Preschool children's performance on Profiling Elements of Prosody in Speech-Communication (PEPS-C)

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Abstract

Profiling Elements of Prosody in Speech-Communication (PEPS-C) has not been used widely to assess prosodic abilities of preschool children. This study therefore aimed to investigate typically developing 4-year-olds' performance on PEPS-C. PEPS-C was presented to 30 typically developing 4-year-olds recruited in southern Ireland. Children were judged to have completed the test if they produced analysable responses to >95% of items. The children's scores were compared to data from typically developing 5-6 year olds. The majority (83%) of 4-year-olds were able to complete the test. The children scored at chance or weak ability levels on all subtests. The 4-year-olds had lower scores than 5-6 year olds in all subtests, apart from one, with the difference reaching statistical significance in 8 out of 12 subtests. The results indicate that PEPS-C could be a valuable tool for assessing prosody in young children with typical development and some groups of young children with communication disorders.

Key words: Prosody; children; assessment; PEPS-C

Introduction

Successful human communication requires speakers to understand and use prosody effectively. The term prosody covers suprasegmental aspects of speech, focusing on how variations in loudness, relative syllable-length and vocal pitch combine to enhance or change the meaning of spoken utterances. Pitch variations (e.g. the relative pitch-height of

the beginnings and ends of syllables, differences of pitch-range) are generally referred to as intonation, and here these are also subsumed under the term prosody (Crystal, 1971; Couper-Kuhlen, 1986; Cruttenden, 1997). Prosody includes effects that cannot be ascribed to a single segment or phoneme, but rather those features of speech that continue over a stretch of an utterance, such as conversational turns, complete utterances, phrases, and words. The meaning conveyed in prosody cannot be transmitted entirely through writing, although some aspects of prosody are conveyed in writing through the use of punctuation. The well-known saying "it's not what you say, but the way that you say it" summarises what is communicated through prosody (Crystal, 1971; Peppé, 2009). Prosody contains many different types of information, such as conveying speakers' emotions or attitudes, highlighting or emphasising important and new information in sentences, distinguishing syntactic boundaries, and regulating pragmatic aspects of conversations between speakers (Crystal, 1971).

Despite its key role in communication, prosody in typically developing children and clinical populations has not been investigated as widely as might be expected. An explanation for this relative neglect of prosody is that its features are difficult to identify and analyse (Crystal, 1971). Differences in pitch, loudness and duration are problematic for listeners to perceive, transcribe and measure in reliable ways. Prosodic features are not categorical or discrete, so differences between a falling tone and a rising-falling tone, or between a "bored" and "sarcastic" tone of voice, are less clear cut than between phonemes or syntactic structures. These difficulties have led to a paucity of assessment tools with which to measure prosody in typical or disordered populations. Diehl and Paul (2009: 287) go so far as to say that "current instruments for assessing prosodic deficits are decades behind those that are used for clinical assessment of other aspects of language".

One test that is becoming increasing used to assess prosody is Profiling Elements of Prosody in Speech-Communication (PEPS-C). This test has a number of positive features and has therefore been used in a number of research studies investigating prosody in typical children and those with communication disorders (e.g. Peppé & McCann, 2003; Wells & Peppé, 2003; Wells, Peppé & Goulandris, 2004; Peppé, McCann, Gibbon, O' Hare & Rutherford, 2007; Martínez-Castilla & Peppé, 2008; Stojanovik, 2010, 2011; Foley, Gibbon & Peppé, 2011). Among its strengths is that the test adopts a psycholinguistic approach, which allows for identification of likely causation, i.e. level of breakdown, of prosodic difficulties in terms of input (e.g. perception or comprehension), mental representations (e.g. knowledge stored in speakers' minds) or output (e.g. lower level phonetic production). Unlike any other prosody assessments, PEPS-C assesses receptive prosodic skills as well as expressive prosodic skills and enables children's prosodic strengths and weaknesses to be profiled. However, like other prosody assessments, PEPS-C is not yet standardised on a large representative sample. Another limitation is PEPS-C is that it is not as highly sensitive to the developmental dimension (Diehl & Paul, 2009) as other language tests, with young children being presented with the same items as older children or adults.

