

Transcription of Vol1.3: The Physiology of Speech

[Slide: 1] “Holistic Emotive Practices Vol. 1 Part 3: The Physiology of Speech”

Hello. This is Brian McPherson. Welcome to Part 3 of Holistic Emotive Practices, Volume 1. In this video I will discuss the physiology of individual speech sounds, called phonemes. In order to understand the scientific evidence for connecting individual speech sounds to an emotional value you have to be familiar with the physiology of speech production, since physiology determines the emotional significance of a phoneme.

[Slide: 2] “Three Universal Vowels: /â/ as in father, /û/ as in moon, and /î/ as in see.”

One of the most important concepts concerning speech sounds is the existence of three primary vowel sounds. These three vowels, /â/ as in father, /û/ as in moon, and /î/ as in see, are found in every language. Some languages only have these three vowels. The sounds may vary slightly, from one language to another, for example the /â/ may sound like /â/ or the /û/ may be /û/ because of slight variations in the rounding of the lips.

[Slide: 3] “Vowel Production Space (Figure with 3 primary vowels)”

However, these three vowels hold the corner positions in a more or less triangular vowel production space for every language. Linguists define vowel production space by the position of the jaw and the relative position of the lips. To produce an /â/ the jaw is lower than it is for any saying any other vowel sound. To produce an /û/ the lips must protrude farther than for any other vowel. The muscle action to do this keeps the jaw drawn up. An /î/ requires the lips to be drawn back and the jaw kept high.

[Slide: 3a] (adds ‘ae’ and ‘o’ ” to figure)

Other vowels such as the “ae” in “say” and the “o” in “slow” fit somewhere in the middle of the vowel production space, with the jaw not so low and the lips not so far out or back. For these reasons I consider the /â/, /û/, and /î/ primary vowels and all other vowels secondary or non-primary vowels.

[Slide: 4] “Vowel Perception Space (Figure with 3 primary vowels)”

The three primary vowels also hold the corner positions in a triangular vowel perception space. Linguists use the first and second formants of vowel sounds to create vowel perception space. Formants are bands of frequencies associated with vowels. When our vocal chords vibrate they produce a number of frequencies. Not all of the frequencies escape the mouth. The mouth blocks some and passes other through. The shape of the mouth determines which frequencies or formants pass through. In essence, the mouth acts like a filter allowing certain frequencies to pass and blocking others. Those frequencies which escape the mouth and are heard come in bands which are called formants. We can identify a vowel sound by its first and second formants.

If you plot the primary vowels in a space defined by first and second formants the three points form a triangle.

[Slide: 4a] (adds 'ae' and 'o' " to figure)

When the first and second formants of other vowels are plotted they fall somewhere in the middle of the vowel perception space, just like in vowel production space. This strong correlation between vowel production space and vowel perception space takes place because mouth shape determines both.

[Slide: 5] "Consonants result from constricting part of the vocal tract."

We form vowels from an open unobstructed vocal tract. We constrict the vocal tract to create consonants. I will examine consonants resulting from vocal tract constrictions based on individual physiological components that make up our speech articulators. The primary articulators include the tongue, lips, and jaw. Each of these three components gets paired with a primary vowel. Two of these pairings have clear connections. The jaw lines up the /â/, since to say the /â/ the jaw assumes a lower position than for any other vowel. The lips pair with the /û/ because of the position of the lips when we utter an /û/.

That leaves one major articulator and one primary vowel and gives us our third pairing: the /î/ with the tongue.

[Slide: 6] "Consonant formed by constricting the jaw from an /â/ position: /r/"

If you constrict the vocal tract by raising the jaw from an /â/ position you can create an /r/ sound. You could also hear an /l/ sound if you raise the jaw and keep the tongue from rising quite as far, in other words let it flatten. In fact, the /r/ and an /l/ are so close in the acoustic parameters that some languages do not distinguish between them. However, to make an /l/ the tongue has to flatten somewhat compared to the /r/. So if we want to consider consonants created only through constricting the jaw, the only one is /r/.

[Slide: 7] "Consonants formed by constricting the lips from a /û/ position: /b/, /p/, /m/, /w/."

We say several consonants using only the lips to constrict the vocal tract from an /û/ position. The nasal /m/, the sound for the letter "m," is one of the most common consonants. It is found in almost every language. You form the /m/ sound by simply closing the lips and keeping them closed while you release air through the nose and vibrate the vocal chords. Two stop consonants the /p/ and /b/ are also formed with the lips. To make each of these sound the lips close momentarily before reopening. The /w/ sound is the final sound formed with the lips. To make the /w/ sound you must constrict the lips to form a small opening through which the air rushes.

[Slide: 8] “Types of consonants formed with the tongue: Stops, Nasals, Fricatives, & Glides”

More consonants result from tongue constriction than all other constrictions combined. We can classify the consonants formed using the tongue into four main categories: stops, nasals, fricatives, and glides. We will examine each of these groups.

