Richard Parncutt

Interval makes the show

Pitch intervals in Western music may be represented as frequency ratios (2:1 for the octave, 3:2 for the fifth) or measured in cents (1/100 of a semitone). A major third (C to E) can be tuned either 5:4 ("just" or pure intonation; 386 cents) or 81:64 (Pythagorean intonation; four fifths minus two octaves; 408 cents). Since Bach, keyboards have been tuned to equal temperament, in which all semitones are 12v2:1 or 100 cents.

Ross Duffin explains the theory and gives an informative and readable historical account of its history. He focuses on the main players — composers, performers and theorists from the 18th to 20th centuries. The result is a useful resource for academics and a good read for music lovers.

How Equal Temperament Ruined Harmony (And Why You Should Care)

By Ross W. Duffin

W. W. Norton, 196pp
£17.99
ISBN 0 393 06227 9

But there is a big problem. The book ignores almost entirely empirical research on the perception of tuning and temperament. Yet the psychological approach is no more or less important than the historical. Our experience of music is quite different from its notation or acoustical representation. Like colours, musical intervals are perceived categorically. A colour like "red" corresponds to a specific range or pattern of wavelengths, and in everyday life we do not normally distinguish shades of red. Similarly, musical intervals are perceived as categories; we are surprisingly insensitive to tuning deviations. While musicians may label interval categories (for example, "minor second"), non-musicians perceive intervals categorically without these labels. Major thirds in typical performances may be smaller than just or larger than Pythagorean without musicians in the audience noticing any mistuning.

These claims are supported by experiments in which expert ears identify intervals and by acoustical measurements of performances. Most such studies have found a preference for equal temperament or quasi-Pythagorean tuning. A preference for quasi-just has only been observed in music comprising sustained harmonic sonorities without vibrato, for only then can beating be perceived between almost-coincident partials.

Intonation in real music depends on several other factors that Duffin largely ignores. Sensitivity to beating in vocal music is limited by vocal jitter. Moreover, when several people sing each part, small differences in tuning render beating between parts imperceptible. Listeners and performers prefer octaves slightly wider than 2:1, even when the upper partials of each tone are exactly harmonic. Soloists often perform sharp relative to their accompaniment.

On the basis of historical treatises, Duffin proposes that intonation in the Middle Ages tended towards Pythagorean (based on ratio theory), in the Renaissance and Baroque towards just (ditto), and since the 18th century towards equal temperament (the influence of keyboards) or back towards Pythagorean (sharp leading tones). The last is consistent with psychoacoustical studies of current practice, but the assumptions about early music are problematic. First, we have no recordings of music before recording began. Second, historical theorists could not measure intonation in performance, and even the best ears may be fallible. Third, we know little about the accuracy with which early keyboard instruments were tuned. Duffin may be right, or he may be wrong.

Duffin is right that intonation is important and that performers do and should systematically deviate from equal temperament. But that does not mean that the piano is "out of tune". It is truer to say that every tuning or intonation is a compromise.

The book's title suggests that equal temperament "ruined harmony". But it also allowed infinite flexibility of modulation. One could equally argue that it gave harmony wings.

Richard Parncutt is