SPiAP07

Speech Prosody in Atypical Groups

Department of Clinical Language Sciences

University of Reading, UK

Monday 2nd April 2007

Abstracts

Keynote Speaker

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Assessment of Prosodic Ability in Atypical Populations

Speech prosody in atypical populations needs first of all to be assessed. This talk will look at the aims of assessment; past and current methods of assessment, their shortcomings and advantages; a brief overview of some of the existing data on prosody in typical and atypical populations; and ways forward.

Abstracts for the remaining presentations at the workshop follow, listed in alphabetical order by first author surname.

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Measurement in Prosody Description and Therapy

Atypical prosody can be found in many conditions: hearing impairment, dysphonia, autism, stammering, developmental speech and language disorders, neurological and psychiatric illnesses. The perceptual and productive patterning of prosody can be described and investigated using different levels of representation including psycho-acoustic, phonetic, grammatical and pragmatic. With appropriate acoustic analysis insights can be gained into important parameters of the physical form of "tone of voice" which are processed perceptually and productively in the pragmatic, emotional and linguistic domains of conversation. Such analyses can also aid differential diagnosis – for example, in contributing to the quantification of blunting of affect in types of schizophrenia and depression.

In this brief presentation we show how quantitative characterisation of pitch and loudness patterning in a speech sample may usefully supplement qualitative linguistic descriptions. Effective analyses must relate to human processing, taking into account both auditory perceptual capability and speech production. Mathematical processing by itself is inappropriate. As a contribution to evidence-based practice, relevant measures can then be made of averages and ranges of pitch, loudness, and of aspects of voice quality. Real-time visual displays of combined pitch and loudness patterning are available to assist the study of linguistic and emotional aspects such as pitch range, nuclear tone shape and placement (focus), rhythmic organisation, declination, and phonation types such as creaky and breathy voice. These displays can also be used for biofeedback in therapy and teaching.

The analyses and displays presented are produced using Speech Studio software running on a laptop. Both microphone and Laryngograph® (EGG) signals are used.

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Prosody in Broca's Aphasia: An interactional Resource?

Traditionally, speech in Broca's aphasia is characterised as effortful, non-fluent and dysprosodic (Goodglass, 1993). In fact, acoustical analyses reveal that some intact aspects of prosody, for example utterance final F_0 fall and F_0 declination, coexist with impaired speech timing, resulting in the absence of utterance-final segmental lengthening and long inter-word pausing (Danly and Shapiro, 1982). However, most studies use experimental data (reading and repetition tasks). Less is known about prosody in everyday interactions of people with Broca's aphasia. This paper reports a study that uses Conversation Analysis (CA) to investigate the prosody of Roy, a man in his 40s who has had Broca's aphasia for 7 years, in conversation with his adult daughter at home. CA has demonstrated the importance of prosody as a resource for turn organisation (Couper-Kuhlen and Selting, 1996). Selting (1996) finds that, in German, the ends of turns exhibit marked falling or rising pitch movements whereas non-final elements are characterised by mid-level pitch height, and that recipients orient to this resource as a turn-holding strategy. Ford and Thompson (1996) find a similar pattern in American English. The presentation will show how Roy's conversation exhibits turn-delimiting prosody, with the result that otherwise agrammatic sequences of nouns, adjectives, discourse markers and conjunctions are packaged into utterances. Video extracts will illustrate a pattern of level intonation on each non-final word in an utterance and falling intonation on the utterance-final word. It will be argued that intonation is a resource of interactional importance for this speaker.

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Understanding Prosody in Adolescents with Asperger Syndrome

Individuals with Autistic Spectrum Disorders (ASD) often exhibit an aberrant intonation. This "constitutes one of the most significant obstacles to [the child's] social integration" [1] and it is therefore surprising that so few studies have tackled the issue [2]. So far, research suggests that performances are higher for grammatical than for affective prosody, but the latter results are often contradictory.

We argue that some contradictions can be squared by resourting to a pragmatic model making finer predictions than the traditional dichotomy between affective and linguistic prosody. In this framework, we predict differences between various types of prosodic information: Linguistic prosody and basic emotions should be understood with little metarepresentational abilities, but more complex emotions (e.g. guilt, embarrassment, irony) requiring the manipulation of one or two metarepresentational levels should be problematic for most ASD participants.

