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German-Austrian Keyboard Temperaments and Tuning Methods, 1770–1840: Evidence from Contemporary Sources

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MANY MODERN PERFORMERS ON THE FORTEPIANO have benefited from lessons learned from the earlier revival of the harpsichord and its music; and cognizant of the great role tuning plays in the timbre and harmonic quality of music played upon the harpsichord, they have been using unequal temperaments on the fortepiano.¹ Their choice of temperaments, however, seems to be rather subjective and arbitrary, and performers in general seem unaware of the historical evidence regarding temperaments and tuning. This article, then, will examine the contemporary evidence about how keyboard instruments such as the Viennese fortepiano were tuned during the period from 1770 to 1840.

Since most surveys of historical tuning practices are content to document the invention of various tuning or temperament schemes without stating whether they were originally disseminated in a form suitable for practical tuning, or without attempting to determine whether a tuning scheme was ever used in practice or how widely it may have been used,² this study focuses on those sources that provide practical tuning schemes. In order to achieve as objective an answer as possible to the question of how keyboard instruments were actually tuned, it will examine twenty-two German-language sources—keyboard tutors, performance treatises, and keyboard tuning and maintenance manuals—that give practical directions for tuning stringed keyboard instruments.

These sources were aimed at an audience of amateur musicians, students, teachers, instrument owners, or tuners, to whom, we can presume, the authors attempted to present their own practical advice or the

1. This is an understandable and perhaps fashionable tendency, for, as Rudolph Rasch observed in "Does 'Well-Tempered' Mean 'Equal-Tempered'?" *Bach, Handel, Scarlatti: Tercentenary Essays*, ed. Peter Williams (Cambridge: Cambridge University Press, 1985), 304, equal temperament can clearly be associated with the "nonauthentic" conventional performance practices of the nineteenth and twentieth centuries.

2. Neither of the two most extensive surveys of tuning make these distinctions: J. Murray Barbour, *Tuning and Temperament: A Historical Survey*, 2d ed. (East Lansing, Mich.: Michigan State College Press, 1953), and Owen Jorgensen, *Tuning the Historical Temperaments by Ear* (Marquette, Mich.: Northern Michigan University Press, 1977).

judgment of professional musicians about tuning. While some relevant sources may not have been located for this study, the ones studied are representative and chosen without bias; and additional sources would be unlikely to alter the broader conclusions of this study.

Three criteria have been used in selecting the sources presented and discussed.

1. Only sources written in German between ca. 1770 and 1840 have been included. (Given the well-known ambiguity of the German term *Klavier* and the fact that the harpsichord, clavichord, and fortepiano coexisted for decades, it was not possible to limit the treatises studied to those that announce “Pianoforte” or “Fortepiano” on their title pages.)

2. The sources must give practical “how to” directions for tuning a keyboard instrument; that is, the directions must be given in such a step-by-step manner that the intent must have been to direct someone in tuning a keyboard instrument. Accounts that merely summarize how keyboard instruments in general are tuned or ought to be tuned, or that only recommend certain tunings are not emphasized (though these are mentioned in passing to give a sense of which tuning schemes received contemporary approval).

3. Treatises whose orientation is theoretical, polemical, and mathematical—that approach the question of dividing the octave into twelve parts as a mathematical problem and leave the solution solely in terms of ratios, string lengths, or logarithms—have been excluded. As J. Murray Barbour observed, German theorists of the eighteenth century were “especially active at [the] intellectual pastime of creating passable temperaments” that were essentially “paper” temperaments that would “look well on paper, but would have been difficult to put into practice.”³

Since the directions that will be presented were practical directions for tuning by ear, we will occasionally find in them ambiguities, imprecisions, or what we now know are minute errors of acoustic fact. But in such cases, there are nevertheless enough consistent and tell-tale features that interpretations of the directions are not problematic. For example, some temperaments claim they are capable of being played equally well in all twelve major and minor keys, mention a closed cycle of fifths, make no mention of wolf intervals or of intervals tempered more

3. J. Murray Barbour, “Irregular Systems of Temperament,” *Journal of the American Musicological Society* 1 (1948): 23.

than others, or explicitly mention narrow fifths, wide thirds, and enharmonic equivalencies—features that suggest that equal temperament was at least intended by the author, if not always the practical result.

Eighteenth-Century Sources Advocating Equal Temperament

An important and influential source, frequently cited throughout the period, that prescribed equal temperament (giving both a theoretical description and practical directions for setting it) was the *Anweisung, wie Man Claviere, Clavecins, und Orgeln, nach einer mechanischen Art, in allen zwölf Tönen gleich rein stimmen könne* by the clavichord builder Barthold Fritz (1697–1766). First published in 1756 with a dedication to C. P. E. Bach, the *Anweisung* had later editions in 1757, 1780, 1799, and 1800, as well as a Dutch translation ca. 1757.

For Fritz, the best tuning for a keyboard instrument is one in which “one can play equally purely in all twelve major and minor keys, and in hearing observe no difference regarding the purity of the keys, whether one plays in C or C#, in F or F#, in G or G#.”⁴ Fritz believes that tuning by fifths is the surest, best, and least deceptive method. For his practical method he tunes forward by fifths and octaves from *f* to *e#* (*f*) within the compass of *A#* to *e'*; the fifths and minor sixths must beat low, and the fourths and major thirds must beat upward (section 11).

Fritz distinguishes three types of “purity” in the tuning of intervals, a distinction that was adopted by many later writers. In the “first degree of purity,” the interval beats a little low; in the degree of “complete purity,” there are no beats; and in “excessive purity,” the interval beats a little high. Fritz describes how to discover these three degrees of purity using a monochord (section 12). These represent, of course, the three types of tuned intervals used in equal temperament: tempered fifths use the first degree of purity; major thirds, the third degree; and octaves, the second degree.

Fritz’ treatise received an early endorsement from the Berlin theorist Friedrich Wilhelm Marpurg (1718–1795). In the third edition of his *Die Kunst das Clavier zu spielen* (1760; first edition 1750), Marpurg offers pertinent advice to the keyboard teacher: “In order to accustom the ear

4. “. . . man in allen zwölf Tönen *moll* und *dur* gleich rein spielen könne, und keinen Unterschied, so viel die Reinigkeit der Töne betrifft, im Gehöre vermerket, ob man aus *c*, oder *cis*, aus *f*, oder *fis*, aus *g*, oder *gis* spielet” (section 2).

of the pupil from the beginning of the instruction to the proper purity of the keys," the teacher must see that the instrument "is always properly tuned, and not only in the commonly used keys, but also in all the rest." In order to accomplish this, Marpurg states, "Moreover, to the part of the teacher belongs a knowledge of the equal temperament, for which today there are enough theoretical and practical instructions."⁵ Of the theoretical instructions, Marpurg mentions specifically his own *Anfangsgründe der theoretischen Musik* (1757) and for the practical, Barthold Fritz's *Anweisung*.

The Abbé Georg Joseph Vogler (1749–1814), in his *Tonwissenschaft und Tonse[t]zkunst*, published in 1776, directs tuning a cycle of fifths from C to F with numerous checks of the tempered intervals.⁶ Fifths are tuned "beating somewhat low" and fourths "beating somewhat high." After the first three fifths have been tuned, Vogler adds checks using sixths and thirds. The sixths must be tuned "downwards not too low," and the thirds "not too high." Since Vogler gives no other qualifications or limitations for the temperament, and since the tuning proceeds through the cycle of fifths, these are clearly directions for equal temperament.

This temperament of Vogler's was later endorsed by Johann Samuel Petri in 1782 (see below) and by Justin Heinrich Knecht (1752–1817). In the article "Temperatur" in his *Kleines alphabetisches Wörterbuch* (1795), Knecht plagiarizes the definition of tempering from the article "Temperatur" in Johann Georg Sulzer's *Allgemeine Theorie der schönen Künste* (1771–1774). But he departs from the article's advocacy of a temperament by Johann Philipp Kirnberger (see below) and recommends instead Vogler's system of equal temperament (though he does not give the actual practical tuning directions):

From our own experience and conviction, we can recommend no better method of temperament for tuning the organ and keyboard than that which Vogler has presented in his *Tonwissenschaft* (page 112, sections 35 to 38), even though out of ignorance it was disdained by his opponents.⁷

5. "Um das Ohr des Untergebenen vom Anfange der Unterweisung zur gehörigen Reinigkeit der Töne zu gewöhnen, . . . allezeit gehörig gestimmt sey, und zwar nicht allein in den gebräuchlichsten Tönen, sondern auch in allen übrigen. . . . Hiezu gehöret auf Seiten des Lehrmeisters eine Kännntniß der gleichschwebenden Temperatur, wozu es heutiges Tages theoretische und practische Anweisungen genug giebt" (part 1, p. 3).

