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Owen Jorgensen's "Lost Art of 19th Century Temperament" – A critical evaluation of his sources and methodology in the context of a review of his 1991 book, *Tuning*...

Owen Jorgensen was a pioneer in the field of tuning and temperament history, an enthusiast for unequal temperaments who took the tunings described by Murray Barbour in his book Tuning and Temperament A Historical Survey,[i] in which Barbour gave specifications expressed in cents, and provided badly needed aural instructions so that tuners of his day could reproduce them. He was very active in promoting the use of unequal tunings, writing many articles, giving classes and lectures, and organizing temperament concerts. His books and articles about historical tuning have a considerable following in certain circles, and they are known, at least by name or reputation, to most people interested in the topic. His work has been particularly influential within the piano tuning community in the United States, where many consider him a leading authority on the subject (Jorgensen was himself a piano technician). His books appear in the bibliographies of several books and articles, and are cited in at least one doctoral dissertation.

Jorgensen's reputation outside the United States, and among scholars of the history of temperament and tuning, has been somewhat mixed, based partly on his book, Tuning the Historical Temperaments by Ear, published in 1977. This book was reviewed by Mark Lindley in 1978 and by Rudolf Rasch in 1980. Rasch was particularly critical, writing that, "Jorgensen starts from a miniscule amount of historical data, and out of his fantasy develops an impressively detailed historical evolution."[ii]

Jorgensen's later book, published in 1991, entitled Tuning, Containing the Perfection of Eighteenth-Century Temperament, the Lost Art of Nineteenth-Century Temperament, and The Science of Equal Temperament Complete with Instructions for Aural and Electronic Tuning,[iii] was not distributed to Europe, and has never been subjected to serious critical investigation to the best of my knowledge. It sets forth an interpretation of 19th century tuning practice that has been accepted by many people, particularly among piano technicians in the United States, and also notably by Ross Duffin in his book, How Equal Temperament Ruined Harmony.[iv] In this paper I will offer a belated review, analyzing the book's methodology and sources, and providing a preliminary assessment of its reliability as a scholarly resource.

Tuning, ... takes much of its impetus from a single source, the seven measurements of actual tunings that Alexander Ellis made in the 1880s and included in his "Translator's Appendix" to Helmholtz' On the Sensations of Tone.[v] Ellis documented these tunings to demonstrate that tuners of his time did not and could not achieve a precise standard of equal temperament using aural methods. Jorgensen, looking at these recorded tunings (which Ellis had measured and calculated to a deviation of one cent), discovered that in three of them, measured on two pianos and one harmonium, there were

traces of "well temperament style." Specifically, in each of these three tunings CE was the narrowest major third, a standard characteristic of most "well temperaments."

Essentially, Jorgensen's main thesis is that tuners actually produced a mild "well temperament" during the late 19th century, even though they claimed they were tuning equal temperament, and he uses Ellis' measurements as the primary evidence of his assertion. Jorgensen coined the term "Victorian" temperament to refer to this tuning style, and the book appears to be designed both to prove his main thesis, and to support his related assertion that true equal temperament was not really practiced until the 20th century.

Let us begin by analyzing Jorgensen's sources. While the title seems to imply a universal coverage of European practice, in fact virtually all the original sources cited are in English, and were published either in Great Britain or, in a few cases, in the United States.[vi] The Ellis Appendix is used as a major resource (as an original source for the late 19th century), and we will return to it later. Original sources from continental Europe are only cited when they were either referred to, or translated and published, in English sources, which usually occurred some years after the original publication. Jorgensen defends his reliance on English sources with the assertion that England was very much a part of Europe at the time, and that musicians migrated freely to and from the continent. While this assertion is correct to a certain extent, it is also true that the history of tuning in England was quite distinct from that of such important musical centers as Germany and France. In general, temperament developments took place in England a few decades later, and there were many trends that were quite distinct and unconnected. One example of the latter is the late 19th century English focus on extended mean tone and just tuning systems, using keyboards on harmoniums with extra keys (as many as 53 per octave).

Because of the lack of continental European sources, there is no reference to the writings of such major figures as Werckmeister, Marpurg, Sorge, or Rameau. Jorgensen ignores the bulk of the writings, either theoretical or practical, from those countries where most of the standard musical literature was being composed. Instead, he provides what amounts to a narrow view from the perspective of one of the more remote and unconnected nations of Europe, a country that was a major consumer of music and musicians, but that was outside the main stream of musical practice.