PEPS-C has 12 subtests incorporating the following two dimensions: "Input" tasks of perception and comprehension versus "Output" tasks of speech generation and production; and "Form" tasks that involve lower level phonetic processing devoid of meaning versus "Function" tasks involving higher level processing accessing meaning. The prosody "Form" tasks involve same/different discrimination of prosodic variations (two tasks: short and long items), and each has comprehension (discrimination) and production (imitation) counterparts. The PEPS-C assesses four communicative "Functions" of prosody: the expression of attitudes and emotions (Affect); the delimitation of syntactic/linguistic units in

speech (Chunking); the signalling of relations between conversational utterances by their type of closure (Turnend); and the assignment of stress to linguistic elements (Focus). Each function is assessed in terms of both input (receptive) and output (expressive) skills in parallel tasks. Details of PEPS-C tasks, instructions for administration, scoring procedures and task items are outlined in the appendix of Peppé et al. (2007) and also on the PEPS-C website http://www.peps-c.com.

Although not standardised, data from PEPS-C has been reported for groups of typically developing school age children, mostly between the ages 5-14 years (e.g. Peppé & McCann, 2003; Wells & Peppé, 2003; Wells et al., 2004; Peppé et al., 2007; Martínez-Castilla & Peppé, 2008; Stojanovik, 2010, 2011; Foley et al., 2011). A few studies have included young children as language matched controls, for example, one study included typically developing children from age 4;8 upwards (Peppé et al., 2007). Recent studies by Stojanovik (2010; 2011) investigated prosody in children with conditions including Williams and Down syndrome and administered PEPS-C to typically developing children aged 4;2 years and older who were matched with the children with genetic syndromes on factors such as chronological and nonverbal mental age. Although Stojanovik does not comment specifically on the younger typically developing children's performance on the test, there is mention that some responses could not be scored. For example, most of the children with Down syndrome were unable to give responses that could be scored in a meaningful way on both input and output components on one subtest (Chunking) and these subtests were not included in the overall results.

The relative lack of PEPS-C use with preschool children could be based on the view that the test's demands are too high to give useful results for this population. Wells and Whiteside (2008: 556) stated "the test demands of a battery like PEPS-C are such as to

preclude its use with preschool children". These authors do not specify exactly what features of the test are too demanding for young children, but one might be the time it takes to administer the test in full. PEPS-C takes 45-60 minutes to administer, so requires children's attention and concentration for this period. Diehl and Paul (2009: 289) share this view, stating that the test is "very long for a clinical measure". Furthermore, the relative lack of developmental sensitivity of PEPS-C means that subtests are not equally easy, or difficult, for children at any age. As a result, young children may lose concentration on specific subtests that are too difficult for them. If young typically developing children, as well as those with Down's syndrome described by Stojanovik (2011), are unable to respond reliably or complete the subtests, then the test has little value for this age group. If on the other hand young children can complete the test and give valid responses, then the test has potential for wider use with young typically developing children and those with developmental delay.

Although there are indications from studies, such as the one by Stojanovik (2011), that PEPS-C can be used with pre-school typically developing children, so far no group studies have investigated how a group of younger children perform on the test or whether their performance can be differentiated from that of older children. The need for research on younger children has been highlighted by Martínez-Castilla and Peppé (2008: 913) who stated that future studies should "extend the age groups, focusing on assessing prosodic abilities in younger children". Indeed, the use of PEPS-C may be particularly valuable for use with younger children because previous studies (e.g. Wells et al., 2004; Foley et al., 2011) found ceiling effects in some subtests for 5-6 year old children. The ceiling effect suggests that some subtests of the PEPS-C may not be challenging enough for school age children but may be at an appropriate level for a younger age group, such as typically developing 4-year-

olds. The aim therefore of the current study was to investigate how a group of typically developing 4-year-olds performed in terms of whether they could complete the PEPS-C test and to compare their scores with results for 5-6 year old children reported in a previous study by Foley et al. (2011).

