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Perception & Multimedia Computing
Term 2: Audio Mini Project
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FORMANT SYNTHESIS Max/MSP Patch

This is an interactive voice synthesis patch that allows the user to experiment with the concatenation of different vowel sounds, to create words and noises. The user selects between two and three vowel sounds, their durations, and a choice between a soft or hard envelope. The envelope is triggered any time the user makes a control change, encouraging rolling experimentation. The frequencies and gains, as well as a spectrogram, are displayed in the patch.

The *osc_and_filterbank* sub-patch contains the saw-tooth wave osciallator, and five-filter filterbank. The frequencies, gains and Q-factors are stored in coll objects, and correspond to the formant frequencies of different vowel sounds. The *formants_lerp* sub-patch utilises the pipe object to send value messages to the coll object at delayed intervals (these in effect equate to the duration for which each individual vowel sound is held.) The coll object in turn sends the value sets to the filterbank object inside the *osc_and_filterbank* sub-patch.

Crucially, the coll data is sent through the *ak.list.line* object before reaching the filterbank. The *ak.list.line* object is an external developed by the cycling74 user "AK" (https://cycling74.com/author/5462a6d5bdbb99652da79b1d). (The external is not available from their profile, but can be found on this forum page: https://cycling74.com/forums/how-to-line-multiple-values-between-succeeding-lists). This external allows ramps to be made between lists of values, and in the case of this patch enables the linear interpolation between the formant value sets. As such, the changing shape of a speaking human mouth is emulated.

After user testing, feedback was given to include more description in the patch, and examples of sound construction, so the patch was improved accordingly.

The formant values and filtering algorithms in the patch were gleaned from a Youtube tutorial on formant synthesis: https://www.youtube.com/watch?v=-luGPjN0Ppc.

Demonstration video of the patch can be found here:
https://vimeo.com/332740228

	FIRST FORMANT		SECOND FORMANT		THIRD FORMANT		FOURTH FORMANT		FIFTH FORMANT	
Vowel	Freq [Hz]	Amp [dB]	Freq [Hz]	Amp [dB]	Freq [Hz]	Amp [dB]	Freq [Hz]	Amp [dB]	Freq [Hz]	Amp [dB]
A	609	0	1000	−6	2450	−12	2700	−11	3240	−24
E	400	0	1700	−9	2300	−8	2900	−11	3400	−19
IY	238	0	1741	−20	2450	−16	2900	−20	4000	−32
O	325	0	700	−12	2550	−26	2850	−22	3100	−28
OO	360	0	750	−12	2400	−29	2675	−26	2950	−35
U	415	0	1400	−12	2200	−16	2800	−18	3300	−27
ER	300	0	1600	−14	2150	−12	2700	−15	3100	−23
UH	400	0	1050	−12	2200	−19	2650	−20	3100	−29

Formant information from youtube tutorial.