This hypothesis was tested in 17 adolescents with Asperger Syndrome (AS) using a battery of novel experiments involving low level perceptual tasks (discrimination of pitch, intensity, duration, and contours), as well as various prosodic tasks (e.g. retrieving information about the speaker's identity; chunking compounds, distinguishing questions and declaratives; and identifying physical and mental states). The results were then correlated with performances in standard Theory of Mind (ToM) tasks and language level.

As predicted, AS participants were unimpaired in prosodic tasks requiring no metarepresentational abilities. More surprinsingly, they proved to have excellent ToM performances and managed to deal with prosodic tasks requiring the manipulation of one or two orders of metarepresentations in the same way as typical children.

We discuss the possibility that standard ToM tests assess the compensatory acquisition of an *explicit* ToM mediated by language, and argue that this compensatory mechanism also underlies the understanding of complex prosodic information in very able adolescents with AS.

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Vocal Profile Analysis Scheme: A Tool to Describe Voice Quality Variations

Many studies on the vocal pathologies have dealt with the notion of voice quality (ex : Mackenzie Beck, 2005). Even though voice quality is a concept that is quite difficult to define, John Laver's description is, to our knowledge, the most complete one. In order to analyse the voice quality of a speaker, a perceptual protocol called the *Vocal Profile Analysis* (VPA) scheme was created by Laver J., Wirz S., Mackenzie J. and Hiller S.M., in 1981, which is based on John Laver's descriptive model. This protocol is already commonly used by speech therapists in order to evaluate different pathologies of the voice and the eventual progress of the therapies. However, as was suggested in Mackenzie Beck (2005), there is a lack of data on non-pathological voices. Indeed, it is well-known that voice quality can vary according to several factors such as age, gender but also social and regional origins (Laver, 1980). Thus, this study aims at describing the voice quality variations of non-pathological voices thanks to the same perceptual analysis, that is to say the VPA scheme. To do so, 50 speakers of five different accents from various cities of the British Isles (Belfast, Cambridge, Cardiff, Liverpool and Newcastle) were analysed in order to provide more information about the typical voice qualities of these accents. The results showed that the VPA scheme was successful in highlighting the main settings that were commonly used by each group of speakers of the five different accents.

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The Effects of L-Dopa on Selected Speech Variables in Parkinson's Disease

Parkinson's disease adversely affects speech in many patients. Increased pausing and initiation difficulties are best documented, while studies of intonation have generated little consensus, with some studies showing both raised and lowered mean F0 levels in PD. L-Dopa has not been found to be very effective at alleviating these symptoms. Many studies consider speech as a single 'system', whereas different aspects of speech may, in fact, be differentially affected by both disease and treatment. We consider speech variables as indicative of three kinds of control regimes: postural variables, such as mean F0, represent slowly changing processes; kinematic variables, such as measures of variability in F0, represent rapid changes in articulation at the level of a single articulator, while coordinative variables, such as voice onset time (VOT), represent temporally bound relations among multiple articulators. We present preliminary analyses of 11 PD patients both on and off L-Dopa medication. The patients are an inhomogeneous set, and we find both raising and lowering of F0 across the two conditions, with significant effects in 9 of 11 subjects. The variability of F0, captured by the standard deviation, is affected in only five subjects, and there is no regular relationship between changes in variability and changes in mean F0 value. VOT is not significantly affected at all. Our results suggest a principled way in which future acoustic studies of PD patients might be designed, by differentiating among relatively static, simply dynamic and complex dynamic variables.

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Machine Learning Based Duration Repair of Tracheoesophageal Speech

Machine learning methods are widely used to model speech in state-of-the-art recognition and synthesis applications. The latter often model duration with regression trees. These are capable of predicting phone durations from features which influence their values (i.e. phone identity, position in word/sentence, lexical stress or contextual information) and whose interactions are learned from data in a preliminary training phase. Prosodic deviations are responsible for quality reduction in tracheoesophageal (TE) speech, its duration pattern being particularly affected by the surgical disconnection between the lungs and the vocal tract. In general, they stop more often, produce vowels with longer durations and speak with slower rates than normal. This paper investigates the application of regression trees to the repair of TE duration, presenting a system in which TE duration patterns are modified based on the predictions of regression trees built from non-pathological data. Objective and subjective evaluation of the repaired sentences show that their duration patterns are closer to normal and preferred to the originals in terms of rhythmic naturalness overall.