6. The tuning directions are given on pp. 112–15 and in his table 16, fig. 5. The *Tonwissenschaft und Tonse[t]zkunst* is available in facsimile reprint (Hildesheim: Olms, 1970).

7. "Wir können aus eigener Erfahrung und Ueberzeugung keine bessere Art von Temperatur bei dem Stimmen der Orgeln und Klaviere, als diejenige empfehlen, welche Vog-

The eighteenth-century keyboard tutor that had the greatest longevity and distribution—in terms of number of editions and subsequent revisions—was the *Clavier-Schule* of Georg Simon Löhlein (1725–1781).⁸ Its first edition in 1765 had no tuning directions, but tuning directions were included by the third edition in 1779 (pp. 69–70) as well as in all subsequent editions. Löhlein's directions were specifically recommended by Georg Friedrich Wolf in his *Kurzgefasstes musikalisches Lexikon* (1787).⁹

Löhlein gives directions for what he calls “today's equally-beating temperament” by setting some preliminary benchmark intervals. First, one sets what must be an equal-tempered triad on *c'* by tuning the fifth (*g'*) so that it “beats somewhat downwards” and *e'* as a third “somewhat sharp” or “somewhat higher” than it actually should be. One also sets *g#'* to the *e'*, thus dividing the octave *c'–c''* into three thirds that “beat equally widely upwards.”¹⁰ One must take special care setting these intervals, Löhlein advises, for upon them depends the success of the remainder of the temperament. Thereafter, one tunes forward to *f'* by fifths with various checks against the initially tuned intervals.

About his equal temperament Löhlein remarks:

And now one key must be as pure as the other; thus B major, C major, F major, F# major are completely alike in regards to tuning. Yet there are various temperaments in which some keys are purer, on account of which other keys will be all the more defective. Therefore the one given here, in which all keys are alike, is unquestionably the best.¹¹

In the second edition of his *Anleitung zur praktischen Musik* (1782), Johann Samuel Petri (1738–1808) gives two tuning schemes—the equal

ler in seiner Tonwissenschaft (Seite 112 von Abschnitt 35 bis 38) gezeigt hat, wenn sie gleich von seinen Widersachern aus Unwissenheit verachtet wurde” (p. 85).

Vogler's *Tonwissenschaft und Tonsetzkunst* had been attacked in the Berlin *Litteratur- und Theatre-Zeitung*, 29 August 1778; Vogler reprinted the reviews in his own serial publication, *Betrachtungen der Mannheimer Tonschule*, vol. 1, nos. 9–12 (January–May 1779), and replied to them in the issue for 15 December 1780.

8. Four editions appeared during Löhlein's lifetime (1765, 1773, 1779, and 1781–82, the latter three enlarged). Thereafter it was edited and enlarged, in 1791 by Johann Georg Witthauer and in 1804 by August Eberhard Müller.

9. In the second edition of 1792, p. 181.

10. In fact, however, the beat rates of the successively higher thirds must increase slightly.

11. “Und nun muß eine Tonart so reine seyn als die andere; also H dur, C dur, F dur, F# dur einander in Ansehung der Stimmung vollkommen gleich seyn. Man hat noch verschiedene Temperaturen, wo zwar etliche Tonarten reiner seyn, hingegen werden dafür andere desto mangelhafter. Daher ist diese angegebene, wo alle Tonarten einander gleich sind, unstreitig die beste” (p. 70).

temperament schemes of Vogler and Fritz.¹² Petri's discussion of keyboard tuning was also recommended by Wolf in his *Kurzgefasstes musikalisches Lexikon*.¹³

For both temperaments, Petri notates the cycle of fifths and provides the necessary directions about tempering the intervals, and there is nothing about these directions that requires comment. But his introductory comments are of interest for suggesting how common and "natural" tempered intervals had become by 1782. Petri writes that Fritz states

that one should tune from the low notes up to the higher ones only in pure, but not harsh, fifths, which in the pure tuning should beat rather than be perfectly pure.¹⁴

And when introducing Vogler's equal temperament, Petri describes it as "a very pure temperament."

Petri's seeming contradictions—that a beating (or equal) temperament is a "pure" temperament, that tempered fifths are "pure," that pure fifths are "harsh," and that a "pure" temperament should not have "completely pure" fifths—can be resolved by noting that Petri uses "pure" in two senses: first, in the sense of a beatless, pure interval; and second, in his preferred sense as a tempered interval (or tuning system) that is "in tune" or tuned correctly, so that all intervals and chords sound equally clean or smooth (in contrast to which Petri can call a beatless, purely tuned fifth "harsh"). Fritz, as we have seen, had distinguished three degrees of "purity" in tuning; and Petri seems to have adopted Fritz's first degree of purity as the usual way of tuning fifths.¹⁵

This special meaning of "pure" (equated with tempered intervals) seems then to have been well established in 1782. But it had precedents; in his *Versuch über die musikalische Temperatur* (1776), Marpurg had defined the word *pure* "as it ordinarily will be taken, namely for *almost pure*, i.e., that each fifth should be flattened one-twelfth of a Pythagorean

12. The tuning directions are contained on pp. 373–77. A facsimile (with notes) of the section on tuning stringed keyboard instruments appears in Vera Schwartz, "Johann Samuel Petris Anweisungen zum Beziehen, Bekielen und Stimmen besaiteter Tasteninstrumente," *Der klangliche Aspekt beim Restaurieren von Saitenklaviere*, ed. Vera Schwartz, Beiträge zur Aufführungspraxis 2 (Graz: Akademische Druck- und Verlagsanstalt, 1973): 87–99.

13. In the second edition of 1792, p. 181.

14. ". . . daß man von den tiefen Tönen zu den höhern hinauf in lauter reinen, nicht aber in scharfen Quinten stimmen solle, welche lieber unter der reinen Stimmung schweben sollen, als vollkommen rein werden" (p. 373).

15. One need read no farther than Fritz's title to find the same meaning of "pure" as meaning equal temperament: *Anweisung, wie Man Claviere, Clavecins, und Orgeln, . . . in allen zwölf Tönen gleich rein stimmen könne, dass aus solchen allen sowohl dur als moll wohlklingend zu spielen sey*.

comma, which amounts to almost nothing."¹⁶ And he states that it is in just this sense that C. P. E. Bach meant it when he wrote, "The clavichord and the fortepiano . . . both *can* and *must* be purely tuned."¹⁷

By the early 1780s, then, slightly beating, tempered intervals had become so accepted and natural to the ear that they could be called "pure."

Unequal Temperaments

In contrast to these sources advocating equal temperament, a number of other sources in the 1770s proposed temperaments that were described by their contemporaries as "unequal," though today we would describe them as irregular temperaments. The most prominent is one that was advocated by Johann Philipp Kirnberger (1721–1783), a temperament now known as Kirnberger II; it is still occasionally used.

Kirnberger devised and set forth three temperaments, all essentially departures from Pythagorean tuning. His first temperament was described in his *Clavierübung* (1766), the second in his *Die Kunst des reinen Satzes in der Musik* (1771–79; second edition, 1793). His third temperament, described only in a letter to Johann Nikolaus Forkel and not published until the nineteenth century, need not concern us here.¹⁸

The first Kirnberger temperament tunes a series of seven pure fifths forward from C♯ to D; to the previously tuned F, one sets a pure third F–A; then the remaining fifths are tuned pure from A to F♯. Thus, all fifths are pure, except the fifth F♯–C♯, which is narrow by one-twelfth of a comma, and the fifth D–A, which is narrow by eleven-twelfths of a comma.¹⁹

16. ". . . das Wort *rein* . . . wie es insgemein genommen wird, nemlich für *beynahe rein*, d. i. daß jede Quinte um ein Zwölftheil Comma pyth., welches bey nahe soviel als nichts ist, erniedriget werden soll" (p. 223).

17. "Das Clavichord und das Fortepiano . . . beyde können und müssen rein gestimmt seyn." C. P. E. Bach, *Versuch über die wahre Art das Klavier zu spielen* (1756–1762), vol. 2, p. 327.