[Slide: 9] “Stops consonants made with the tongue: (Includes chart with Point of Articulation and voicing for 6 stop consonants: Alveolar- d,t; palatal- j,ch; velar-k,g)”

To make stop consonants the tongue momentarily stops the flow of air before releasing its position and then letting air past. We distinguish these stops on two parameters: point of articulation and voicing. The point of articulation refers to the particular spot you place the tongue in order to stop the air. If the tongue stops the airflow by touching the alveolar ridge, a point just above the upper teeth, you say either a /t/ or /d/. When the tongue touches the roof of the mouth, the palate, we can speak a /ch/ or /j/. Raising the back of the tongue to the velum yields either a /k/ or /g/.

As you probably noticed for each point of articulation we can say a pair of consonants. In each of these pairs one consonant is voiced and the other unvoiced. A voiced consonant results whenever the vocal chords begin to vibrate before the blockage of air is released by the tongue. If the blockage is removed prior to the vibration of the vocal chords, then the consonant is said to be unvoiced. The voiced stops formed by the tongue include /d/, /j/ and /g/. The unvoiced are the other three, the /t/, /ch/, and /k/.

[Slide: 10] “Nasal Consonants made with the tongue: /n/, /ng/”

English has three nasal consonants, sounds in which the air flows through the nose. We already mentioned one, the /m/, which is formed by constricting the lips. The other two result from tongue constrictions. To make the /n/ the tongue presses against the roof of the mouth. The /ng/ results from raising the back of the tongue against the velum.

[Slide: 11] “Fricative consonants made with the tongue: (includes chart with POA and voicing for 4 fricative: alveolar- s,z; palatal – sh, sh”

Fricative consonants result when we force air through a narrow channel. We classify fricatives formed using the tongue in the same manner that we classify stop consonants, that is, by point of articulation and by voicing. Using this system we classify /s/ as alveolar and unvoiced, where the /z/ is alveolar and voiced. The /sh/ sound (as in sheep) we say is unvoiced, palatal, and the /sh/ sound (as in measure) is voiced palatal.

[Slide: 12] “Glide Consonants Made with the Tongue (palatal-y; lateral-l)”

We only have two glide consonants formed with the tongue. To say the /y/ sound the middle of the tongue raises toward the roof of the mouth. The /l/ is considered a lateral glide because air flows around the side of the tongue.

[Slide: 13] “Consonants Employing More Than One Articulator (Tongue & Teeth – voiced –th, unvoiced –th; Lips and teeth – voiced –v; unvoiced – f)”

Some consonants employ more than one articulator. The tongue touches the teeth for two fricatives, the voiced /th/ (as in they) and the unvoiced /th/ (as in think). The teeth touch the upper lip for two fricatives the voiced /v/ and the unvoiced /f/. Finally, the /q/ sound (as in quick) involves both the lips and the tongue. For this sound the lips round slightly as the tongue raises to the velum to stop the airflow.

[Slide: 14] “Guttural Consonants (Pharyngeal – voiced stop –gh; unvoiced stop – kh; unvoiced fricative – h; Glottal – voiced stop – ‘ or ayin; unvoiced fricative – h)”

In English we only have one sound considered guttural. A guttural sound is one formed by a constriction in the back of the throat, before the air reaches the mouth cavity. In English we form the /h/ by constricting the throat at the top of the vocal chords, the glottis. Other languages have a number of other guttural consonants. Because some of these prove useful in HEP, I need to introduce them at this time. Another guttural glottal consonant of interest is called the ayin. It is a voiced stop consonant formed by stopping the airflow with the glottis before releasing it as you start to vibrate the vocal chords. It sounds like this /’ae/.

Three guttural consonants of interest are considered pharyngeal because they stop or constrict the airflow with the pharynx, which is located in the back of the throat, slightly above the vocal chords. One of these three is a fricative that I represent with an underlined letter “h.” It is similar to the English “h” in sound, but is harsher and usually louder sounding than the English “h.” It sounds somewhat like an attempt to clear the throat, like this, /h/.

The other two pharyngeal sounds are stop consonants. Like other pairs of stop consonants that share a point of articulation one of these is voiced and the other unvoiced. The unvoiced one is represented by the letters “k” and “h.” This is a single phoneme, however it does sound somewhat like a combination of the English “k” and “h”, like this, /kh/. The voiced pharyngeal stop consonant, represented by “g” and “h,” sounds like a combination of the English “g” and “h,” like this, /gh/. The air is stopped in both of these sounds by the back of the tongue pushing the airway shut at the pharynx.

[Slide: 15]”photos by Brian McPherson”

This concludes the discussion on the physiology of phonemes. The next presentation in this series puts together the information from this and the previous talk to arrive at the heart of HEP. It makes the connections between specific speech sounds and the physiological dimensions of emotions.

That’s it for now. Thanks for listening.