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Does the Phonological Deficit in Developmental Dyslexia Extend Beyond the Segmental Level?

It is widely believed that a deficit in phonology is a major source of the difficulties experienced by individuals with dyslexia (a developmental difficulty with reading, writing and spelling). Phonological representations in dyslexia are often said to be 'poor' or 'fuzzy'. However, it has not yet been investigated whether this deficit is restricted to segmental areas of phonology, or whether it also extends to prosodic areas.

A group of adults with dyslexia was tested on a range of tasks which addressed segmental and prosodic skills in parallel. The tasks involved both the perception and interpretation of minimal pairs, such as the difference between /t/ and /k/ on the segmental level and the difference between compound stress and phrasal stress on the prosodic level (eg *'toy factory* 'place where toys are manufactured' vs *toy 'factory* 'pretend factory for children to play with'). Participants were also tested on their ability to manipulate phonological components of words in segmental and prosodic versions of pig Latin and spoonerism tasks (eg extracting the segment /b/ from consonant clusters and the main stress from SWW or WSW stress patterns).

Although no evidence was found for a deficit in the perception or interpretation tasks, the dyslexics' performance was poorer on both the segmental and the stress versions of the manipulation tasks. These results suggest that the phonological deficits in dyslexia extend to some aspects of prosody, although it remains to be seen how fundamental this problem is to underlying phonological representations.

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Effects of Short Breath-groups on Prosody in an Adult Speaker Post-aneurysm.

Analyses of perceptual and acoustic data are presented from a young adult male speaker of English who was recorded in conversation with a speech and language therapist on synchronised audio and video about 20 months after suffering a brain haemorrhage. His speech is slow and laboured, of variable intelligibility, lacking in fluency, and very high pitched for an adult male. Shortness of breath-groups is very noticeable, with breath-intakes typically occurring every two or three syllables. This paper will focus on the relationship between his breath-groups and units of prosodic organisation – rhythm groups and intonation groups. It will also look at measurement of speech rate. A key factor in the analysis is establishing the locus of breath-intakes in relation to rhythm- and intonation-group boundaries so as to see how rhythm and intonation are disrupted, and how pitch is affected as a cue to stress and as a carrier of intonational information. It appears that the speaker has not only preserved his prosodic competence, but may have developed a strategy for minimising prosodic damage by trying to breathe in at prosodic boundaries rather than at locations between them.

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Supra-segmental Aspects of Pre-lexical and Early Multi-word Speech in Paediatric Cochlear Implanted Children

Newborn hearing infants heavily rely on perceptual cues such as prosody and rhythm to discriminate between a foreign and their native language (i.a. Jusczyk 1997). Prosody has also been claimed to play an important role in bootstrapping syntax from speech: young children may use fall-rise patterns in pitch to break up running speech into larger prosodic units such as syntactic phrases (Morgan & Demuth 1996, Durieux & Gillis 2001, Christophe e.a. 2003, Mazuka 1996). The robust acoustic cues crucial for speech perception are also found in children's speech production, both at the pre-linguistic babbling stage as well as at the morpho-syntactic stage of language development.

Deaf children with a cochlear implant (CI), i.e. children wearing an electronic device that replaces the cochlear function via electrical stimulation of the auditory nerve, are known to have difficulties to perceive pitch information when listening to running speech (Fearn 2001, Faulkner e.a. 2005). A number of questions directly follow from this finding: (i) are CI-children able to perceive the acoustic cues to prosody relevant for language acquisition?; (ii) does the speech of CI children show deviant features at the supra-segmental level (already) in the pre-linguistic babbling stage?; (iii) are CI children able to relate syntactic information to prosody at the morpho-syntactic stage of language development?

In this study, we analyze supra-segmental aspects of multi-syllabic babbling of 10 pediatric cochlear implanted children (age at implantation between 5-20 months) from the babbling spurt until the 10-word stage, and compare the results with those of a control group of typically developing hearing children. We further also investigate the relation between prosodic perception and morpho-syntactic development by analyzing the use of particular grammatical morphemes in syntactic contexts with well-defined prosodic features found in early multi-word utterances. The results will be discussed with respect to the CI infants' age at implantation and the length of cochlear implant experience.