For other earlier uses of the word "rein" in reference to J. S. Bach's tunings and an argument that Bach's temperament must have been "equal temperament, or something not perceptibly different," see Rasch, 302–3.

18. Kirnberger's third temperament is printed in J. G. H. Bellerman, "Briefe von Kirnberger an Forkel III" *Allgemeine musikalische Zeitung* (6 September 1871), cols. 565–72. The temperament described here is an "improvement" over Kirnberger's earlier temperaments in that now four fifths are tempered (i.e., those on C–G, D–A, G–D, and A–E) in addition to the "wolf" fifth F♯–C♯ at the extreme of the cycle of fifths. The temperament is also described in Herbert Kellertat, *Zur musikalischen Temperatur insbesondere bei Johann Sebastian Bach* (Kassel: J. G. Oncken, 1960), 47–48.

19. *Clavierübung. Vierte Sammlung* (1766). Kirnberger's first temperament is discussed and described in Kellertat, 47; Wilhelm Dupont, *Geschichte der musikalischen Temperatur* (Nördlingen: C. H. Beck, 1935), 95; Martin Vogel, "Die Kirnberger-Stimmung vor und

The Kirnberger unequal temperament that was the most widely known and discussed is the one now known as Kirnberger II, set forth in 1771 in the first part of his *Die Kunst des reinen Satzes in der Musik*.²⁰ After a brief review of the history of tuning and temperament, Kirnberger acknowledges that many see equal temperament as advantageous because every chromatic degree has usable major and minor thirds and sixths, and fourths and fifths tuned so close to pure that the ear does not notice their departure from complete purity; one can therefore “play almost completely purely” in all major and minor keys (pp. 10–11).

But Kirnberger raises three criticisms of equal temperament that suggest it should be abandoned: (1) it is impossible to tune it without a monochord, for the naked ear can accurately tune only consonant intervals; (2) equal temperament abolishes the variety or diversity of the keys (key characteristics), leaving only the quality of major and minor; and (3) nothing is really achieved by having twenty-four usable scales; instead (he says again), the variety between modes and keys is lost, and the composer is left with the choice of only major and minor. Kirnberger’s advocacy of his unequal temperament is clearly a necessary corollary of his belief in the existence of (or the need to create) key characteristics, i.e., the belief that each key has a different and distinct affective quality.²¹

Kirnberger also sets forth three criteria for a good keyboard temperament: (1) it must be easy to tune; (2) it must not destroy the variety of the keys; and (3) it must produce, as far as possible, all the intervals that are created by the pure progressions of melodies. Kirnberger calls the unequal temperament he sets forth “the best possible” (p. 13).

nach Kirnberger,” *Colloquium Amicorum: Joseph Schmidt-Görg zum 70. Geburtstag*, ed. Siegfried Kross and Hans Schmidt (Bonn: Beethovenhaus, 1967), 442–43; and Marpurg, *Neue Methode allerley Arten von Temperaturen dem Claviere* (1790), 21–22 and 36–39.

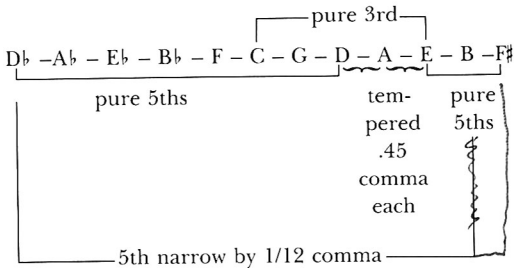
Kirnberger had, interestingly enough, earlier proposed equal temperament in his *Konstruktion der gleichschwebenden Temperatur* (1760).

20. Kirnberger II is described in Barbour, 157–58; Dupont, 96–98; Kelletat, 47; Vogel, 443–44 (by use of selective quotation, Vogel overstates the use and longevity of this Kirnberger temperament); Marpurg, *Versuch*, 182–219; and Marpurg, *Neue Methode*, 39–40.

On Kirnberger’s *Die Kunst des Reinen Satzes*, see Kelletat, 40–46, and Dupont, 94–98. The section on tuning and temperament is included in the portions of *Die Kunst des reinen Satzes* translated by David Beach and Jurgen Thym as *The Art of Strict Musical Composition* (New Haven: Yale University Press, 1982), 11–24.

21. Kirnberger develops the notion of the affective characters of intervals and modes later in *Die Kunst des reinen Satzes*; see vol. 2, pp. 51 and 193. For a thorough discussion of Kirnberger and the concept and history of key characteristics, see Rita Steblin, *A History of Key Characteristics in the Eighteenth and Early Nineteenth Centuries* (Ann Arbor: UMI Research Press, 1983).

TABLE I
Kirnberger's Second Tuning



This Kirnberger temperament is constructed by setting two series of pure fifths and two individually-set tempered fifths (table 1). First, one sets a series of pure fifths forward from $d\flat$ to d' . Then to the previously set c , one tunes e as a pure major third. Then beginning with the e , one again tunes a series of pure fifths from e to $f\sharp'$. The remaining note a is tuned so that it makes a narrow fifth $d-a$ and likewise a narrow fifth $a-e'$. Each of these two tempered fifths ($d-a$ and $a-e'$) will be narrow by almost one-half ($.45$ or $5\frac{1}{2}$ twelfths) of a comma; and the third tempered fifth, $F\sharp-D\flat$ (formed by the extreme points of the cycle), is narrow by one-twelfth comma. The remaining fifths, as stated, are pure; and there are three pure thirds: $C-E$, $D-F\sharp$, and $G-B$. Equivalents in cents for Kirnberger II are given in table 2.²²

It should be pointed out that this temperament, although called by Kirnberger and his contemporaries an "unequal" temperament, is quite unlike those "well-tempered" tunings we now tend to call unequal when comparing them to equal temperament. It is what J. Murray Barbour calls an irregular temperament: it is essentially a Pythagorean tuning with two fifths tempered almost one-half a syntonic comma. Given its strong Pythagorean character, it is unlikely to be acceptable to modern players seeking an unequal but historical temperament. In fact, Barbour notes laconically, even in its own day Kirnberger II "must have been wholly unsatisfactory for the performance of contemporary music."²³

22. In comparison with an equal-tempered fifth, which is narrower than pure by two cents and beats about once per second, Kirnberger's tempered fifth $d'-a'$ is narrow by eleven cents and beats five and one-half times per second.

23. Barbour, "Persistence of the Pythagorean Tuning System," *Scripta Mathematica* 1 (1932): 300.

TABLE 2

Kirnberger's Second Tuning Expressed in Cents

<i>Note</i>	<i>Cents</i>
C	0
D \flat	90
D	204
E \flat	294
E	386
F	498
F \sharp	590
G	702
A \flat	792
A	895
B \flat	996
B	1088
C	1200

Unlike the other unequal temperaments proposed during the decade, Kirnberger II acquired many outspoken advocates. The sources most responsible over the next fifty years for granting prestige to Kirnberger's ideas on tuning and key characteristics, and for disseminating them to a wider, nonspecialist audience were the articles "Stimmen," "Temperatur," and "Ton" in Johann Georg Sulzer's *Allgemeine Theorie der schönen Künste* (1771–74; second edition, 1792–1794). These articles, though unsigned, are now known to have been written by Johann Abraham Peter Schulz (1747–1800) under the direction of Kirnberger, who was his teacher. The article "Temperatur" summarizes the features of equal temperament and Kirnberger II and recommends the latter; the article "Ton" states that Kirnberger's temperament provides the necessary differences among the keys, while the article "Stimmen" gives practical directions for setting it that differ from Kirnberger's directions only in the order of the intervals tuned.

Another of Kirnberger's adherents was Georg Friedrich Tempelhof, who in his *Gedanken über die Temperatur des Herrn Kirnberger* (1775) accepted without reservation the doctrine of key characteristics, Kirnberger's objections to equal temperament, and his criteria for a good temperament. Tempelhof can thus confidently proclaim that equal temperament is "the worst that can be conceived" (p. 18). Because it preserves the distinct character of keys and provides a variety of major

thirds that come as close as possible to their true purity, Tempelhof advocates Kirnberger's temperament.²⁴

After a thorough presentation of the theory underlying the tuning (pp. 11–31), Tempelhof gives practical tuning directions for Kirnberger II (pp. 33–34) that differ slightly from Kirnberger's method. Beginning with C \sharp , he directs that one tune forward a series of pure fifths G \sharp , D \sharp , B \flat , F, C, G, and D. Then one tunes pure triads on F and C. From the already-tuned E, one tunes the remaining fifths E–B and B–F \sharp pure, finally retuning the A higher so that the fifths D–A and A–E beat equally narrowly.

