Stress-Timed vs. Syllable-Timed Music?
A Comment on Huron and Ollen (2003)

ANIRUDDH D. PATEL & JOSEPH R. DANIELE

The Neurosciences Institute

Linguists have long distinguished between "stress-timed" and "syllable-timed" languages. Using new methods for comparing rhythm in language and music (A. D. Patel & J. R. Daniele, 2003) and new data on musical rhythm from a range of nations (D. Huron & J. Ollen, 2003), one can begin to address whether stress-timed and syllable-timed languages are associated with distinctive musical rhythms. In conducting such studies, it is important to be aware of historical influences on musical rhythm that might run counter to linguistic influences. An empirical method for studying historical influences is proposed.

Patel and Daniele (2003) examined a "stress-timed" and a "syllable-timed" language (English and French, respectively) and found evidence that speech rhythms were reflected in musical rhythms. Specifically, they found that the greater durational contrast between successive vowels in English vs. French speech was reflected in greater durational contrast between successive notes in English vs. French instrumental music. The quantitative measure of durational contrast they used was the normalized pairwise variability index or nPVI (Low, Grabe, & Nolan, 2000).

Using an electronic database of musical themes, Huron and Ollen (2003) have now replicated this finding on a much larger sample of English and French music. They have also provided valuable data on the musical rhythms of composers from a number of different nationalities (see their Table 1). Of particular interest are the musical nPVI values they report for other nations where stress-timed vs. syllable-timed languages are spoken. To what extent do these data support the idea that stress-timed and syllable-timed languages are associated with distinctive musical rhythms?

Of the nationalities listed in Huron and Ollen's Table 1, those associated with stress-timed languages are American, Austrian, English, German, and

Scandinavian, whereas those associated with syllable-timed languages are French, Italian, and Spanish (Fant, Kruckenberg, & Nord, 1991; Grabe & Low, 2002 and references therein). Of these, linguistic nPVI values are available for two stress-timed languages (English and German) and for all three syllable-timed languages, with the former languages having substantially higher nPVI values (Grabe & Low, 2002; Ramus, 2002).

Comparing this pattern of linguistic data with Huron and Ollen's data, an apparent contradiction is observed: Austrian and German music have *lower* nPVI values than music from nations with syllable-timed languages, despite the fact that spoken German is stress-timed and has a much *higher* linguistic nPVI than spoken French, Italian, or Spanish. What might account for this finding? One possibility is the influence of Italian music on German and Austrian classical music (Hanning, 2002). That is, the low nPVI of German and Austrian music may reflect a historical stylistic influence that outweighs any linguistic influence on musical rhythm.

One way to test this idea is to examine nPVI in a historical perspective. To illustrate this approach, we have computed the nPVI of 20 German and Austrian composers who were born between 1637 and 1895 (similar to the range analyzed by Huron & Ollen, based on themes from Barlow & Morgenstern, 1983). Plotting nPVI as a function of time (birth year) reveals a striking trend for nPVI to increase over time (Figure 1, Table 1),
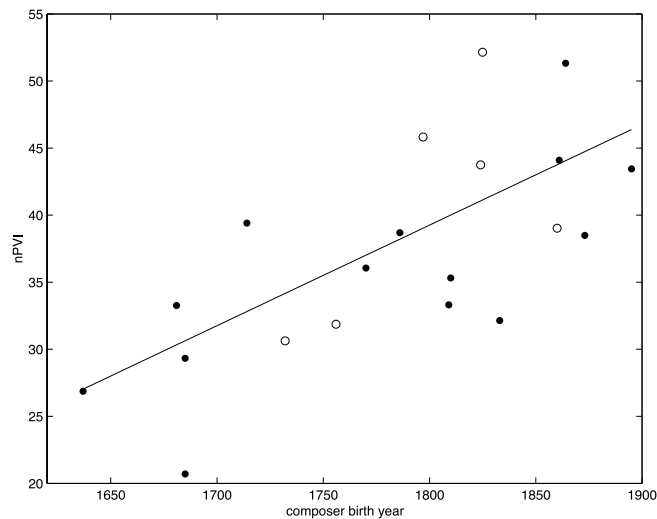

Fig. 1. The relationship between a composer's birth year and a measure of the rhythmic structure of his music (nPVI) for 20 composers born between 1637 and 1895. German composers are indicated by solid dots and Austrian composers by open circles. The best-fitting regression line is also shown (nPVI = [0.075 × birth year] − 95.742). The regression of birth year against nPVI is highly significant (r^2 = .49, df = 18, p < .01). All German and Austrian composers from Barlow and Morgenstern (1983) who had at least 15 usable themes were used in this analysis. For details of inclusion criteria for themes, see Daniele and Patel (2003).

