



Establishing Cepstral Peak Prominence (CPP) normative data for young adults in Ireland: the impact of gender, speech task and recording conditions

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Background

- Cepstral Peak Prominence (CPP) is recommended as a robust measure of dysphonia in clinical voice assessment (Patel et al., 2018)
- Its use in clinic is limited due to its relative conceptual complexity and the lack of normative data
- CPP values vary significantly with recording conditions, analysis software, speech tasks, and speaker age and gender (Murton et al 2020 and references therein)
- Aims:** to establish CPP normative data for young adults in Ireland and to determine the extent of CPP variability across genders, speech tasks and recording conditions (onsite and remote)

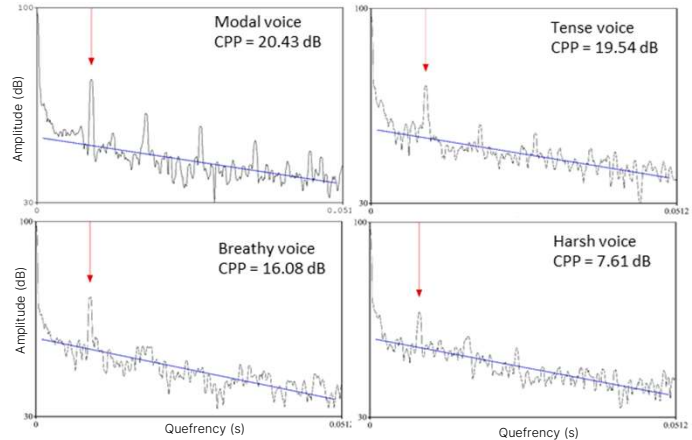
Method

- 34 participants (28F, 6M), 18-24 years old, all normophonic
- Speech tasks: sustained vowels [i], [a]; sentences with different segmental composition (CAPE-V, Rainbow passage), a subset is analysed here
- Recorded twice: onsite in a sound insulated room using a head-mounted microphone and remotely using the participants' mobile phones
- CPP values extracted automatically using Praat (Boersma & Weenink, 2023, Heller Murray et al 2022)
- Analysis: a complex mixed-effect ANOVA, with two within-subject factors (recording condition, speech task) and one between-subject factor (gender), SPSS v27 (IBM Corp, 2020)

Results

- See Table 1 for the obtained normative values
- ANOVA results showed significant SpeechTask*Gender and SpeechTask*RecordingCondition interactions
- As the segmental composition of the speech task becomes more complex, CPP values decrease for both genders
- CPP_{remote} > CPP_{onsite} though not for all speech tasks
- Gender effect was not significant (results must be interpreted with caution due to the gender imbalance of participants)

Figure 1. Examples of cepstra and cepstral peaks of different voice qualities.



Power cepstrum of a signal equals to the Fourier transform of the logarithm of its power spectrum. Periodic signals have a prominent peak in their cepstra at the time ('quefrency') corresponding to their fundamental period. CPP measures the magnitude of the cepstral peak relative to a linear regression line fitted to the cepstrum (Hillenbrand et al 1994).

Figure 2. Results of the complex mixed-effect ANOVA: Plot of the main interactions. Error bars – 95% CI.

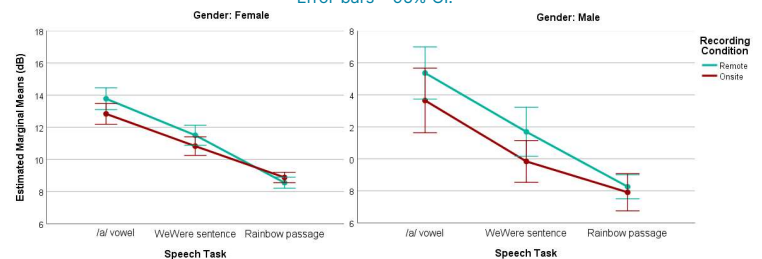


Table 2. Results of the complex mixed-effect ANOVA.

Source	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared
SpeechTask	832.94	1.75	475.62	266.32	.000	.88
SpeechTask*Gender	27.33	1.75	15.61	8.74	.001	.20
Error (SpeechTask)	112.59	63.05	1.79			
RecordingCondition	31.02	1.00	31.02	8.23	.007	.19
RecordingCondition*Gender	7.88	1.00	7.88	2.09	.157	.06
Error (RecordingCondition)	135.76	36.00	3.77			
SpeechTask*RecordingCondition	15.16	1.77	8.55	10.62	.000	.23
SpeechTask*RecordingCondition* Gender	.48	1.77	.27	.33	.692	.01
Error (SpeechTask*RecordingCondition)	51.42	63.86	.81			

Table 1. Normative CPP values (dB) for the three speech tasks recorded onsite and remotely.

Gender		Mean	SD	Median	Min	Max
Female	[a] remote	13.8	1.8	13.7	9.4	16.9
	[a] onsite	12.8	1.7	13.3	10.2	16.2
	WeWere remote	11.5	1.6	11.6	6.9	14.7
	WeWere onsite	10.8	1.5	10.9	7.7	14.9
	Rainbow remote	8.6	0.9	8.5	6.0	10.4
	Rainbow onsite	8.9	0.8	9.0	6.6	10.9
Male	[a] remote	15.4	2.1	15.6	12.7	19.6
	[a] onsite	13.6	2.6	13.8	10.0	18.1
	WeWere remote	11.7	1.9	11.5	8.6	14.5
	WeWere onsite	9.8	1.7	9.9	7.3	12.7
	Rainbow remote	8.3	0.9	8.1	6.9	9.7
	Rainbow onsite	7.9	1.5	7.8	4.5	9.6

Conclusions

- Work on CPP normative data collection is ongoing (age groups, gender balance)
- Smartphones can be used to record audio data of adequate quality for acoustic voice analysis
- Normative CPP data reported here contributes to the standardised use of CPP as a robust voice analysis tool to facilitate its interpretation in the assessment and treatment of voice disorders