A variant of Kirnberger's second temperament was given by the Baron Christian Ludwig Gustav von Wiese (1732–1800) in his *Anweisung der mechanischen Behandlung des Clavier nach einer vorgeschlagenen neuen Temperatur zu Stimmen* [1790]. Von Wiese's tuning is similar to Kirnberger II, except that the two tempered fifths are placed on different intervals.²⁵

Von Wiese achieves his tuning in three steps (see table 3). First, beginning on *f*, one tunes forward a cycle of pure fifths to *a* \sharp ; then one tunes *f'* as a pure octave to *f*. Second, one retunes the *a* \sharp so that it makes two equally tempered fifths *d* \sharp –*a* \sharp and *a* \sharp –*f'*. Third, beginning with *d* \sharp one retunes backwards using descending pure fifths through the cycle of fifths until reaching *f* \sharp (the fifth B–*f* \sharp is now a narrow fifth). The result is an irregular, closed temperament of ten pure fifths with two fifths (B–F \sharp and A \sharp –F) narrow each by one-half comma. Table 4 lists equivalents in cents for this tuning of Von Wiese.²⁶

Kirnberger's ideas about temperaments as set forth both in *Die Kunst des reinen Satzes* and the articles in the *Allgemeine Theorie der schönen Künste* were thoroughly examined and vigorously denounced in the writings of Friedrich Wilhelm Marpurg, thus becoming a matter of notorious

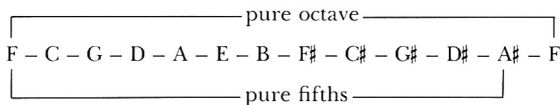
24. Tempelhof's method of setting Kirnberger II is also described in Kelletat, 47; see also Steblin, 91–92 and 207 (n. 25).

25. This tuning of von Wiese was discussed (and rejected) by Marpurg, *Neue Methode*, 34–40 (apparently the only contemporary discussion of it). Von Wiese proposed other theoretical temperaments: see his *Versuch eines formularisch und tabellarisch vorgebildeten Leitfadens* (1792) (discussed in Kelletat, 37, 62–63), and *Formularisches Handbuch für den ausübenden Stimmer des Tasteninstrumentes* (1792). His *Versuch über die logisch-mathematische Klangeintheilungs-, Stimmungs- und Temperature-Lehre* (1793) contains four temperaments, the second of which is identical to Kirnberger II; these are discussed in Barbour, *Tuning and Temperament*, 158–59.

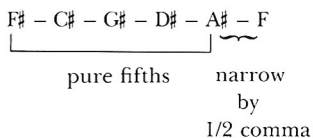
26. In comparison with an equal-tempered fifth, which is narrower than pure by two cents and beats about once per second, von Wiese's tempered fifths (*a* \sharp –*f'* and *b*–*f* \sharp) are narrow by twelve cents and will beat about five times (4.98 and 5.38 respectively) per second.

TABLE 3
 Christian von Wiese's Tuning
 (from his *Anweisung der mechanischen Behandlung*)

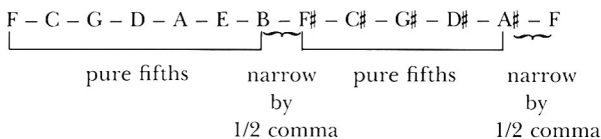
tune forward:



retune backwards:



result:



theoretical controversy.²⁷ After a detailed discussion and refutation of Kirnberger's first and second temperaments (pp. 182–219), Marpurg concludes his *Versuch über die musikalische Temperatur* (1776) with the chapter "Vorzug der gleichschwebenden Temperatur vor der ungleichschwebenden" (The Superiority of the Equally Beating over the Unequally Beating Temperament," pp. 219–23). Invoking no less an authority than C. P. E. Bach, Marpurg states that "the unequally beating temperament is useless for our system, and that the equally beating temperament is the *only natural and true* temperament."²⁸

As a rebuttal to Marpurg's critique, Kirnberger added an unsigned review of Marpurg's book (written by Tempelhof) to the second edition of his *Die Kunst des reinen Satzes* (1776–79), part 2, section 3, pp. 181–88.

27. For useful surveys of the Marpurg-Kirnberger controversy, see Steblin, 91–102; Kelletat, 40–60; and Dupont, 98–102.

28. "Die ungleichschwebende Temperatur für unser System nichts tauget, und daß die gleichschwebende Temperatur die *einzig natürliche und wahre* Temperatur ist" (p. 220).

TABLE 4
 Christian von Wiese's Tuning
 (from his *Anweisung der mechanischen Behandlung*)
 Expressed in Cents

<i>Note</i>	<i>Cents</i>
C	0
C#	102
D	204
D#	306
E	408
F	498
F#	600
G	702
G#	804
A	906
A#	1008
B	1110
C	1200

Kirnberger's unequal temperament became a controversial and long-lived subject, and the basic points of the Kirnberger-Marpurg controversy were repeated endlessly by late eighteenth- and early nineteenth-century theorists and musical writers. When one surveys these writings, it becomes clear that Kirnberger's rejection of equal temperament, and his belief in the existence of key characteristics and the virtues of his own alternative temperament, become literary and critical commonplaces that many belletristic essayists, dictionary compilers, and musical dilettantes (some with personal ties to Kirnberger) freely plagiarized and uncritically repeated as an article of faith. That Kirnberger claimed to represent the tradition of J. S. Bach was another reason for some (especially Johann Nikolaus Forkel) to adopt and proselytize for his ideas. Believing that Greek music used modes of different qualities to arouse various passions in men, many of these writers may have been indulging a nostalgic wish that such powers of music could be achieved again in contemporary music through the different qualities of keys made possible by the use of Kirnberger's tuning.²⁹

Since most of the sources of the Marpurg-Kirnberger controversy have been discussed in several places, were written by nonmusicians or

29. See especially, for example, Tempelhof, 5-6.

TABLE 5
Heinrich Laag's Tuning

F – C – G – D – A – E – B – F \sharp – C \sharp – G \sharp – D \sharp – B \flat – F
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border-top: 1px solid black; width: 40%;"></div> <div style="border-top: 1px solid black; width: 40%;"></div> </div>
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center; width: 40%;">pure 5ths</div> <div style="text-align: center; width: 40%;">beating a little low</div> </div>
<div style="border-top: 1px solid black; width: 100%;"></div>
closed cycle

dilettantes, and clearly are of a speculative, polemical nature—arguing what musical practice ought to be like—they need not concern us further, for our attempt is to focus on those practical sources that give us more reliable, concrete evidence about the tuning practices recommended by professional or practicing musicians.

Two other unequal temperaments were proposed in a form suitable for practical tuning during the period of our survey, though neither seems to have received any further comment or adherents. In his keyboard tutor *Anfangsgründe zum Clavierspielen und Generalbas[s]* (1774), Heinrich Laag (1713–1797) gives his own practical method of tuning (p. 74). As shown in table 5, Laag tunes a closed circle of fifths forward from F. The first six fifths (from F forward to B) Laag tunes “completely pure and exact,” while to the remaining fifths in the cycle (F \sharp to F) he allows “a very little beating,” so that the final fifth B \flat –F “beats a little under.”³⁰ Unfortunately, Laag doesn’t specify whether the tempering is equal, increases, or decreases as he progresses through the six tempered fifths. If the final six fifths equally divided the Pythagorean comma, i.e., were tempered flat by one-sixth of a comma (as is assumed in the equivalents in cents given in table 6), Laag’s temperament would be similar in this respect to several other eighteenth-century irregular temperaments.³¹

Laag claims his temperament has three advantages: (1) the seventh to the octave is not too low, which would not be acceptable to the ear; (2) all the thirds have their proper beating and temperament; and (3) the chords on E \flat and A \flat major are harmonious. But it is unlikely that Laag’s temperament would prove very useful in practice. Unlike other temperaments that either contain many pure fifths or an unbroken series of

30. In the following section, Laag states that after years of daily experience, he has found it better to begin the cycle an octave lower with *f* instead of *f'*.

Assuming Laag’s fifths are the same size, they are four cents narrower than pure and (around middle C) will beat about twice a second.

