from reduced rates of speech, and research suggests that faster rates of speech do not necessarily lead to further detriment. The purpose of this study was to explore acoustic characteristics of speech as talkers modified their rate from very slow to very fast. Three groups participated: people with PD receiving standard pharmaceutical intervention, people with PD who had received deep brain stimulation, and older healthy controls. All produced bisyllabic nonsense words embedded in a carrier phrase at seven rates of speech elicited via a magnitude production task. Overall across the continuum, slower speech was associated with greater acoustic distinctiveness, quieter speech, and poorer voice quality. Important group differences emerged that suggest clinical implications of rate modification.

An examination of the relationship between sentence length and speech rate in typically developing adolescents
M. Darling-White, S. Whitney Banks

The purpose of this proposal was to examine the effect of sentence length on speech rate, articulation rate, and pauses in typically developing adolescents. Fifty typically developing adolescents between the ages of 10 and 14 years participated in the study. Adolescents repeated sentences that varied in length from two to seven words in length. Dependent variables included speech rate (syllables per second), articulation rate (syllables per second), and proportion of time spent pausing. The effect of age and sentence length for each dependent variable will be examined and discussed. Results from this study will provide a more comprehensive understanding of the interaction between cognitive-linguistic and speech motor processes during adolescence.

Articulatory Mechanisms of Stress Pattern Disturbances in Dysarthria
D. Kim, A. Mefferd, M. Kuruvilla-Dugdale

In this study we examined lower lip kinematics (duration, articulatory stiffness, parameter C, % time to peak speed) during stressed and unstressed segments in two groups of talkers with distinct stress pattern disturbances: reduced stress (Parkinson's disease), excessive and equal stress (amyotrophic lateral sclerosis, multiple sclerosis). We sought to address the need to a) better understand how talkers with distinct stress pattern disturbances differ in their articulatory impairment patterns and b) determine if talkers with similar deviant stress pattern yet different etiologies share similar articulatory impairment patterns.

Speech kinematic data were recorded using 3D electromagnetic articulography (AG501). Data analysis is currently underway. The discussion will focus on articulatory mechanisms that may underlie the two different stress pattern disturbances and the presumed links between neuropathology, pathophysiology, and speech perceptual features of dysarthria.

Canonical babbling in infants at-risk for cerebral palsy: A longitudinal multiple case study
H. Long, N. Eichorn, D. Kimbrough Oller

Late onset of canonical babbling (CB) after 10 months has been shown to predict several developmental disabilities; however, there is no research assessing CB emergence longitudinally in infants at-risk for cerebral palsy (CP). We evaluated CB using 24 5-minute segments randomly selected from all-day recordings to observe the CB developmental trajectory in two infants at risk for CP (ICP) across a 12-month period (ages 5-16 months). Data from 12 typically developing (TD) infants at 6, 9, and 12 months was used for TD comparison. Results show that the two ICPs did not show a convincing onset of CB by 10 months and both infants evidenced an atypical CB emergence pattern. Delayed onset of CB and abnormal CB development may be an early indicator for pediatric dysarthria in ICP. Studying the emergence of CB in children at-risk and diagnosed with cerebral palsy may improve our understanding of pre-linguistic speech development in this population.

A single case experimental design study of Rapid Syllable Transition (ReST)
treatment for Italian children with Childhood Apraxia of Speech
I. Scarcella, L. Michelazzo, P. McCabe

The goal of the present study is to investigate the ReST treatment efficacy in Italian children. We hypothesized that the ReST approach would improve total accuracy in prosody and smoothness in the targeted behaviours, with speech sound accuracy remaining unchanged. Two children diagnosed with CAS attended to the treatment for a total of twelve sessions. The Italian treatment procedures contained different stress patterns than the English ones although the stimuli were modified accordingly. Accuracy of articulation, prosody and smoothness were assessed at pre-treatment and post treatment in treated and untreated pseudo words and in real words. Both children gained accuracy and maintained these changes, however, only one child generalised to the untreated behaviours. ReST in Italian demonstrates that the therapy may be valid in other languages. However, further investigation needs to be undertaken regarding the nature of the Italian stressed stimuli and replication is required.

