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periodic waveforms. If the waveform is complex, then this repetition rate is the fundamental frequency (F0), whereas if it is a pure tone, individual harmonic, or frequency component that consists of a single sinusoid, this repetition rate is its frequency (f), and f = F0.

An extensive literature exists on the physics and acoustics of musical instruments (Benade, 1990; Rossing, Wheeler, & Moore, 2002; Forster, 2010; Hartmann, 2013; Heller, 2013). Most musical instruments that produce strong, clear pitches involve vibrating strings (e.g., pianos, violins, guitars), air columns (e.g., organs, woodwinds, brass), flexible structures (reeds), and membranes (voices) that produce harmonic complex tones. Less periodic sounds, such as

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events are more likely to be determined by auditory constraints, whereas preferences are much more open to influence from acquired learned associations and rewarded cultural norms. On the other hand, many discriminative auditory acuities can be improved by musical training, and some preferences may be innate, near-universals (e.g., sweet vs. bitter tastants, low vs. high frequency tones).

10. See von Helmholtz (1885/1954, pp. 280–284), Forster (2010), and Midya (2015) for more detailed analyses. See p. 169.

11. Note that 1 cent is ~1/100th of a semitone, and 15 cents is roughly a sixth of a semitone or about 1 percent in frequency.

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The Western major diatonic scale (figure 5.3) includes all but one of these consonances, the minor third (6:5). Almost all tuning systems in use, such as just intonation, Pythagorean tuning, and equal temperament, provide either perfect or close approximations (within 1 percent) to these consonant ratios. Both Arabic-Persian and Indian scales contain notes that closely approximate the Pythagorean consonances.[10] The Persian-Arabic scale shown

Fishman, Y. I., Volkov, I. O., Noh, M. D., Garell, P. C., Bakken, H., Arezzo, J. C., ... & Steinschneider, M. (2001). Consonance and dissonance of musical chords: Neural correlates in auditory cortex of monkeys and humans. *Journal of Neurophysiology, 86*(6), 2761–2788.

Forster, C. (2010). *Musical mathematics: On the art and science of musical instruments*. San Francisco, CA: Chronicle Books.

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These are the Balinese gamelan scales and tunings, which appear to lack fifths (3:2) and sixths (5:3). However, gamelan music is quite diverse, and others have reported gamelan intervals close to minor thirds, fifths, and sixths (Forster, 2010; Duimelaar, 2017). The ethnomusicological literature has a spirited, ongoing discussion of gamelan tunings, whose complexity is compounded by the multiplicity of Indonesian musical styles and the varied, individualized tunings of instruments and ensembles. Some theorists have posited that the metallophones,