31. See Barbour, *Tuning and Temperament*, 163–64.

TABLE 6
Heinrich Laag's Tuning Expressed in Cents

<i>Note</i>	<i>Cents</i>
C	0
C♯	106
D	204
E♭	302
E	408
F	498
F♯	608
G	702
G♯	804
A	906
B♭	1000
B	1110
C	1200

tempered fifths (many are described by Marpurg and Barbour), Laag reverses the usual practice and instead puts all the pure fifths among the central (diatonic) fifths; and he locates the tempered fifths among the extreme (chromatic) fifths.³² Thus the central diatonic keys will sound very Pythagorean.

While in 1776 Vogler included a well-known set of directions for equal temperament in his *Tonwissenschaft und Tonse[t]zkunst*, in his later theoretical writings the Abbé seems to have adopted the doctrine of key characteristics.³³ In his *Handbuch zur Harmonielehre* (1802) Vogler presents a practical keyboard tuning that he calls his "characteristic" temperament (p. 7), one that will preserve the distinct character of each key.³⁴

32. Rasch, 306.

33. See his *Betrachtungen der Mannheimer Tonschule* (1778–81), vol. 1, pp. 284, 288 and vol. 3, nos. 10–12, p. 41; his articles "Ausdruck" and "Farbe" in the *Deutsche Encyclopädie* (1778–1804) vol. 2, p. 386 and vol. 9, p. 509; *Choralsystem* (1800), vol. 1, pp. 17, 103; and *Vergleichungs-Plan der, nach Vogler'schen Simplifikazions-System ungeschaffenen, Neuwünster-Orgel in Würzburg* (1812), 14–15.

For discussions and excerpts from these passages, see Floyd K. Grave and Margaret G. Grave, *In Praise of Harmony: The Teachings of Abbé Georg Joseph Vogler* (Lincoln: University of Nebraska Press, 1987), 42–43; and Steblin, 118, 126–29, 137–38, and appendices A, B, and C.

34. The temperament is described in Grave and Grave, 41–42, who do not, however, include Vogler's crucial details about the amount of tempering. Vogler also described the temperament in the *Vergleichsplan* (see Steblin, p. 211, n. 44).

TABLE 7
Vogler's "Characteristic" Temperament
Expressed in Cents

<i>Note</i>	<i>Cents</i>
C	0
C♯	> 95
D	215
D♯	> 283
E	397
F	509
F♯	> 596
G	691
G♯	> 790
A	906
B♭	> 995
B	1088
C	1200

Vogler's directions for setting the temperament (pp. 119–29) have two stages. First, the notes of the diatonic scale are tuned in the order c' (with its octave c''), g' , f' , a' , e' , d' , and b' . He wants each of these notes to play (albeit necessarily imperfectly) a dual role: as a major third to one note and a perfect fifth to another. Vogler determines the amount of tempering by directing that in a fifth relationship a note must be tuned "as narrow as the ear can bear" (but not approaching $1/81$); while the same note in a third relationship must be tuned high (but not as much as $1/80$). Such a compromise will allow a range of values, but it appears that Vogler wants each diatonic note to be the mean between these values ($1/80.5$ or $.0124$).³⁵ Values in cents for the diatonic notes are given in table 7.

35. For example, the fifth $c'-g'$ is eleven cents narrower than pure and beats about five (5.23) times per second; the third $c'-e'$ is eleven cents wider than pure and beats about eight (8.37) times per second, while the same equal-tempered third is fourteen cents wide and beats about ten (10.37) times per second.

Several pages later (p. 123) Vogler gives an empirical method for testing the temperament. Using a bichord fortepiano, he directs setting one string of an e'' as a pure major third to c'' , the other string as a pure fifth to a' . One raises the former string and lowers the latter until they reach a unison, and the model for the temperament is ready. (This method is not likely to be very helpful, however, since the value for the a' is not given.)

The second stage is to set the accidentals, in the order $f\sharp'$, $c\sharp'$, $g\sharp'$, $d\sharp'$, and $b\flat'$. Each of these notes is also a compromise, in its double role as a major third and a perfect fourth, though Vogler would like each note to be somewhat higher than the exact mean value. The approximate values in cents that result are given in table 7. It is in these last five notes, Vogler states, that the characteristic temperament becomes apparent.

Works Comparing Equal and Unequal Temperaments

The keyboard tutor that is best known and most readily available today is Daniel Gottlob Türk's *Klavierschule* (1789; second edition, 1802).³⁶ Türk (1750–1813) presents the major concepts behind the necessity for tempering and gives two choices for tuning: equal temperament and the “unequally beating” temperament of Kirnberger. Türk professes to refrain from making an outright prescription for tuning, contenting himself with leaving the reader to choose. But, as we will see, he does slant his presentation in favor of equal temperament.

Türk's description of equal temperament and its characteristics is quite clear and precise:

When one fifth beats as low as the others, or when one major third is tuned too high as much as the others, etc., then this temperament is called *equally beating*. In this case, one naturally plays in one key as purely as in another, that is, none completely purely. Nevertheless, the necessary deviation here is so insignificant that our ear has become accustomed to it, and a keyboard tuned in this way can be considered pure.³⁷

Observing that equal temperament eliminates any possibility for the phenomenon of key characteristics, Türk concludes that if it exists, it must be due to some cause other than temperament.

36. The section on tuning is found on pp. 380–86. Türk's discussion of tuning was also recommended by Wolf in his *Kurzgefasstes musikalisches Lexikon*. The *Klavierschule* is available in a facsimile reprint (Basel: Bärenreiter, 1962) and has been translated by Raymond H. Hagg as *School of Clavier Playing* (Lincoln: University of Nebraska Press, 1982); the section on tuning is on pp. 372–78.

37. “Wenn Eine Quinte so viel abwärts schwebt, als die Andere, oder wenn Eine große Terz um eben so viel zu hoch gestimmt wird, als die Andere u. s. w. so heißt die Temperatur *gleichschwebend*. Man spielt in diesem Falle natürlicher Weise aus Einem Tone so rein, als aus dem Andern, d. h. aus keinem ganz rein. Indes ist die hierzu erforderliche Abweichung so unbedeutend, daß sich unser Ohr daran gewöhnt, und ein auf diese Art gestimmtes Klavier für rein gelten läßt” (p. 381).

Türk gives two schemes for setting equal temperament. The first proceeds forward from C to F by fifths that “must beat downwards a little.” The second scheme he gives is the system of Barthold Fritz.

The alternative tuning scheme that Türk presents is the unequal temperament of Kirnberger. Türk purports to present the two temperaments impartially; but if we consider his remarks carefully, it is clear that in fact he has reservations about Kirnberger’s temperament—he probably felt obligated to discuss it because of the controversy surrounding it. And as was suggested, it is no doubt just this controversy over the Kirnberger temperament, rather than any actual widespread use of it, that causes references to it to keep appearing in various tutors and maintenance manuals.

Türk notes that Kirnberger’s temperament was described as “the most correct” in Sulzer’s *Allgemeine Theorie der schönen Künste*,³⁸ but he is at some pains to question Sulzer’s objectivity in advocating it. He points out that Sulzer was very prejudiced toward Kirnberger (the author of the article, Schulz, was in fact Kirnberger’s pupil). And Türk asks whether, despite the temperament’s advantage—that it gives each key an individual quality—there might be some imperfections; whether music as a whole would benefit; whether it would be applicable to all instruments; and whether keyboard works intended for equal temperament would be properly effective in Kirnberger’s temperament (pp. 382–83). Türk points out that the temperament was recommended by Sulzer despite the fact that it had been scrutinized and rejected in Marpurg’s *Versuch* of 1776. And finally, he cites an example in which Sulzer’s opinion is suspect: the claim that equal temperament is impossible to tune by ear, but that Kirnberger’s can be tuned easily by every tuner.³⁹ Despite his professed impartiality in presenting both temperaments, therefore, Türk’s *Klavierschule* should probably be seen as recommending equal temperament.

38. Türk presents Kirnberger’s temperament as given in the article “Stimmen” in Sulzer’s *Allgemeine Theorie der schönen Künste*. Türk prints the series of notes to be tuned and paraphrases Sulzer’s text, but assumes that the prospective tuner will know that the fifths are to be tuned pure (p. 386). Türk reports that Kirnberger finds equal temperament unacceptable because it abolishes key characteristics and also that Sulzer, for the same reason, rejects equal temperament and recommends Kirnberger’s temperament, in which some intervals are tuned pure or almost pure, and others even more impure, thus giving each key its own character (p. 382).

