

Articulatory Synthesis Exercise

Your assignment is to use the articulatory synthesizer to create five vowel sounds: /i/, /æ/, /ɑ/, /u/, and /ɚ/. Of these, /ɚ/ may be the most difficult. An install file and instructions for controlling the synthesizer are on my SPPA 2040 web page (see the link called '[Help in getting started](#)'). The yellow squares control different aspects of the vocal tract model. The main controls that you'll be fiddling with are: (1) the yellow square in the center of the tongue, (2) the bottom-right square that controls jaw height, and (3) the square in the upper right that controls lip posture. As you make adjustments to the vocal tract model, hit the "play part" button to listen, but also pay attention to the formant frequencies (mainly F_1 & F_2 , except for /ɚ/); for example, to get a decent sounding /i/, F_1 needs to be low (~300 Hz or so, maybe a little lower) and F_2 needs to be high (~2300 Hz or so), while for /u/ both F_1 and F_2 need to be low (F_1 ~300 and F_2 ~900). The key for /ɚ/ is to find adjustments that will cause F_3 to drop below ~2000 Hz or so. This may take some fiddling, but ***keep in mind as you're doing this exercise that this is a pretty good analog of what kids are going through as they learn to speak, except that they have only their ear to guide them.***

A table showing expected formant patterns for 10 vowels spoken by men is attached at the end of this document. For all cases except schwa (/ɚ/) you can attend mainly to F_1 and F_2 . You can use the information in this table or not. It's up to you. Either way, ***you want to start with your knowledge of vowel articulation*** (e.g., is the vowel high, mid, or low, is it front, back or central, are the lips rounded, retracted, or somewhere in the middle?). And no matter how you do it you will have to use your ear to tell you whether or not you got the vowel quality that you were shooting for. If you do use the formant values in the table, use them as a general guide. It is not necessary to hit the exact values. If the vowel sounds right it is right – and vice versa.

When you're satisfied that the vowel quality sounds right:

1. Go to the File menu and choose "**Save vocal tract parameters**". There are other choices under the File menu, so **be sure you pick "Save vocal tract parameters"**.
2. For a file name, use this format: 'LastnameFirstnameVowelCode.vtp'. My filenames for the five vowels would be:

HillenbrandJamesiy.vtp	/i/ ("heed")
HillenbrandJamesah.vtp	/ɑ/ ("hot")
HillenbrandJamesae.vtp	/æ/ ("had")
HillenbrandJamesuw.vtp	/u/ ("who'd")
HillenbrandJameser.vtp	/ɚ/ ("heard")

3. After saving your file, go to the File menu again and choose "Load vocal tract parameters". Pick "schwa.vtp", then get started on the next vowel.

When you've finished all five vowels, email your files as attachments to the graduate assistant for the course (see the syllabus for this email address). **Please use the subject line: "Synthesis Exercise"**.

Notes for students who run the exercise on one of the 4th floor listening labs (*room 4085 or room 4087*).

1. The labs are locked. Paula Armstrong can let you in. She's around most but not all of the time. If your schedule is really tight, you may want to arrange a time with her (387-8045, paula.armstrong@wmich.edu).

2. If you need to login:

Account name: JHUser
Password: Speech09 (case matters)

3. Bug the "Remote ArticSyn" shortcut, near the center of the screen.
4. Bug the "Tract" button in the lower left.
5. When you're satisfied with the vowel you're working on, pick "Save vocal tract parameters". Save the file to something like:

'f:/Program files/articsyn/JonesJilliy.vtp' (note that the drive is 'f:', not 'c:')

6. When you've finished all five vowels, email your files as attachments to the graduate assistant for the course (see the syllabus for this email address). Please use the subject line: "Synthesis Exercise".

Average formant frequency values for men (from G. Peterson & H. Barney, Control methods used a study of the vowels. *Journal of the Acoustical Society of America*, 1952).

	F₁	F₂	F₃
/i/	270	2298	2955 (“heed”)
/ɪ/	396	2012	2593 (“hid”)
/ɛ/	530	1860	2489 (“head”)
/æ/	667	1732	2438 (“had”)
/ɑ/	721	1095	2465 (“hot”)
/ɔ/	573	845	2445 (“hawed”)
/ʊ/	441	1036	2287 (“hood”)
/u/	302	879	2258 (“who’d”)
/ʌ/	634	1191	2386 (“hud”)
/ɚ/	491	1362	1740 (“heard”)