TABLE 1
Details of Composers Depicted in Figure 1, Arranged in Chronological Order by Birth Year

Composer	Nationality	Birth Year	Mean Normalized Pairwise Variability Index (nPVI)	No. of Themes Analyzed
Buxtehude	German	1637	26.9	15
Telemann	German	1681	33.3	29
Bach	German	1685	20.7	40
Handel	German	1685	29.3	40
C. P. E. Bach	German	1714	39.4	15
Haydn	Austrian	1732	30.6	40
Mozart	Austrian	1756	31.9	40
Beethoven	German	1770	36.0	40
Weber	German	1786	38.7	21
Schubert	Austrian	1797	45.8	40
Mendelssohn	German	1809	33.3	40
Schumann	German	1810	35.3	40
Bruckner	Austrian	1824	43.7	40
Johan Strauss Jr.	Austrian	1825	52.1	39
Brahms	German	1833	32.1	40
Mahler	Austrian	1860	39.0	40
Loeffler	German	1861	44.1	20
Richard Strauss	German	1864	51.3	40
Reger	German	1873	38.5	19
Hindemith	German	1895	43.4	31

nearly doubling over the course of some 250 years. This historical perspective enriches the findings of Huron and Ollen. It is unlikely that this change reflects changes in German speech rhythm over this period (i.e., from more syllable-timed to more stress-timed). Rather, this trend most likely reflects historical changes in musical style, perhaps including the waning influence of Italian music on German music over this time period.

Thus one idea for testing the "Italian hypothesis" for the low musical German and Austrian musical nPVI values reported by Huron and Ollen would be to construct graphs such as Figure 1 for other musics with putatively less influence from the Italian style (e.g., American, English, and Scandinavian). One might predict that a lesser influence of Italian music would be reflected in a shallower slope of the line relating the birth year of composers to the nPVI of their music.

More generally, we wish to make the point that in studying linguistic influences on musical rhythm it is important to keep in mind the role of historical influences, which may run counter to linguistic forces.[1]

References

Barlow, H., & Morgenstern, S. (1983). *A dictionary of musical themes* (rev. ed.). London: Faber and Faber.

Daniele, J. R., & Patel, A. D. (2003). *The interplay of linguistic and historical influences on musical rhythm in different cultures.* Manuscript in preparation.

Fant, G., Kruckenberg, A., & Nord, L. (1991). Durational correlates of stress in Swedish, French and English. *Journal of Phonetics, 19,* 351–365.

Grabe, E., & Low, E. L. (2002) Durational variability in speech and the rhythm class hypothesis. In C. Gussenhoven & N. Warner (Eds.), *Laboratory phonology 7* (pp. 515–546). Berlin: Mouton de Gruyter.

Hanning, B. (2002). *Concise history of Western music* (2nd ed.) New York: W.W. Norton.

Huron, D., & Ollen, J. (2003). Agogic contrast in French and English themes: Further support for Patel and Daniele (2003). *Music Perception*, *21,* 267–271.

Low, E. L., Grabe, E., & Nolan, F. (2000). Quantitative characterizations of speech rhythm: syllable-timing in Singapore English. *Language and Speech, 43*, 377–401.

Patel, A. D., & Daniele, J. R. (2003). An empirical comparison of rhythm in language and music. *Cognition, 87,* B35–B45.

Ramus, F. (2002). Acoustic correlates of linguistic rhythm: Perspectives. In *Proceedings of Speech Prosody, Aix-en-Provence* (pp. 115–120). Aix-en-Provence: Laboratoire Parole et Langage.