39. Türk returned to the subject of Kirnberger’s temperament again in *Anleitung zu Temperaturberechnungen* (1806; another ed. 1808).

The distinction between “equally beating” and “unequally beating” temperaments was also recognized by Johann Joseph Klein (1740–1823) in his *Lehrbuch der theoretischen Musik* of 1801 (pp. 68–69). Klein realizes that the purpose of using unequally beating temperaments is to provide key characteristics, but it is clear from his tone that he remains skeptical of their existence:

With the unequally beating temperament, one intends to create a differentiation among the keys, by which one imagines each key can be given various characteristics and advantages over the others. How far this purpose will be achieved will be left to everyone's individual experience.⁴⁰

And when it comes to giving directions for tuning, Klein prescribes only equal temperament. After determining the values for equal temperament through various divisions of the comma and through use of the monochord, Klein gives directions for tuning a temperament by ear (p. 82). He divides the octave $c'-c''$ into three major thirds, $c'-e'$, $e'-g\sharp'$, and $g\sharp'-c''$, each tuned a little high. Then the fifths C–G, G–D, D–A, and A–E are tuned, each slightly low. Finally, the remaining fifths are tuned.

Early Nineteenth-Century Keyboard Maintenance Manuals

At the beginning of the nineteenth century, we have a group of sources that provides even more concrete evidence about practical keyboard tuning: manuals written for the tuning and maintenance of fortepianos and other stringed keyboard instruments.

The first of these sources is the *Stimmbuch, oder vielmehr: Anweisung, wie jeder Liebhaber sein Clavierinstrument . . . selbst repariren und also auch stimmen könne*, published in 1801 by Joseph Büttner and Ernst Nachersberg (a second edition appeared in 1804 under the name of Nachersberg only⁴¹). Büttner was organist at the Domkirche at Glogau (until at least 1830), and Nachersberg (b. 1775) was a grammarian and novelist.

Büttner and Nachersberg initially state that a correct tuning can be achieved only “if the unequally beating temperament is taken as the foundation.” But when they give practical instructions for tuning, the

40. “Bey der ungleichschwebenden Temperatur hat man zur Absicht, den Tonarten eine Verschiedenheit unter sich zu geben, wodurch man zu bewirken glaubt, daß jede Tonart verschiedene Eigenschaften und Vorzüge vor der andern haben soll. In wie fern dieser Endzweck erreicht werde, solches wird der eigenen Erfahrung eines Ieden überlassen” (p. 68).

41. Though contrary to the statements on the title page this was merely a reissue, not an enlarged edition. In the first edition (cited here), the tuning directions are found on pp. 51–58.

temperament is equal temperament. According to them, the following rules (accurate, though somewhat confusing) constitute all that can be said about tuning: (1) one first tunes all the notes between *A* and *f'*; (2) one tunes forward from *f* to *a#* upwards by fifths and (as necessary to stay within the limits of *A* to *f'*) down by octaves; and (3) within the compass of *A* to *f'* all the notes are tuned "beating downwards" and outside this compass, pure (pp. 54–56). This latter direction, of course, is a rather cryptic way of saying that the fifths within the temperament compass are tuned slightly flat and the remaining notes in the keyboard are tuned by pure octaves. The authors also suggest checking the major thirds that are formed within the compass *A* to *f'* to ascertain that they "have their proper sharpness and a somewhat upwardly beating sound" (p. 57).

Büttner and Nachersberg's *Stimmbuch* received a favorable review in the *Allgemeine musikalische Zeitung* (15 July 1801), which remarked specifically on the tuning recommendation. The anonymous reviewer seemed to recognize that the directions for equal temperament were not very clear:

More emphasis should also be placed on the equal temperament—i.e., that one makes all fifths a little too low, all major thirds a little too high, and all put in an equal proportion, which the ear easily recognizes; only in this way is an instrument prepared so that it can be played in all keys.⁴²

Another tuning and maintenance manual, *Clavier-Stimmbuch oder deutliche Anweisung wie jeder Musikfreund sein Clavier-Flügel, Forte-piano und Flügel-Fortepiano selbst stimmen, repariren, und bestmöglichst gut erhalten könne*, edited or compiled in 1805 by a certain Gall, reprints the entire section on tuning from Büttner and Nachersberg's *Stimmbuch* (pp. 54–62) and adds some remarks to clarify the theory of tuning keyboard instruments (pp. 62–66). In 1807 there appeared yet another tuning manual, *Gründliche Anleitung zum Clavierstimmen*, which, though it is attributed on the title page to Abbé Vogler, offers neither of Vogler's earlier temperaments, but reprints virtually verbatim the tuning directions of Büttner and Nachersberg.⁴³

42. "Auch sollte mehr auf die gleichschwebende Temperatur gedrungen seyn—d.h. darauf, dass man alle Quinten ein klein wenig zu tief, alle grosse Terzen ein klein wenig zu hoch, und nun in allen ein gleiches Verhältnis, über welches das Ohr leicht Rechen-schaft giebt, herstelle; als wodurch allein man sein Instrument in den Stand setzt, aus allen Tönen gespielt werden zu können" (col. 704).

43. In fact, since the sixteen-page (anonymously published) pamphlet is entirely plagiarized from Büttner and Nachersberg, it is likely that the attribution to Vogler is fraudulent.

The manual that devotes the most space to practical tuning is the *Ueber Klavierinstrumente* by Christian F. G. Thon (1773–1844). Thon's manual, published as *Ueber Klavierinstrumente, deren Ankauf, Behandlung und Stimmung* in 1817 and 1825, was reissued in 1836 under the title *Abhandlung über Klavier-Saiten-Instrumente*; it was also reprinted as volume 89 of the *Neuer Schauplatz der Künste und Handwerke* series in 1843.

Judging from his publications, Thon was not a practicing musician but rather a compiler (of encyclopedic habits), for he wrote manuals on (among other things) bookbinding, wine making, lacquering and varnishing, veterinary medicine, chess, distilling, and dog training. Unfortunately, in his attempt to be comprehensive, Thon compiled material somewhat haphazardly from a number of identifiable sources; this perhaps explains why it often seems that he doesn't quite understand what he is writing about, and why several of his tuning directions are incomplete.

Thon begins his discussion of tuning with the physical, mathematical, and acoustic foundations of sound and scales, and gives the reasons for the necessity of temperament (pp. 117–24). He observes that there are two very different principal systems of temperament: equal temperament and unequal temperament (pp. 124–25). His description of the features of equal temperament is accurate enough, but—and here Thon's credibility weakens—the unequal temperament Thon describes is the quite obsolete one-quarter comma meantone.⁴⁴

There is no doubt, Thon states, that unequal (i.e., meantone) temperament is to be preferred; even though equal temperament comes closer to the mathematical ratios, its equal beating produces a uniformity that diminishes variety in practical music. Unequal temperament, however, preserves the distinct character of each key and allows the composer greater variety and expressive possibility.

Thon then notes that in addition to equal and unequal temperaments, many theorists and musicians had proposed a variety of other temperaments; and of these he singles out the temperaments of Kirnberger and Marpurg as epoch making.⁴⁵ Thon proposes to explain what it is nec-

44. That is, Thon describes this unequal temperament as having eleven fifths that are tempered one-quarter of a comma, the twelfth fifth being an unusable "wolf"; thereby one salvages eight major thirds (p. 125).

45. Here Thon is confused. In a note he cites Kirnberger's early treatise on tuning that had propounded a method of setting equal temperament, *Konstruktion der gleichschwebenden Temperatur* (1760); but as becomes clear, he juxtaposes Kirnberger II against equal temperament. For Marpurg Thon cites the *Versuch* and *Neue Methode*.

essary to know about each. First he gives directions for the Kirnberger II temperament, though his method of setting it differs from those of Kirnberger, Sulzer, and Tempelhof (p. 128). In addition to the practical directions, he gives the temperament in fractions and decimal ratios.

But according to Thon a temperament of Marpurg pleases many musicians more than the Kirnberger temperament. Thon quotes a long section (no. 167) from Marpurg's *Versuch* in such a way that it seems to describe two ways to set this temperament (pp. 128–31 and figs. 1 and 2). But in fact, they are not tuning systems, but Marpurg's demonstrations of how to find the size of an equally tempered fourth or fifth at the keyboard without the help of a monochord. (The first demonstration proceeds forward from C by seven pure fifths, adding to the last fifth a pure major third C♯–E♯, the resulting C–E♯ approximating an equal tempered fourth; the second demonstration proceeds forward from C by seven pure fourths, adding to the last fourth a downward pure major third B–G.)