Severity of speech sound disorders
A. Van Doornik, S. McLeod, H. Terband, E. Gerrits

It is hypothesized that severity of speech sound disorders (SSD) in children involves multiple speech-related factors. The aim of the present study is to identify the factors that predict the severity of SSD in 4- to 7-year-old children. Possible contributing factors to the severity of SSD were evaluated and compared to an overall rating of children's intelligibility by a panel of naïve listeners. Speech accuracy, children's intelligibility in different contexts, parents' perception of communicative participation, and children's perception of their communicative participation was evaluated by validated and normed instruments. Preliminary results from a multiple regression analysis on 79 children with SSD (48-91 months), indicate that speech accuracy, intelligibility in different contexts, and children's perception, together, contribute to the severity of SSD. Severity of SSD is predicted by a multi-factorial model that can be applied in clinical settings.

An Examination of the Effect of Background Noise on Speech Intelligibility in Spontaneous Parkinsonian Speech
C. Rountrey

Background noise impacts both the speaker and the listener and in Parkinson's Disease (PD), its functional impact on spontaneous speech intelligibility in natural environments is unclear. Might background noise upregulate the speech system (i.e., the speaker increases vocal intensity to overcome noise, thereby affecting other speech subsystems) and promote more intelligible speech? Or might it create another barrier to communication for the listener? Or some combination of the two? There have been mixed findings regarding the relationship between intelligibility to speech intensity in PD. In a study conducted by this author, there was not a significant difference in speech intensity sampled in the home environment between PD and Healthy Volunteers (HV); however, there was a significant difference in intelligibility ($F = 14.98$; $p = 0.001$). A strong relationship between natural background noise intensity and spontaneous speech intelligibility in home environments was also noted ($r = .752$, $p = 0.003$), but only for participants with PD. Theoretically, background noise may impact the speaker's intelligibility positively or negatively, but, natural background noise cannot be divorced from the listener, who is the judge of intelligibility. However, the nature of this relationship was not scientifically examined.

"I still have issues with pronunciation of words": The long term speech and psychosocial effects of Childhood Apraxia of Speech
C. Cassar, P. McCabe, S. Cumming

Research into the long term speech and psychosocial effects of CAS is in the early stages. It is unknown if adults diagnosed with CAS as children have ongoing speech and psychosocial implications as a result of their CAS. The aim of this study was to determine if there are adults with speech characteristics consistent with a previous diagnosis of CAS, and to describe these speech characteristics and the possible psychosocial impacts associated with their diagnosis of CAS. Results indicate that adults with CAS may experience segmental, syllabic and suprasegmental speech errors. Ongoing psychosocial implications were reported, including increased levels of anxiety, lower confidence, and reduced levels of participation.

Correlating out-of-scanner voice intensity with laryngeal motor cortex activity in older healthy adults and individuals with Parkinson's disease and hypophonia
J. Manes, E. Herschel, A. Kurani, A. Roberts, K. Tjaden, T. Parrish, T. Simuni, D. Corcos

In the present study, we utilized a mock MRI scanner to examine the effect of recording environment on voice intensity in individuals with Parkinson's disease and hypophonia (PDH) and older healthy controls (OHC) as they performed a sustained vowel task. Participants performed a sustained vowel task in three out-of-scanner recording environments: 1) Upright, 2) Mock Scanner + No Noise, 3) Mock Scanner + MRI Noise. We then compared laryngeal motor cortex (LMC) activity between PDH and OHC groups while they performed the same task during fMRI. Voice intensity was lower in the PDH group for the Upright and Mock Scanner + No Noise conditions; however, voice intensity normalized in the Mock Scanner + MRI Noise condition. No group differences were found in LMC activity. The similarity of LMC activity between the two groups may reflect the normalizing effect of scanner noise on PD hypophonia.