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**ABSTRACT**

When people speak, they choose not only the syntax, but also the rhythm, articulation, dynamic and pitch of each utterance. In this manner, all speakers instantaneously compose melodies with their voices. But why do we use the pitches that we use? Is there a reason we choose them, or are they arbitrary? Do our pitch choices communicate any meaning?

It is well documented that when conversing, people tend to synchronize their body movements and speech rhythms with those of their conversation partner. For example, body movements of the listener, such as eye blinks and hand gestures, regularly occur in synchronization with the speaker's speech rhythms and/or body movements. As the intimacy level increases, so does the level of rhythmic synchrony. Such coordination conveys mutual cooperation and unites members of a group.

By examining recorded examples of speech from a musical perspective, one finds that certain conversation partners synchronize not only their speech and body rhythms,

but also do in fact synchronize their speech pitch. Such synchrony takes the form of “harmonic synchrony” (speaking in the same “tonal area”) or “pitch synchrony” (actual matching of pitch). Pitch and harmonic synchrony seem to non-verbally connect the conversation partners and aid the flow of conversation. One such conversation excerpt, from the *Live With Regis and Kathie Lee* show is examined in such a manner.

This dialogue example was transcribed into musical notation by ear and then corroborated by computer analysis. Speech examples were first converted into digital information to facilitate aural analysis by isolating, and then playing repeatedly, phonetic components. These digitized examples were then fed into a speech analysis program for a relatively non-subjective analysis. The resulting frequency data was then processed to reflect intervallic ratios. This analysis showed the aural transcription to be extremely accurate.

*Pitch Synchrony Found Live with Regis and Kathie Lee Dialogue*

When people speak, they choose not only the syntax, but also the rhythm, articulation, dynamic and pitch of each utterance. In this manner, all speakers instantaneously compose melodies with their voices. But why do we use the pitches that we use? Is there a reason we choose them, or are they arbitrary? Do our pitch choices communicate any meaning?

I speculate speech pitch acts as a carrier of nonverbal information, just as one's body language has been shown to convey nonverbal messages. An examination of research on rhythmic synchrony and frequency covariance will lead to an inquiry into the possible reasons speakers match the pitch of their conversation partners, or utter pitches harmonically related to those of their conversation partners.

#### Rhythmic Synchrony

When speaking, people tend to synchronize their speech rhythms with their conversation partner. Body movements, such as eye blinks and hand gestures, occur in synchronization with the speaker's speech rhythms. Listeners even coordinate their movements with the speaker's speech rhythms. In one study, pairs of interacting speech partners were even shown to have synchronous brain wave patterns.<sup>1</sup> Condon offers physiological reasons people rhythmically synchronize to such a high degree:

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<sup>1</sup>William S. Condon and L. W. Sander, "Synchrony Demonstrated Between Movements of the Neonate and Adult Speech," *Child Development* 45 (1974), 456-462 in Gregory, "A Sociological Indicator, 191.

The synchrony of the listener with the speaker is just as good as my own synchrony with myself ... We are almost in auditory touch. When I speak to you, my thoughts are translated into muscle movements and then into airways that hit your ear, and your eardrum starts to oscillate in absolute synchrony with my voice. In essence there is no vacuum between us -- it takes only a few milliseconds for a sound to register in the brain stem, fourteen milliseconds for it to reach the left hemisphere ... Communication is like a dance, with everyone engaged in intricate and shared movements across many subtle dimensions.<sup>2</sup>

Such synchronization of speech and body movements between conversation partners has been shown to be so pervasive that during the playback of a recording of a typical family dinner, a coordinated ballet can be witnessed:

You can stomp your foot to the family dinner as you could to the strains of bebop or Beethoven, once you learn to see and hear this unintentional rhythm. When family members talk, stressed syllables -- emphasized by louder volume and/or change in pitch -- usually carry the rhythm. Even when the conversation lapses, the beat goes on. Diners dab their napkins to the beat. Hands reach for the salt on the beat. A knife hits the plate on the beat. And when the mother gets up, her footsteps continue to tap out the pulse as clearly as a metronome would. When two conversations develop at the table ... they share the same pulse ...<sup>3</sup>

Rhythmic matching, also known as "rhythmic synchrony," "seems to be the fundamental glue by which cohesive discourse is maintained."<sup>4</sup> In viewing a film of a large crowd, families or groups of friends can be separated out after only a few film frames as "they will share their own rhythm and move in rhythmic synchrony."<sup>5</sup>

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<sup>2</sup> William S. Condon, psychologist at Boston University Medical Center, quoted in Carole Douglis, "The Beat Goes On: Social Rhythms Underlie All Our Speech and Actions," *Psychology Today* (Nov. 1987): 40.