Thon grants that using this method may be difficult for a person just beginning to learn to tune, and he therefore provides for beginners an easy and short method by which to tune an instrument “so that one can play every scale in all keys equally purely” (pp. 132–33). After preliminaries about the mechanics of making tuning easier, and after teaching how to discriminate between the pure and impure tuning of intervals, Thon describes two closed tuning cycles using fifths and octaves, one proceeding from *c'*, the other from *f'*, with various checks of thirds (pp. 138–40 and figs. 3, 4, and 5). To use these schemes to obtain “a good temperament,” Thon states, one must tune

the fifths of the temperament octave *downwards* and *not noticeably* departing from their purity; the thirds *upwards*; the fourths beating *slightly downwards*; [and] the octaves, on the contrary, *absolutely purely*.⁴⁶

These are, of course, unambiguous and unequivocal directions for equal temperament.⁴⁷

46. “Die Quinten der Temperaturoctave *nicht merklich* von ihrer Reinigkeit abgehen und *unterwärts*; die Terzen aber *überwärts*; die Quartan *gelind unterwärts* schweben; die Octaven hingegen *völlig rein*” (p. 141).

47. Thon then adds that “if the ear, in the course of time, is already more experienced and can clearly make fine distinctions,” one can attempt another temperament. The directions are for a closed cycle of fifths forward from C; all fifths are pure except for three (or possibly four) variously tempered fifths: the fifth C–G “beating unnoticeably lower,” the fifth G–D “somewhat more diminished,” and the fifth B–F♯ “beating low.” Since Thon

Although Thon apparently was not a musician, and his discussion of tuning was quite clearly cobbled together from a number of sources (which explains the confusions and incomplete tuning schemes), he nonetheless in general agrees with his contemporaries in recognizing Kirnberger II and equal temperament as the two principal tunings, and in reporting that many musicians prefer equal temperament to Kirnberger II.⁴⁸

The final manual in this group is the *Gründliches, vollständiges und leichtfassliches Stimmssystem, oder Anweisung wie Ieder Fortepiano- oder Klavierinstrumente auf die beste und leichteste Art, rein und richtig, in kurzer Zeit stimmen lernen kann* (1827) by Johann Traugott Lehmann. Lehmann states that on a correctly tuned instrument one must be able to play in all twelve keys “equally purely,” and he adds that this “requirement is absolutely necessary for our present manner of composition” (pp. 23–24). In such a temperament, which he calls the “evenly tempered temperament,” “every fifth must beat somewhat downwards . . . approximately one-twelfth of a comma.” This procedure requires tuning “the major thirds higher than their perfect purity, thus sharper (beating upwards) than they really should be.” For the actual tuning, Lehmann gives a closed cycle of fifths and octaves proceeding forward (depending on the tuning fork) from *c'* or *a* (pp. 28–31). About unequal temperaments, he prefers to remain silent, “for no more use can now be made of them” (p. 25).

Early Nineteenth-Century Keyboard Performance Treatises

For the sixth edition of Löhlein's *Klavier-Schule* (1804),⁴⁹ its editor, August Eberhard Müller (1767–1817), provided a new and expanded section on tuning, in which he notes that it is impossible to tune an

fails to specify the fifth D–A, the exact number and amount of tempering of the tempered fifths that he intended is unclear.

48. In *Leichter und fasslicher Unterricht das Pianoforte zu stimmen* (1822), August Harder gives the simplest possible directions for equal temperament. He describes setting fifths forward from *f* to *b*, and downward from *f'* to *f#*. The fifths must beat “somewhat low” and the octaves must be tuned purely. One maintenance manual, *Kurze Anleitung zu einer richtigen Kenntniss und Behandlung der Forte-Pianos in Beziehung auf das Spielen, Stimmen und Erhalten* (1824) by the Stuttgart builders Dieudonné and Schiedmayer, offers no practical directions; but the authors clearly state “the temperament of the keys must be as equal as possible” (p. 54).

49. Sixth edition title: *A. E. Müllers Klavier- und Fortepiano-Schule*. In this edition, the section on tuning occurs on pp. 301–3. The new tuning schemes provided by Müller also appeared in the two subsequent editions ca. 1815 and ca. 1825. The article “Stimmung” in the seventh edition of the *Allgemeine deutsche Real-Encyclopaedia* 10 (1827): 719, referred the reader to Müller's *Klavierschule* for keyboard tuning.

instrument using the pure intervals given by nature. Therefore “each fifth must be lowered a little, [and] each major third raised slightly.” Even though each note now departs from its natural or mathematical purity, this nonetheless produces “what one can call its practical or artistic purity.” This tempering is required to achieve equal temperament, which will make possible “the perfect execution of new music.”

Müller does mention that Kirnberger had proposed and recommended an unequal temperament; but according to Müller, Kirnberger defended it with greater ingenuity than thoroughness. Müller claims that “every unfastidious ear will immediately decide the uselessness of this temperament,” and that the temperament has been scientifically refuted by Marpurg and Chladni.⁵⁰

Müller states there are several ways to achieve an equal temperament so that one can play in all keys, and he offers two schemes. The easiest and surest method (which he says is based on his own extensive experience) begins by inserting into the octave $c-c'$ the tempered major thirds $c-e$ and $e-g\sharp$. Then one tunes the series of tempered fifths $C-G$, $G-D$, $D-A$, and $A-E$, with the final e' agreeing with the previously set e . Likewise, to the just-now tuned G , one tunes the thirds $G-B$, $B-D\sharp$, and $E\flat-G$; to the already-tuned D , one tunes the thirds $D-F\sharp$, $F\sharp-A\sharp$, and $B\flat-D$; and finally to the already-tuned A , one tunes the thirds $A-C\sharp$, $C\sharp-E\sharp$, and $F-A$.

Müller gives a second tuning scheme that he admits is more difficult. One begins by setting an equal tempered triad on c' , then adding the flat seventh ($b\flat'$) as sharp as the harmony allows. Then by a series of tempered fourths and fifths, the remaining notes are tuned: $B\flat-E\flat$, $E\flat-A\flat$, $G\sharp-C\sharp$, $C\sharp-F\sharp$, $F\sharp-B$, $B-E$, $E-A$, $A-D$, and from the original c' , $C-F$.

In the preface to his *Wiener Pianoforte-Schule* (1819), Friedrich Starke states that a prime requisite for a student is “a good pianoforte, always tuned purely” in the manner he gives later in his tutor (p. 20), a method that is a version of the first of Müller’s equal temperament schemes, transposed up a major sixth and with more explicit instructions about the tempering of each interval.

At the end of our survey, we have advice about tuning from two indisputably important sources, the composers and pianists Johann N. Hummel (1778–1837) and Carl Czerny (1791–1857). Hummel’s *Ausführliche theoretisch-practische Anweisung zum Piano-forte-Spiel* (1828) ap-

50. *Versuch über die musikalische Temperatur* (1776); *Entdeckungen über die theorie des Klanges* (1787) and *Die Akustik* (1802).

peared in the same year in English translation as *A Complete Theoretical and Practical Course of Instructions, on the Art of Playing the Piano Forte*. Writing from Weimar in 1827, Hummel looks back at “former times” when clavichords, harpsichords, pantalons, and even pianofortes had “only two thin, feeble strings” for each note (p. 458), and authors such as Sorge, Fritz, Marpurg, Kirnberger, and Vogler set forth practical systems about tuning. But modern tuners, Hummel claims, don’t have ears acute enough to discriminate the minute deviations in the tuning systems proposed by these authors. Now, according to Hummel, those early keyboard instruments are “almost wholly set aside”; and with pianofortes whose strings are four to five times thicker, a temperament is needed that will make tuning much easier and more convenient.

Hummel claims that according to professional tuners, especially those in Vienna, equal temperament is “the one that is most easily tuned, and [by which] the whole instrument [is] tuned with the greatest certainty and probability of keeping in tune.” Hummel gives an equal temperament that is set using a cycle of fifths from A to D, with the qualification that each fifth must be tuned “somewhat *flatter* than perfect” (p. 459). Such tempered fifths he describes as “good” when they are “not indeed absolutely perfect, but yet do not sound offensive to the ear.”