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Using Conversation Analysis to assess and treat prosody in autism

Individuals with autism are often described as having disordered prosody, and this is thought to contribute to social exclusion (Peppe, McCann, Gibbon, O'Hare & Rutherford 2006, Paul, Augustyn, Klin & Volkmar 2005). This workshop reports on a study by the first author that used Conversation Analysis (CA) to investigate prosody in the everyday interactions of a child, Sammy (a pseudonym), who has high functioning autism. Sammy was video recorded talking to his mother at home. The analysis examined turn taking, given that CA has demonstrated the importance of prosody as a resource to signal the end of a speaker's turn at talk, and thus mark a legitimate place for speaker transition (Couper-Kuhlen and Selting, 1996). The workshop will give participants the opportunity to discuss data that shows Sammy successfully deploying pitch movement to mark the end of a turn, and thus to signal a place where his mother has the opportunity to take a turn. It will also examine incidences where creak and vowel lengthening within Sammy's turn misleads his mother as to the site of turn ending, resulting in overlap. The workshop will conclude with a debate about the resulting issues for treatment of prosodic disorder in autism, such as whether the delivery of intervention should focus on direct work with the child, indirect work with the conversational partner, or both.

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Aspects of Rhythm and Intonation in Ataxic Dysarthria

Ataxic dysarthria is a speech motor disorder, resulting from damage to the cerebellum and subsequent incoordination of muscle activity. Several studies have claimed that perceptually ataxic dysarthria is characterised by a noticeable disturbance of rhythm and intonation, marked by excess and equal stress or monotonous intonation due to slowness of speech. Previous work, both, perceptual and acoustic, has usually focused on single aspects of intonation and rhythm separately. Since rhythm and intonation are intricately linked (through stress), the present study combines measures from both areas in several sentence reading tasks.

This work presents data from two Scottish English speakers with dysarthria due to Friedreich's ataxia and two age and gender matched control participants. In a first experiment, participants were asked to read a list of sentences, which were designed to contain potentially differing numbers of pitch accents. In a second experiment, we increased the pressure to produce recognizable differences between stressed and unstressed syllables by creating stress clash situations where two pitch accents had to be realised in close proximity to each other, with and without intervening unstressed syllables. In a final task, participants were asked to produce contrastive stress in different positions in the sentence. We will report results pertaining to F0 measures, pitch alignment, and rhythmic measures such as the PVI (Pairwise Variability Index).

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Rhythm in the Speech of a Person with Right Hemisphere Damage: Applying the Pairwise Variability Index

Although several aspects of prosody have been studied in speakers with right hemisphere damage (RHD), rhythm remains largely uninvestigated. This paper compares the rhythm of an Australian English speaker with right hemisphere damage to that of a neurologically unimpaired individual using the pairwise variability index (PVI). The PVI allows for an acoustic characterisation of rhythm by comparing the duration of successive vocalic and intervocalic intervals. A sample of speech from a structured interview between a speech and language therapist and each participant was analysed. It was hypothesised that there may be some rhythmic disturbance in the speech of the speaker with RHD, as previous research findings show difficulties in other areas of prosody for this population. Results show that the neurologically normal control uses a similar rhythm to that reported for British English (there are no previous studies available for Australian English), whilst the speaker with RHD produces speech with a less strongly stress-timed rhythm. This finding was statistically significant for the intervocalic intervals measured, and suggests that some aspects of prosody may be right lateralised for this speaker. The findings are discussed in relation to previous findings of dysprosody in RHD populations, and in relation to syllable-timed speech of people with other neurological conditions.

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Analysis of Intonation in Atypical Populations: The Case of Williams Syndrome Children

Many authors think that the prosodic structure of an utterance is the index that determines the choice of the possible structure for utterance and turn. The hypothesis is that a different modulation of the tone of voice represents the way a speaker organises the discourse on-line (Halliday, 1985). Based on fundamental frequency variations, we can observe two methods for utterance implementation: a *linear complex utterance* and a *patterned complex utterance*. In the first, the instrumental analysis of the wave shows a continuous ascending-descending line. In the second, the sound wave shown by the instrumental analysis appears fragmented indicating that within the same intonation profile two different tone units are produced (Cresti & Moneglia, 2005).The current work extends this research to children with Williams syndrome, a rare genetic developmental disorder notable for low general cognitive ability (IQ usually between 50 and 70) but relatively strong language development and a 'hyper-social' personality profile (see, e.g., Morris, Lenoff & Wang, 2006). The current work provides a set of quantitative measurements concerning intonation and its variation parameters in a sample of 50 utterances from speech corpora of two children with Williams syndrome, an English one and an Italian one. The following measures were extracted and analysed: pitch variations (minimum and maximum), length of final syllable, utterance duration, speed (words per second), and episodes of fragmentation. The results from atypical development offer a window onto the role of prosody in the development of language abilities.