<sup>3</sup> Douglis, "The Beat Goes On," 37.

<sup>4</sup> Frederick Erickson, a sociolinguist at the University of Pennsylvania, quoted in Douglis, "The Beat Goes On," 38. I have noticed when speaking with friends over the telephone in Australia or Africa, where the telephone signals are slightly delayed, it is difficult to rhythmically synchronize. This lack of synchrony may account for the uncomfortable nature of these conversations.

<sup>5</sup> Edward T. Hall, anthropologist at Northwestern Univ., quoted in Douglis, "The Beat Goes On," 42.

Rhythmic synchrony increases with level of intimacy and interest. Lovers have been shown to engage in a heightened form of synchrony, mirror synchrony. "They shift posture at the same time. They reach for their wine glasses, raise them, and drink simultaneously, an unthinking toast to their closeness."<sup>6</sup> Rhythmic and mirror synchrony may also account for the "chemistry" some new acquaintances experience. "Over the course of an evening, a newly acquainted but smitten couple will begin to synchronize first head and arm movements. Then more body parts will join the mating dance, until the two are dancing as one. Biologist Timothy Perper calls sustained mirror synchrony the 'best indicator that exists of mutual involvement.'"<sup>7</sup>

#### Pitch and Harmonic Synchrony

In light of the studies cited above, it is not unreasonable to speculate that speech pitch plays a similar role in conversational contexts, acting as a cohesive element. Research has shown we adapt even broader speech parameters when conversing: we imitate the dialect of our speaking partners. When in intimate conversation, Southerners tend to shift to non-literary speech forms such as double negatives and words like "ain't." A speaker who does not adapt their speech similarly may be looked upon by Southerners as an outsider withholding intimacy.<sup>8</sup> Thus, rhythmic, dialectic and syntactic imitation can provide a litmus test for group membership. In this light, the adages "imitation is the greatest form of flattery" and "on the same wave length" appear to accurately reflect forms of nonverbal communication.

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<sup>6</sup>Douglas, "The Beat Goes On," 42.

<sup>7</sup>Ibid.

<sup>8</sup>Raven I. McDavid, Jr. and Raymond D. O'Cain, "Sociolinguistics and Linguistics Geography," *Kansas Journal of Sociology* 9 (1973), 149.

Stanford Gregory's research on long-term frequency band covariance between conversation partners is one of the few studies which addresses harmonic covariation. Gregory measured frequencies below 4,000Hz in 25Hz bands from recorded interviews he conducted with army personnel. He divided each excerpt into three sections, each several minutes long, and then calculated which frequency bands were most utilized by both partners. He then compared this data with data collected from interviews with different subjects. Each interview displayed its own unique pattern of covariance, enabling one interview partner to be distinguished from the rest. In other words, speaking pairs had gravitated to the same areas of the frequency spectrum, pointing to a psychological desire on the part of the conversation partners to form some sort of common ground. Gregory calls this phenomenon "interpersonal similitude," a "multiplex interaction channel that fulfills several functions: it has the practical function of parsimoniously coordinating activity thus optimizing energy expenditure; and of binding units of the group together."<sup>9</sup> Gregory's studies show when two people speak in a military interview situation where one individual is clearly the superior, and the other inclined to be congenial, their frequency bands tend to coincide if averaged in large temporal divisions.

While supporting Gregory's findings, I suggest a much more detailed view of the nature of the covariance found by Gregory: that the covariance is locally one of pitch consonance, and broadly one of pitch center or "key." It seems natural that an attentive and congenial conversation partner would answer or interject on a consonant pitch, or with pitches from the same pitch class as those used by the previous speaker, as people in conversations generally desire agreement. Such behavior may be learned in the first six weeks of life.<sup>10</sup> As noted above, infants have been shown to imitate the fundamental

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<sup>9</sup>Stanford Gregory, "Voice Pitch and Amplitude Convergence," *Language and Communications* 13 (July 1993): 197.