Method

Participants

Thirty children aged 4;0-4;11 years (mean 4;04 years) were recruited from pre-schools located within a city in the south of Ireland. Criteria for inclusion were that the children: (a) attended a mainstream pre-school (b) had no history of speech, language and/or learning difficulties (c) had no significant hearing loss or visual impairment (d) had no major physical or structural disability abnormality of the vocal tract (e) spoke English as the first language and as the main language at home and (f) had been a resident in Ireland for at least three years. These criteria were similar to those used in previous studies (Peppé et al., 2007; Foley et al., 2011). The information for criteria (a)-(d) was gained from pre-school staff report. The information for criteria (e)-(f) was gained from parent/guardian report via a questionnaire accompanying the consent form. Approval from the local Clinical Research Ethics Committee was granted. The data gathered from the 4-year-olds was compared to data from 10 typically developing 5;9-6;11 years olds reported in the previous study by Foley et al. (2011) who were also recruited in southern Ireland.

Procedure

The Irish computerised version of the PEPS-C was used in the study (see Foley et al., 2011, for a description). Children were tested individually in a quiet room within their familiar pre-school surroundings by the second author, who was a final year speech and language therapy student with experience in assessing language skills in young children. The

tester was trained to administer the Irish version of PEPS-C by an experienced user who demonstrated very good inter-rater reliability in scoring the test (the first author of the Foley et al., 2011 study). A staff member from the pre-school was present in the room during the assessment. Prior to beginning the assessment, the same/different concept check and the vocabulary item check were carried out. Each of the 12 subtests had two practise items; if a child failed the two practise items they were re-administered and if they failed again, the test was abandoned.

Results

Out of 30 children, 5 (17%) did not complete the PEPS-C battery. These children completed less than 10% of the PEPS-C items and in each case the child made it known to the tester early on in testing that he or she did not wish to continue, and the test was abandoned. All the 5 children were within the lower age range (4;0-4;5 years). The remaining 25 (83%) children completed >95% of the test, and 22 children attempted all items of the test.

Tables 1 and 2 show Input and Output scores of the 4-year-olds and the 5-6 year olds reported in Foley et al. (2011). As in previous studies, competence on PEPS-C Input tasks was set at 75% (i.e. a score of 12 out of 16 total) to avoid the possibility of chance scoring (Peppe et al., 2007). The reason for this is that all Input tasks are in binary choice format, so scores >25% and <75% could be obtained by chance. For Output tasks, if a child produces all test items with the same prosodic form, then this could result in a chance score of 50%, so scores 50%-75% are taken as indicating only weak ability and scores >75% indicate competence.

Table 1.

Results by age group for six Input prosodic tasks

Age Group	Sample Size	Affect**			Chunking*			Focus*		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
4-years	25	10.6	2.5	6-16	9.4	1.92	6-13	9.24	1.92	6-13
5-6 years	10	15	0.94	13-16	11	2.05	7-14	12	3.12	8-16

Age Group	Sample Size	Intonation*			Prosody**			Turnend		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
4-years	25	8.2	2.3	5-13	7.89	1.9	4-11	8.84	2	6-12
5-6 years	10	10.5	3.27	5-14	11.2	2.25	8-14	10.5	3.43	6-15

*Significant at p<0.05 **Significant at p<0.01

Table 2.

Results by age group for six Output prosodic tasks

Age Group	Sample Size	Affect			Chunking			Focus**		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
4-years	25	10.9	4.4	2-16	9.68	3.56	3-15	7	3.74	0-12
5-6 years	10	13.4	2.27	8-16	8.8	2.29	5-12	11.5	4.03	2-16

Age Group	Sample Size	Intonation*			Prosody			Turnend*		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
4-years	25	8.9	4.73	1-16	10.96	4.7	2-16	7.52	4.3	0-14
5-6 years	10	12.8	2	9.5-15.5	12.1	1.61	10-14.5	11.6	3.23	7-16

*Significant at p<0.05 **Significant at p<0.01

Tables 1 and 2 show that 4-year-olds did not perform at competency levels on any Input or Output subtests. On average they scored less than 12 on all Input subtests, indicating chance level performance. The high standard deviation and wide range of scores indicates great individual variation in performance on the Input subtests. Table 2 shows that the 4-year-olds on average showed weak ability (scoring between 8-12) on four Output subtests (Affect, Chunking, Intonation, Prosody) and chance level performance on two Output subtests (Focus, Turnend).