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Perception of Phonological Quantity by AS/HFA Speakers in a Quantity Language

The present paper deals with the prosodic module of the Academy of Finland project *Grammatical, Pragmatic and Prosodic Performance in Autism Spectrum Disorder*.

Quantity opposition is pervasive in Finnish, as the disyllabic word-stems can exhibit all possible short-long structures (the exx. are forms of verbs 'come' and 'blow'):

	V-V	VV-V	V-VV	VV-VV
C	/tu.le/	/tuu.le/	/tu.lee/	/tuu.lee/
CC	/tul.le/	/tuul.le	/tul.lee/	/tuul.lee/

I will report results obtained from 10 school-age Finnish AS/HFA speakers and their controls in a categorization experiment, where the material was 50 instances of semi-synthesized (PRAAT) stimuli based on eight disyllabic Finnish words. The consonants were manipulated in 25, the vowels in 15 ms steps. The subjects were to decide whether the isolated stimulus was a word carrying the /short/ or the /long/ segment (e.g., whether it was *uni* 'sleep' or *uuni* 'stove').

The results indicate that ASD subjects exhibit a categorical phonological boundary, both in vowels and in consonants.

The results will also be discussed in terms, at least, of the *Preservation of Grammar Hypothesis in ASD* and relative difficulty in vowels and consonants in ASD, and time permitting, I will also present data on other aspects of prosody in Finnish ASD (e.g., lexical stress, intonation and final lengthening).

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Effect of Dopamine Intake in Parkinsonian Dysprosody

Parkinson's disease (PD) is commonly characterized by a reduction in motor activity and, at the speech production level, by "dysprosody". The speech disorders occurring as a result of PD are a form of hypokinetic dysarthria.

The disorders would thus affect speech production and in particular the handling of fundamental frequency (F0). The fact that voice can't correctly be used depends on various factors, mainly of physiological nature (defect of the vocal cords vibrations for example).

Our research aims to acquire a better knowledge of prosody disturbances in Parkinson disease via an acoustic analysis.

The investigation of the patients' vocal productions by the way of acoustic analysis allows two kinds of results.

Firstly, to identify phonetic and prosodic parameters that are specific of such a pathology. Secondly, to study the effect of a pharmacological treatment (based on dopamine) on these patients' speech production. In order to determine the effect of dopamine, oral productions of 14 parkinsonian patients were collected, in the OFF and ON states, and were then compared to those of control subjects.

The specific aim of this study is (a) to examine the ability of patients to handle the variations in fundamental frequency of their voice as well as to master the rise in frequency required by the task (i.e. production of the musical scale and intonation patterns) and (b) to measure the palliative effects that can be induced, at least partly, in the management of frequency by a treatment based on L-Dopa.

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Long Term Average Spectrum: A Tool to Measure the Voice Quality of Deaf Speakers

Voice quality in general is affected by both the physiology of the speaker and their social environment. In the case of hearing-impaired speakers, their voice quality can also be influenced by the type of 'handicap' or by the type of cochlear implant they may use. Although there are many sources of variation, a specific hearing-impaired voice quality is still auditorily identifiable.

This study is one of the first to analyze the voice quality of Arabic hearing-impaired children. In order to measure variations of voice quality, we needed a tool that would analyze the signal on a long-term basis and the Long Term Average Spectrum seemed an appropriate candidate.

Our corpus was produced by eight deaf speakers and ten control speakers of the same age group (10-14 years old). The hearing-impaired speakers were all recorded at the same specialized school in Southern Algeria and the control group attended another school in the same city (Laghouat).