Jorgensen appears to have consulted almost no secondary sources. While a great deal of research had been done in the area of temperament history by 1991, and the results had been published in a wide array of articles, Jorgensen makes no reference to any of this body of scholarship. Hence, he was presumably unaware of the wealth of archival material unearthed during the 1970s and 1980s, including letters, unpublished manuscripts, and obscure published materials. Much of our current knowledge of the history of tuning practices stems from this research. Jorgensen seems to have relied on Murray Barbour's 1951 Tuning and Temperament A Historical Survey as his basic secondary reference, in spite of the fact that it had been rendered largely obsolete by 1991, at least in terms of its treatment of historical practice.[vii]

Jorgensen's lack of familiarity with basic original sources, and with the research and analysis of scholars of the second half of the twentieth century, led him to make many unfounded and demonstrably false assertions. A number of these occur in his second chapter, entitled "Why Equal Temperament was not Commonly Practiced on Pianos Before the Twentieth Century." For example, he states, "In the past, tuning by ear

meant that one judged the relationships between the two notes of an interval by listening to the two notes melodically only." He footnotes this statement to an article in the 1810 Philosophical Magazine, a rather unlikely source for knowledge about European tuning techniques of the past few centuries. In fact, countless original sources from throughout Europe, from as early as the beginning of the 16th century, make clear that tuners played intervals simultaneously while tuning, just as they do today.

There are a few rather disturbing instances in which a source cited specifically in a footnote turns out to state something quite different from what Jorgensen says it did. For example, he makes the following statement: "It was thought that most beating was heard at the fundamentals where one was playing the interval. For this reason, it was believed that the beatings of thirds and sixths could not be heard at all except on reed instruments." This is followed by a footnote reference to Helmholtz' On the Sensations of Tone, Appendix, page 492. On that page we find no discussion of historical tuning practices. Instead, we find a passage where Ellis analyzes an obscure late 19th century process for setting a microtonal tuning on a harmonium by a method involving minor thirds, in which both partials and "reed tones" are mentioned.[viii]

These are but two examples among very many. The misconceptions and false generalizations he presents in the early chapters are used later as the basis for many of his arguments, and are important elements in his reconstructions of how tuners of that time must have thought and acted.

Let us now turn to the nexus of the book, the analysis of the Ellis tunings, on the basis of which Jorgensen developed his thesis of the "Victorian" temperament. Alexander Ellis provided considerable supplemental material in his "translator's appendix," including the results of research that he undertook himself. He developed and tuned a large set of tuning forks calibrated very carefully (after a pattern developed by J. H. Scheibler), capable of measuring pitch to within one cent through the use of sophisticated techniques of beat counting. He used these forks for a number of purposes, including some of the earliest research into historical standards of pitch, based on measurements of historical tuning forks, organs, and other artifacts.

One of the projects Ellis undertook using the set of forks was that of measuring a sampling of temperaments from four pianos, two harmoniums, and one organ, documentation that essentially provides our only precise concrete evidence of actual tuning practice prior to the 20th century. Three of the tuned pianos were made available to him by A. J. Hipkins, then in charge the Broadwood showrooms, and these pianos were supposed to have been prepared by Broadwood's "best" tuners. The fourth was Ellis' own piano, tuned by Ellis' "ordinary" tuner, and "let stand unused a fortnight" before being measured. The harmoniums were provided by two different manufacturers. The organ was reported to have been freshly tuned. As Ellis noted, one harmonium was tuned very nearly to a precise equal temperament, one piano somewhat less so. One piano and the organ were particularly far from equal temperament, with no apparent pattern, seemingly examples of very bad workmanship. Jorgensen focused on the remaining three instruments: two of the pianos and one harmonium.

First, he analyzed the two piano tunings that he believed showed "well temperament" characteristics. He found, by a fairly reasonable argument, that some of the notes in each were quite probably not where the tuner had intended to leave them. He adjusted the tunings to account for what he refers to as "obvious slips," in accordance

with what he believed they "must have intended." In one tuning, he moved one note by 7.5 cents, and two others by 4 cents each. (This particular piano tuning was the one measured by Ellis only after two weeks had elapsed following the tuning). In another piano tuning, Jorgensen moved one note 2 cents, and another 3 cents.