Tables 1 and 2 show that the 5-6 year olds performed better than the 4-year-olds on all but one PEPS-C subtest (Chunking Output). Mann Whitney U-tests revealed that the 4-year-olds scored significantly lower than the 5-6 year-olds on 5 out of 6 Input subtests (Affect, Chunking, Intonation, Prosody, Focus), and significantly lower on 3 out of 6 Output subtests (Intonation, Focus and Turnend). Thus the results suggest that the test differentiated between the age groups on most Input subtests and half of Output subtests.

Discussion

The aim of the study was to investigate how a young group of typically developing children performed on the PEPS-C. The study set out to determine whether the task demands would be too high for the young children to complete the test or whether the items would be beyond their ability with result that they would abandon the test or that responses could not be scored in a meaningful way (e.g., responses of children with Down syndrome on an Output subtest reported by Stojanovik, 2011). The results indicated that the majority of 4-year-old children (83%) were able to complete the test and their responses were reliable in that they could be scored according to PEPS-C protocol. In terms of their attention, most of the children were able to engage with the computer based tasks for

sufficient time to complete the test at one sitting. However, the tester noted that some children required verbal encouragement to continue and some needed short breaks between the subtests. These factors meant that the test took longer than an hour to administer with a number of the preschool children. The children who did not complete the test were the younger ones in the group, and these children may have been developmentally less mature, and perhaps unfamiliar with test-like settings, compared with those who completed the test.

The 4-year-old children scored at chance level on all Input subtests and two Output subtests (Focus, Turnend) and their scores indicated weak ability in the remaining four Output subtests (Affect, Chunking, Intonation, Prosody). These results indicate that the 4-year-old typically developing children in this study did not yet have competence in any of the receptive and expressive prosodic skills assessed by the PEPS-C, although they showed weak or perhaps emerging ability in 4 Output tasks (Affect, Chunking, Intonation, Prosody). Although the 4-year-olds scored at chance level on all Input tasks, their scores were significantly lower than the 5-6 year olds for all but one subtest (Turnend). For the Output tasks, there were significant differences between the younger (4-year-olds) and older (5-6 year olds) group on 3 subtests (Focus, Intonation and Turnend). The significant differences observed between the two age groups for Input and Output subtests suggest that PEPS-C can differentiate between performance of preschool children and 5-6 year olds on some receptive and expressive prosodic skills, although larger groups of children need to be investigated to confirm this finding.

There was a significant difference between the 4- and 5-6 year olds' performance on all the Function subtests. The most significant difference ($p < 0.001$) between the two groups occurred on the Affect Input subtest (production of contrastive stress), in which the

4-year-olds performed at chance level and the 5-6 year olds performed at competence level. In the current study, the 4-year-olds who failed this subtest demonstrated mostly ambiguity/absence of expression of contrastive stress. Foley et al. (2011) found that this subtest was the only one that did not show a significant difference between scores from the younger (5-6 years) and older (10-11 years) groups of typically developing children reported in this study. These authors interpreted the non-significance in scores as reflecting a ceiling effect shown by all the children in the 5-6 and 10-11 years age groups. This subtest would therefore appear to be developmentally sensitive in identifying the acquisition of this prosodic skill between the ages of 4 to 5 years in typically developing children.

Although the 4-year-olds scores were on average lower than the 5-6 year olds on all but one of the PEPS-C subtests, the difference was not statistically different for 4 (Input Turnend, Output Affect, Output Chunking, Output Prosody) out of 12 subtests. This result could be due to neither group having acquired these prosodic skills, which would lead to the children in both groups performing at chance levels. Alternatively, there may be a real difference between the groups in terms of prosodic skills, but the numbers tested were too small and the individual variation too large to reveal the difference statistically. Further research is needed using larger groups of children to establish the developmental acquisition of these prosodic skills in typically developing children.