In order to carry out the LTAS analysis, a script was written using the Matlab software. Two methods were used in order to compare the results. Principal Component Analysis allowed us to check whether the deaf speakers form a separate group from the control speakers. The results showed that the 'normal' speakers formed a rather significant group whereas the deaf speakers' group was spread out. The second method consisted in measuring the distance between the different LTAS. The results showed a difference in the distribution of energy which was even more significant above 1 KHz.

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Prosody in Clinical Conversations: Is There a Systematic Use of Prosodic Patterns within a Particular Clinical Setting?

In the present study clinical conversations between speech language therapists and children with language impairment (LI) were analyzed prosodically. The conversations analyzed are recorded within a test activity in speech-language clinics. Twenty-four children with LI and six speech language pathologists participated in the study, which is a part of a more extensive research project involving children with prosodic problems in addition to their LI.

Previous findings have indicated a systematic use of prosody in the sequential and prosodic co-construction within the setting of speech therapy. In the present study we focus on the prosodic structure of one particular question-answer activity of the test situation in comparison with the prosodic structure of other parts of the conversation between child and pathologist.

Preliminary results show that the children's mean F0 is rather similar for the specific test answers and for the other answers in the conversations. The F0-variation is significantly lower for the test answers than for the other parts of the conversations as calculated with t-test, $p<.001$. For the therapists the mean F0 is significantly higher in the test questions, $p<.001$, whereas the F0 variation is significantly higher in the other questions, $p<.001$.

These preliminary results indicate that the prosody of the children with LI is influenced by the prosody of the therapist, also when the children are diagnosed with prosodic problems. It is also shown the prosody of the specific question-answer activity is carried out with a less varied pitch. The results point out the importance of assessing prosody in different activities.

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Prosodic Labelling of Adult Dysarthric Speech

Although dysarthric speech can sound quite unintelligible to a listener unfamiliar with the speaker, recent work has shown that many dysarthric speakers retain the ability to control aspects of spoken prosody well enough to convey at least some linguistic contrasts in their spoken utterances (Patel 2002, 2003, 2004; Patel & Salata, 2006; Patel & Watkins, in press). This raises the question of which aspects of prosodic contrast, such as phrasing and accent, are represented in the production plans of these speakers, and signaled in some way in their speech. We are currently studying this question from the point of view of three recent inter-related developments in the theory of speech production planning: the auto-segmental metrical theory of prosodic contrasts, embodied in the ToBI system of prosodic transcription of spoken utterances; the landmark-, cue- and feature-based theory of segmental contrasts, embodied in Stevens' (1998, 2002, 2003) model of speech production planning and speech perception; and the emerging consensus that prosodic contrasts in constituent structure and prominence are reflected in the realization of acoustic cues to segmental features as well as in the more traditional prosodic parameters of intonation, duration, amplitude and voiced quality. Stevens' landmark-, cue- and feature-based theory postulates that, in typical adult speakers, a given feature contrast can be signaled by different acoustic cues when it occurs in different contexts, both prosodic (e.g. constituent-initial vs. constituent-final locations, pitch accented syllables) and segmental (e.g. stops that occur as singletons vs. in consonant clusters, or before high vs. low vowels). In addition, in different contexts speakers can select different enhancing gestures to re-enforce the perceptual salience of feature cues (Keyser and Stevens 2006, Stevens and Keyser, in press). Thus, speakers are accustomed to selecting among potential cues to linguistic contrasts, just as listeners are accustomed to decoding them (Gow 2002, Manuel 1995). Our goal is to determine the extent to which adults with dysarthria spontaneously signal prosodic contrasts, which parameters that they use to do this (and how these cues may differ from those provided by more typical speakers), and the possibility that the range of contrasts these speakers can signal might be extended by therapeutic intervention. Our first step is to identify the prosodic phonology of these speakers, by exploring the extent to which they signal prosodic contrasts in phrasing and accent, in ways that trained labelers can learn to annotate their productions using the ToBI system for transcribing Mainstream American English prosody.

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Prosodic Ability in Children with Williams Syndrome

The aims of the present study are: 1) to investigate the expressive and receptive intonation skills of a group of children with WS using specially designed software: Profiling Elements of Prosodic Systems – children (PEPS-C) (Peppe, McCann and Gibon, 2003); 2) to investigate whether receptive language abilities and non-verbal abilities can predict receptive and expressive intonation skills; 3) to investigate how children with WS are perceived by naïve listeners.