<sup>10</sup>Lieberman, *Intonation, Perception and Language*, 239.

frequency fluctuations of their parents. Further, the mechanics of listening and speaking as explained earlier in this chapter is quite an intimate affair: the speaker's voice physically excites the eardrum of the listener, causing it to oscillate in synchrony with the speaker's vocal cords. A sympathetic response by the listener -- returning the speaker's caress by voicing the same frequency or one of its harmonics -- meshes the two utterances into a continuity. Perceptual studies support this romantic portrayal: "Two simultaneous sounds having identical pitches [or pitch classes] tend to fuse perceptually, into a single sound, losing the characteristic qualities of the original sounds."<sup>11</sup> This fusion occurs neurologically because "two simultaneous sounds having the same pitch will be mapped onto the same harmonic template and thereby fuse into one sound."<sup>12</sup> In this manner, attentive and congenial speaker-hearers unite in an almost spiritual, or even sexual way. Thus, the pitch matching I documented in my dissertation (*The Music of Words: A Musical Analysis of the Fundamental Frequency Content of American English Speech*) can be viewed as a fusion between the conversation partners.

A cursory review of the relationship between the ending note or notes of a speaker's phrase and the beginning note or notes of the respondent's phrase (or the simultaneous speaker's phrase) will illustrate just such a high level of pitch continuity. In my dissertation (*The Music of Words: A Musical Analysis of the Fundamental Frequency Content of American English Speech*), I transcribed monologue and dialogue examples from recordings of early blues performers and contemporary talk shows into musical notation by ear and then corroborated my transcription with computer analysis. Speech examples were first converted into digital information to facilitate aural analysis by isolating, and then playing repeatedly, phonetic components. These digitized examples

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<sup>11</sup>Brox, "Perceptual Separation," 25.

<sup>12</sup>Ibid., 34

were then fed into a speech analysis program for a relatively non-subjective analysis. The resulting frequency data was then processed to reflect intervallic ratios. This analysis showed the aural transcription to be extremely accurate.

In a transcription of a typical conversation on the *Live with Regis and Kathie Lee* show, Regis' first phrase is continued by Kathie Lee in dovetail fashion, with Kathie Lee supplying the seventh of the minor sonority outlined by Regis. In other words, her entering pitch was harmonically related to Regis' pitch – but not entirely consonant (it was an interruption). She then segues into a new but related sonority, the dominant in response to Regis' subdominant (with proper voice leading!). Regis interjects a "hmm" on the very note Kathie Lee voices, D#. A caller then begins her first phrase on the very note Kathie Lee ended her previous sentence, D#, resolving the dominant sonority to the tonic, E. Then Regis and Kathie Lee, in a stunning display of complementation, each articulate two different notes which, when combined, render the dominate of Liz's tonic. Next, Kathie Lee begins on the pitch Regis ended his utterance on, A. Again, Regis and Kathie Lee speak simultaneously, outlining a B sonority. They even land on the tonic at the same time. Moments later, Kathie Lee fills in the root of the tonic sonority, E, begun by Regis. Finally, in yet another display of harmonious simultaneous speech, Regis and Kathie Lee render a half-diminished, then fully diminished sonority together. All in under 15 seconds.

Does this example prove that rhythmic synchrony exists? Certainly not. But it does show that Regis and Kathie Lee's choices of speech pitch are uncannily related. Interestingly, the relationship of these pitches mirrors the harmonic principles of the Western music tradition and the naturally occurring overtone series (which we use as a template for speech recognition). Since they could have chosen an infinite amount of speech pitches, it seems highly improbable that such a high degree of covariance would

have occurred. In fact, Regis and Kathie Lee seem to be so literally "in tune" with each other that they form sonorities when speaking at the same time. Perhaps this level of agreement is responsible for the perceived "sugar-sweetness" of their dialogue; they are just *too* synchronous, too in tune with each other, operating as a unit rather than individuals.