The results of the performance of 4-year-olds on PEPS-C may be of value when interpreting the performance on PEPS-C of clinical populations, such as those with language and developmental delays. For example, Stojanovik (2011) reported the performance of a small group of children with Down syndrome aged 8-12 years on the test. The study included chronological age matched and mental age matched typically developing children. In the Stojanovik study, 6 out of 9 children with Down syndrome “did not seem able to

reliably carry out the Chunking comprehension and production tasks" (p. 150). It appears that the children with Down syndrome had not yet developed sufficient prosodic Chunking skills to produce responses that could be analysed in a meaningful way, although the preschool typically developing children in the current study did have sufficient skills to complete these tasks. Furthermore, Stojanovik found statistically significant differences between the scores from children with Down syndrome and those of the typically developing controls on all the Function subtests. Observation of the scores of the children with Down syndrome reported by Stojanovik and the typical 4-year-olds in the current study reveals similarities in the scores on Function subtests. The similarity may indicate that the children with Down syndrome were developmentally at a similar level to the 4-year-olds in terms of Function prosody skills. In contrast, the children with Down syndrome scored at a much lower level than the 4-year-olds on two Output subtests (Affect and Turnend), possibly highlighting that children with Down syndrome experience specific difficulties with these areas of prosody.

Future directions

The results of this study have shown that most typically developing 4-year-olds are able to complete the PEPS-C and their performance can be statistically differentiated from 5-6 year olds on many subtests. The results must be treated with caution however because of the relatively small number of children included and the large amount of variation shown by individuals in this young age group. Further research is needed to investigate young children's performance on PEPS-C.

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Declaration of Interest

The authors report no declarations of interest.

References

Couper-Kuhlen, E. (1986). *An introduction to English prosody*. Cambridge: CUP.

Cruttenden, A. (1997). *Intonation. 2nd ed*. Cambridge: CUP.

Crystal, D. (1971) Prosodic and paralinguistic correlates of social categories. In E. Ardener (ed), *Social anthropology* (London: Tavistock), ASA Monographs 10, 185-206.

Diehl, J.J., & Paul, R. (2009). The assessment and treatment of prosodic disorders and neurological theories of prosody. *International Journal of Speech-Language Pathology, 11* (4), 287-292.

Foley, M., Gibbon, F., & Peppé, S. (2011). Benchmarking typically developing children's prosodic performance on the Irish-English version of the Profiling Elements of Prosody in Speech-Communication (PEPS-C). *Journal of Clinical Speech and Language Studies*, 18, 19-40.

Martínez-Castilla, P., & Peppé, S. (2008). Intonation features of the expression of emotions in Spanish: Preliminary study for a prosody assessment procedure. *Clinical Linguistics & Phonetics,* 22, 363-370.

Peppé, S. (2009). Aspects of identifying prosodic impairment. *International Journal of Speech, Language Pathology, 11,* 332-338.

Peppé, S., & McCann, J. (2003). Assessing intonation and prosody in children with atypical language development: the PEPS-C test and the revised version. *Clinical Linguistics & Phonetics, 17*, 345-354.

Peppé, S., McCann, J., Gibbon, F., O' Hare, A., & Rutherford, M. (2007). Receptive and expressive prosodic ability in children with high-functioning autism. *Journal of Speech, Language, and Hearing Research, 50,* 1015-1028.

Stojanovik, V. (2010). Understanding and production of prosody in children with Williams syndrome: A developmental trajectory approach. *Journal of Neurolinguistics*, 23, 112-126.

Stojanovik, V. (2011). Prosodic deficits in children with Down syndrome. *Journal of Neurolinguistics*, 24, 145-155.

Wells, B., & Peppé, S. (2003). Intonation abilities of children with speech and language impairments. *Journal of Speech, Language, and Hearing Research,* 46, 5–20.

Wells, B., Peppé, S., & Goulandris, N. (2004). Intonation development from five to thirteen. *Journal of Child Language, 31,* 749-778.

Wells, B., & Whiteside, S. (2008). Prosodic impairments. In Ball, M., Perkins, M. Mueller, N., Howard, S. (eds) *Handbook of clinical linguistics*. Wiley: Blackwell. Pp. 549-567.