A group of 14 children with WS (7;06 to 13;09) is compared to a group of 15 CA matched children and a group of 14 children matched for receptive language age. The results show that the children with WS perform similarly to the LA group on all aspects of intonation apart from prosody output; however when compared to the CA group, the children with WS were significantly poorer in relation to perceiving and producing syntactic groupings in speech and disambiguating phrases and sentences using prosody, understanding questioning versus declarative intonation, perceiving what is being emphasised in what is being said to them, and producing variations of prosody. Regression analyses showed that receptive language and non-verbal skills had almost no predictive power with regard to intonation performance in the WS and the LA groups but they did predict a number of intonation skills in the CA group. Laryngograph analysis of the spontaneous speech data showed that the WS group had a significantly wider pitch range than the two control groups, which may be perceived as a greater level of emotional involvement. It was also found that the children with WS were perceived as being twice as emotionally involved in comparison to the control children.

In conclusion, the data from the WS group suggest that their functional intonation skills are generally not impaired when receptive language skills are controlled for. The analyses of the spontaneous speech data suggest that it seems to be the pitch range that makes individuals with WS sound 'odd'. The findings will be discussed with reference to current theoretical views regarding the WS developmental profile.

References

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Beat Processing in Developmental Dyslexia: Comparing a Stress-timed and Syllable-timed Language

A consensus now exists that a phonological deficit is central to the causality of developmental dyslexia. To understand why this might be, much research interest has focused on basic auditory perception as a possible underlying factor. In previous behavioural studies we have found that a cue to speech rhythm, amplitude envelope onset (AEO) detection, can be highly predictive of concurrent reading performance in English-speaking developmentally dyslexic individuals and their controls (Goswami et al., 2002; Richardson et al., 2004; Thomson et al., 2006).

Given that English is a stress-timed language, in this study we sought to examine whether AEO detection would be equally predictive of reading in Finnish, a language with a syllable-timed rhythm. Nine-year old primary school children from England and Finland were tested on their AEO sensitivity alongside phonological and literacy measures. Preliminary analyses of the results suggest cross-linguistic similarities, but also differences in the associations between AEO sensitivity, phonological processing and literacy. The findings are discussed in terms of the role of auditory processing in literacy acquisition and interactions with the auditory speech rhythm characteristics of a child's native language.

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The Effect of Rate Control on the Intelligibility of Dysarthric Speech

Purpose: The aim of this study was to investigate the effect of rate control techniques on both speaking rate and intelligibility of dysarthric speakers. Methods: 19 dysarthric patients (12 male, 6 female; age-range: 17-88 years old) with heterogeneous aetiology (10 cerebral vascular accident, 5 Parkinson Disease, 2 Myotonic Dystrophy, 2 trauma) participated in this study. Speech rate, articulation rate and intelligibility were determined on one-minute recorded reading passages. Next to the subjects' habitual speaking rate, 7 rate control techniques were examined: speaking slower on demand, alphabet board, hand tapping, pacing board and delayed auditory feedback with a delay of 50, 100 and 150 ms. Speech rate and articulation rate were respectively calculated as syllables/second- pauses included and syllables/second- pauses excluded. Intelligibility was rated by five experienced speech language therapists, using a 10 millimetre visual-analogue scale. Statistical analysis was performed by means of SPSS.12. Results: This study reveals that all examined rate control strategies do have a significant effect ($p<.05$) on both articulation and speech rate. Rate controlling methods result in lower speech and articulation rates in the investigated dysarthric population. However, reduction of speech rate does not result in higher intelligibility ratings. The findings of this study are discussed and compared with data available in literature.

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Intonation and Foreign Accent Syndrome: A Case Study

Foreign Accent Syndrome is a rare motor speech disorder in which the speech of the patient is recognized as foreign by listeners of the same speech community. A detailed literature survey reveals that the most frequently reported errors relate to the prosodic aspects of speech, particularly concerning speech tempo and intonation. FAS-patients are often reported to have a significantly slowed down speech tempo and it is often pointed out that their intonation patterns are abnormal and the use of F0 is deviant. This has often been held responsible for the foreign accent quality of their speech.

