High speed ultrasound/acoustic database of lingual articulation in typically developing children between three and thirteen years old

Collected within the ESRC research project ES/K002597/1,
"Coarticulation and tongue differentiation in children between three and thirteen years old"
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Description of Methodology

The project participants were 60 children, all native speakers of Scottish Standard English with no known speech or hearing disorders. There were six tightly defined age groups with ten speakers per group, as follows: 3-year-olds (3;4 [years;months] to 4;1); 5-year-olds (5;5 to 5;11); 7-year-olds (6;11 to 8;2); 9-year-olds (9;0 to 9;9), 11-year-olds (11;0 to 11;10) and 13-year-olds (13;0 to 13;11). Age and sex details for all participants can be found in Table 1.

Table 1. Participants' age and sex details.

Age group	Participant code	Age (years; months)	Sex
3-year-olds	c3yo1	3;4	Female
	c3yo2	4;0	Male
	c3yo3	3;11	Male
	c3yo4	3;9	Male
	c3yo5	3;9	Male
	c3yo6	3;8	Male
	c3yo7	3;10	Female
	c3yo8	4;1	Female
	c3yo9	3;11	Female
	c3yo10	3;4	Male
5-year-olds	c5yo1	5;9	Male
	c5yo2	5;5	Female
	c5yo3	5;7	Female
	c5yo4	5;6	Male
	c5yo5	5;10	Female
	c5yo6	5;7	Female
	c5yo7	5;11	Female
	c5yo8	5;11	Male
	c5yo9	5;9	Male

	c5yo10	5;9	Male
7-year-olds	c7yo1	7;10	Male
	c7yo2	7;7	Male
	c7yo3	8;1	Male
	c7yo4	8;0	Male
	c7yo5	6;11	Male
	c7yo6	8;2	Male
	c7yo7	7;3	Male
	c7yo8	7;3	Male
	c7yo9	7;1	Male
	c7yo10	7;6	Female
9-year-olds	c9yo1	9;5	Male
	c9yo2	9;9	Female
	c9yo3	9;7	Female
	c9yo4	9;0	Male
	c9yo5	9;2	Female
	c9yo6	9;5	Female
	c9yo7	9;1	Male
	c9yo8	9;9	Male
	c9yo9	9;7	Male
	c9yo10	9;0	Female
11-year-olds	11yo1	11;7	Female
	11yo2	11;6	Female
	11yo3	11;3	Male
	11yo4	11;5	Female
	11yo5	11;10	Female
	11yo6	11;6	Male
	11yo7	11;2	Male
	11yo8	11;2	Female
	11yo9	11;0	Female
	11yo10	11;5	Female
13-year-olds	13yo1	13;0	Male
	13yo2	13;5	Female

	13yo3	13;10	Female
	13yo4	13;10	Female
	13yo5	13;11	Female
	13yo6	13;10	Female
	13yo7	13;0	Male
	13yo8	13;0	Male
	13yo9	13;1	Female
	13yo10	13;2	Male

Synchronised high speed (100 Hz) ultrasound tongue video and acoustic data were collected using an Ultrasonix Sonix RP ultrasound scanner connected to a computer running Articulate Assistant Advanced software (Articulate Instruments Ltd, 2012). The stimuli were consonant-vowel syllables /pa/, /pi/, /ta/, /ti/, /sa/, /si/, /ʃa/, /ʃi/, in the carrier phrase "It's a …, Pam", with five repetitions of each target. The stimuli were presented in random order. The youngest children were instructed to repeat the stimulus several times after their carer at each presentation, in order to maximise the children's level of engagement with the task and to reduce the total recording time.

For the two youngest groups, the ultrasound transducer was hand-held by the experimenter. In all other age groups, participants wore a headset stabilising the transducer in relation to the head. The participants from the oldest group also produced the same stimuli without head-to-transducer stabilisation. The recording sessions without head-to-transducer stabilisation were also recorded on video, using two cameras, one facing the participant, and the other one recording the participant in profile. These recordings were used to assist with determining the transducer position under the speaker's chin.

The analysis procedures are described in more detail in Zharkova et al. (2015a; 2015b). For each token, tongue curves were traced at the middle of the consonant, and xy coordinates of these tongue curves were used to calculate indices of tongue shape. Inferential statistical analyses were carried out in R (R Development Core Team, 2013), using linear mixed models with speaker as a random effect.

References

Articulate Instruments Ltd. (2012). Articulate Assistant Advanced Ultrasound Module User Guide: Version 2.14. Edinburgh, UK: Articulate Instruments Ltd.

R Development Core Team. (2013). R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing. Retrieved from http://www.R-project.org.

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