Carl Czerny begins his discussion of tuning in his *Vollständige theoretisch-practische Piano-forte-Schule* of 1839 (part 3, pp. 94–95) by stating that “a completely and thoroughly tuned *fortepiano* . . . will be tuned purely.” This purely tuned fortepiano, we will see, is tuned in equal temperament.

To achieve this pure tuning, Czerny begins, as did Hummel, with a cycle of fifths tuned forward from A to D, with a check of C# against the original A to see if it sounds pure. To describe the tempering, Czerny states there are three degrees of “purity” in which one can tune an octave, fifth, or third. These three degrees of purity, of course, Czerny has adopted from Barthold Fritz: the first beats “very slightly downwards”; the second is “the exactly pure”; and the third, “the excessive or the very harsh purity.” In tuning, Czerny states the octaves must be “exactly pure,” that is, the second degree of purity. The fifths must also be pure, but “beating very slightly downwards,” that is, the first degree of purity. Czerny doesn’t mention the degree of purity of the thirds, but by elimination they would be of the third degree of purity, beating slightly sharp.

* * *

The majority of our twenty-two principal sources (see Appendix) advocate equal temperament, recognizing that equal temperament will

eliminate the possibility of key characteristics, but that this is desirable, or compensated for, because one can play equally purely in all keys.

Of the unequal temperaments, it was Kirnberger's second temperament that was sufficiently well known to be recognized as *the* alternative to equal temperament. However, we should not let the number of the advocates of Kirnberger's temperament, or its notoriety, mislead us about its importance and use as a practical tuning scheme. The temperament clearly is bound up with Kirnberger's own theories about music and aesthetics. Advocates of Kirnberger II were clearly in a minority position—friends and partisans of Kirnberger, and musical conservatives (some of whom thought he was transmitting the Bach tradition) conducting a polemical campaign, motivated partly by an antiquated desire to retain the possibility of key characteristics in musical performance. Moreover, as J. Murray Barbour pointed out, Kirnberger II was not likely to have been satisfactory even for the performance of music of its own period. None of the other unequal temperaments—those of Laag, von Wiese, and Vogler—seems to have had advocates or received any recognition.

The general consensus in favor of equal temperament in German-speaking areas of Europe was recognized as early as 1793 by several disinterested contemporary writers. In that year the English musician Charles Clagget wrote in his *A Discourse on Musick* that on the continent a tuning method was used

by which the imperfection of keyed instruments has been equally distributed amongst all the musical keys, instead of throwing this imperfection, as in England, upon those keys which have a greater number of flats and sharps.⁵¹

John Broadwood also suggested in 1811 that a consensus existed in favor of equal temperament. In a letter to the London *Monthly Magazine*, he states that "Haydn, Mozart, and other masters of harmony" have pronounced equal temperament the system best deserving the appellation "the best practical method of tuning keyed stringed instruments."⁵²

And in 1848, in a survey of tuning practices, an anonymous writer in the *Allgemeine musikalische Zeitung* said that the most famous of the

51. P. 6. In "David Tannenberg's Directions for Organ Tuning," *The Organ Yearbook* 16 (1985):78–89, I present sources that suggest that this same English-German difference in tuning preferences was also operative in colonial America.

52. *Monthly Magazine* 32 (1811), part 2, p. 321. For a study of Mozart's teaching of intonation as recorded by his pupil Thomas Attwood see John Hind Chesnut, "Mozart's Teaching of Intonation," *Journal of the American Musicological Society* 30 (1977):254–71; but Chesnut's attempt to relate Mozart's manuscript notes on scale tuning to keyboard temperaments is misguided and misleading.

unequal temperaments was that of Kirnberger, but that it was never commonly in use, and that for the past forty years, equal temperament had superseded all the rest.⁵³ The historical sources studied in this survey suggest, then, that for German-Austrian keyboard instruments of the period 1770–1840, the tuning scheme most often used was equal temperament.⁵⁴

Champaign, Illinois

53. "Dass es mit der Charakteristik der Tonart Nichts sei," *Allgemeine musikalische Zeitung*, 16 August 1848, cols. 532 and 534. The article is signed "Hdt." The prevalence of equal temperament had also been asserted twenty-three years earlier by an anonymous writer in the same magazine; see "Das Charakteristische der Tonarten betreffend," 6 April 1825, col. 222.

54. Cf. Rasch's statement that "equal temperament was becoming the norm for tuning during the second half of the eighteenth century" (p. 303). While Rasch's important essay is focused primarily on J. S. Bach, the present study confirms one of its principal points, that "equal temperament has been described and discussed so often in eighteenth-century writings as a practical system that it must have played an important part in musical performance" (p. 304).

APPENDIX

A Summary of Publications That Contain Practical Directions
For Tuning Keyboard Instruments, 1770–1840

<i>Date</i>	<i>Publication</i>	<i>Tuning</i>
1756	Barthold Fritz, <i>Anweisung, wie Man Claviere, Clavecins, und Orgeln . . . in allen zwölf Tönen gleich rein stimmen könne</i> (1st and 2d eds., 1756, 1757; later eds., 1780, 1799, ca. 1800)	Equal temperament
1771	Johann Philipp Kirnberger, <i>Die Kunst des reinen Satzes in der Musik</i> , 1	Kirnberger II
1774	Heinrich Laag, <i>Anfangsgründe zum Clavierspielen und Generalbas[s]</i>	Laag's own tuning
1774	Johann Georg Sulzer, <i>Allgemeine Theorie der schönen Künste</i> , 2 (2d ed., 1792–1794)	Kirnberger II
1775	Georg Friedrich Tempelhof, <i>Gedanken über die Temperatur des Herrn Kirnberger</i>	Kirnberger II
1776	Georg Joseph Vogler, <i>Tonwissenschaft und Tonsetz[kunst]</i>	Equal temperament
1779	Georg Simon Löhlein, <i>Clavier-Schule</i> (3d ed.)	Equal temperament
1782	Johann Samuel Petri, <i>Anleitung zur praktischen Musik</i> (2d ed.)	Equal temperament
1789	Daniel Gottlob Türk, <i>Klavierschule</i> (2d ed., 1802)	Prefers equal temperament, but also gives Kirnberger II
1790	Christian Ludwig Gustav von Wiese, <i>Anweisung der mechanischen Behandlung des Clavier nach einer vorgeschlagenen neuen Temperatur zu stimmen</i>	Von Wiese's variant of Kirnberger II
1801	Johann Joseph Klein, <i>Lehrbuch der theoretischen Musik</i>	Equal temperament
1801	Joseph Büttner and Ernst Nachersberg, <i>Stimm-buch, oder . . . Anweisung, wie jeder Liebhaber sein Clavierinstrument . . . selbst repariren und auch stimmen könne</i> (2d ed., 1804)	Equal temperament
1802	Georg Joseph Vogler, <i>Handbuch zur Harmonie-lehre</i>	Vogler's "characteristic" temperament
1804	Georg Simon Löhlein/August Eberhard Müller, <i>A. E. Müllers Klavier- und Fortepiano-Schule</i> (later eds., ca. 1815, ca. 1825)	Equal temperament

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| 1805 | <i>Gall, Clavier-Stimmbuch oder . . . Anweisung wie jeder Musikfreund sein Clavier-Flügel, Forte-piano und Flügel-Fortepiano selbst stimmen . . . könne</i> | Equal temperament |
| 1807 | <i>Gründliche Anleitung zum Clavierstimmen</i> , attributed to Vogler | Equal temperament |
| 1817 | Christian F. G. Thon, <i>Ueber Klavierinstrumente, deren Ankauf, Behandlung und Stimmung</i> (later eds., 1825, 1836, 1843) | Equal temperament and Kirnberger II |
| 1819 | Friedrich Starke, <i>Wiener Pianoforte-Schule</i> | Equal temperament |
| 1822 | August Harder, <i>Leichter und fasslicher Unterricht das Pianoforte zu stimmen</i> | Equal temperament |
| 1827 | Johann Traugott Lehmann, <i>Gründliches, vollständiges und leichtfassliches Stimmsystem, oder Anweisung wie Ieder Fortepiano- oder Klavierinstrumente . . . in kurzer Zeit stimmen lernen kann</i> | Equal temperament |
| 1828 | Johann N. Hummel, <i>Ausführliche theoretisch-practische Anweisung zum Piano-forte-Spiel</i> | Equal temperament |
| 1839 | Carl Czerny, <i>Vollständige theoretisch-practische Piano-forte-Schule</i> | Equal temperament |