This talk will present a detailed investigation of the intonation patterns of a Dutch speaking patient with Foreign Accent Syndrome. The analysis is based on the technique of close-copy stylization and it reveals that the patient's contours are generally wellformed. The frequency of occurrence of certain patterns, however, deviates significantly from what is to be expected in Standard Dutch. This is accounted for by the strategic use of pitch which allows the patient to stay in control of the speaking situation. In addition, the well-formedness of the pitch contours shows that Foreign Accent Syndrome is not a prosodic disturbance per se.

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An Autosegmental-metrical Investigation of Intonation in People with Parkinson's Disease

The dysarthria most commonly associated with prosodic problems is the hypokinetic dysarthria resulting from Parkinson's Disease (PD). One of its reported primary symptoms is "monopitch" or "monotone f0 contours". Although previous studies have focused on various f0 measures to characterise pitch range in people with PD, their intonation patterns have rarely been investigated.

This study investigates the intonation patterns of eight people with idiopathic PD and compares them with those of age and gender matched controls. Our intonational analysis was carried out within an autosegmental-metrical framework (AM). By analysing intonational contours as a sequence of abstract, discrete pitch *targets* (Low or High), AM enables the teasing apart of two levels in intonational analysis: an intonational phonology and its phonetic realisation. Despite its potential for revealing patterns of disordered usage, it has been seldom deployed in the analysis of disordered speech, and has never been used to investigate the intonation patterns of people with PD.

Acoustic data from two speech tasks (read speech vs semi-structured speech) were annotated using the AM methodology, and statistical comparisons were made to investigate effects of disease status, gender and speech task. Results showed that only speech task had a significant effect on intonation. When reading aloud, all subjects produced longer intonation phrases with a narrower range of less complex pitch targets, than when speaking spontaneously. However, both gender and disease status appeared to influence this effect with male Parkinson's patients being the most markedly affected of all the subject groups.

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Quantifying Speech Rhythm Deficits in Dysarthria

Disturbances in speech rhythm are common in dysarthria, and deficit patterns vary among dysarthria subtypes. Efforts to empirically distinguish disordered rhythm patterns have met with limited success. Here, we attempt to differentiate various forms of dysarthria using metrics designed to quantify linguistic rhythm on a stress-timed versus syllable-timed continuum. Speakers with hypokinetic, ataxic, hyperkinetic, or mixed flaccid-spastic dysarthria read sentences. Rhythm metrics were calculated for these utterances based on vocalic and consonantal interval durations. Differences among groups were discovered for %V (percentage of utterance duration comprised of vocalic intervals), VarcoV (rate-normalized standard deviation of vocalic interval durations), and nPVI-V (normalized pairwise variability index for vocalic intervals). Differences were independent of variable speaking rates among groups. All dysarthric groups produced rhythm patterns less stress-timed than the control American English speakers, with lower VarcoV and nPVI-V, and higher %V. Those with flaccid-spastic dysarthria secondary to amyotrophic lateral sclerosis exhibited a syllable-timed pattern more extreme than even control Spanish speakers, indicating minimal differentiation of stressed and unstressed syllables. These results show that the various types of rhythmic disturbance accompanying dysarthria can be effectively described and distinguished within a stress-/syllable-timed continuum and relative to healthy speech.

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Production Characteristics of Experimental Iambs in Children with and without Speech Impairment

The production of words with iambic (weak-strong) stress can pose a particular challenge for young English-speaking children. There is a tendency for children below the age of 3 years to omit the weak syllable and to assimilate its duration to that of the following strong syllable. This study investigated the production accuracy and duration of experimental iambs in children with and without speech impairment.

The participants were four 2-year-olds, four 4-year-olds, and four 4-year-olds with speech impairment. The two youngest children were followed longitudinally. Multiple tokens of six, nonword disyllables with iambic stress were elicited from the participants by repetition.

For the 2-year-olds, the proportion of responses characterised by weak syllable omission or segmental errors was .49, compared to .02 for the 4-year-olds, and .48 for the 4-year-olds with speech impairment. Most errors could be attributed to the two youngest children in the study and one child with severe speech impairment. Overall, there was a decrease in duration with increasing age. The longitudinal data revealed trade-off effects in production accuracy between the strong and weak syllables for the two youngest children.

The general reduction in duration across groups is consistent with an age-related improvement in speech motor control. However, phonological selectivity and attentional factors may impact on the ability of young children to produce words with iambic stress. In addition, the pattern of production errors across the children with speech impairment may have implications for use of the term *childhood apraxia of speech*.