This procedure already raises some very serious questions of methodology and judgment. If several notes have "obviously slipped," why should we not suppose that other notes might have moved as well? What scientific basis is there for accepting the "adjusted" tunings as more "authentic" than they were in their original, flawed form? Jorgensen presents his two "adjusted" piano tunings as if they were precise patterns followed by tuners of the time, not taking into account any margin of error. It seems far more likely that the tuners of these pianos followed the well-known procedure of making the fifths on diatonic notes somewhat narrower than those which include chromatic notes, thereby making the diatonic thirds narrower than the more chromatic ones, and that any irregularities are simply a matter of random error. But Jorgensen presents these precise patterns, along with one of the harmonium tunings, as if all the irregularities were significant. Two of these patterns have become well-known and widely used in modern times as supposedly "historic tunings of the late 19th century," based on Jorgensen's book.[ix]

He deserves credit for bringing these examples to our attention, as evidence that unequal temperament traditions persisted in England as late as the 1880s, though we would certainly quarrel with his insistence on the precision of his altered figures. And we will note that there is ample documentary evidence of the persistence of unequal temperament in England beyond the mid 19th century, so that the Ellis samples are by no means a revolutionary discovery. We would point out, once again, that England was exceptional in this regard, as the evidence for the virtually unanimous acceptance of equal temperament in Germany and France at this time is very clear.

Jorgensen's next step is yet more questionable. In order to arrive at the "principles by which Victorian tuners tuned," he combined the three unequal "well temperament style" tunings with the two tunings documented by Ellis that most closely approximated equal temperament, deriving from the combination of five tunings an average deviation for each note of the temperament. That result he claims to be a template for a supposed "representative Victorian temperament," a very mildly unequal tuning midway between the more unequal and the more equal of the Ellis tunings. He implies that this style prevailed throughout Europe during the late 19th century.

This is a rather astonishing claim. There is no reason to believe that a style midway between those "well temperament-like" tunings and equal temperament was ever practiced. Including the two tunings that came closest to equal temperament contaminates the evidence of well temperament, and yields a result that has no scientific basis, an intermediate pattern for which there is no evidence. There is neither an example among the tunings documented by Ellis, nor are there any tuning instructions from the period that correspond to such a pattern.

In fact, the only supporting evidence Jorgensen provides for his "Victorian" style of tuning comes in the form of vague written comments, wherein certain authors of the time express the opinion that the best tuners shade their equal temperament somewhat, to favor certain keys and to add color to the tuning. These comments are certainly suggestive, and may lead to speculation of possible ways tuners may have modified equal

temperament to achieve a subtly different result. But there are no specific instructions, nor even hints as to how the best tuners proceeded.

According to Jorgensen, they "listened to the color qualities and not the beats of the thirds and sixths," and relied on "their aesthetic quality judgments" to preserve "the traditional character of the keys." He claims that, "Nineteenth-century tuning by ear was a highly developed art based on aesthetic judgments for every tone, and test chords were used more than test intervals." As far as I have been able to determine, this description of 19th century practice is entirely Jorgensen's invention. He provides no evidence to support his assertions. One of Rudolf Rasch's comments concerning his earlier book seems very appropriate here: "Yes, he even knows how to write history without any historical data."

In fact, tuning instructions from the time almost universally rely on sequences of fifths and sometimes thirds. Where chords are used, their function is in "proving" the tuning, to ascertain if errors have been made. When the chords reveal errors, the tuner is to go back over the previous sequence again, a series of fifths and thirds.

Jorgensen's secondary thesis, that equal temperament was not practiced before the twentieth century, is based largely on an overly precise and impractical definition of equal temperament. In a footnote, Jorgensen writes, "According to the modern meaning of 'equal temperament,' if any interval is incorrectly tempered by a cent or more, the tuning cannot be classified as equal temperament even though tuners of previous centuries considered deviations much more than this to be normal. As an example, if any major third or major sixth were tempered one cent too wide, they would beat faster than the intervals one semitone higher, and this can clearly be heard as inaccuracies by modern piano technicians." [x]

This is obviously a very exacting definition, and one that may lead us to question whether equal temperament as he defines it was often achieved even in the 20th century. Later in the book, Jorgensen repeatedly refers to current standards of piano tuning in the United States, and to the tuning test of the Piano Technicians Guild (PTG) in particular, stating that there was a very high and consistent standard among piano technicians in the late 20th century.

The PTG tuning test has a one-cent threshold for determining errors in the temperament, the same threshold used by Jorgensen in his definition. A passing score of 80% for that test allows up to eight errors of that magnitude within the temperament octave. Only a small minority of examinees achieves a score of 100% in temperament. Many examinees are unable to achieve a passing score, in a test that uses a fine instrument, and allows a generous amount of time for completion.[xi] Average tuners in the late 20th century United States were unable to achieve 100% tuning aurally under these favorable conditions, and it seems obvious that actual piano tunings in the field would be of lower quality than tuning for the test. Thus it seems reasonable to suppose that a late 20th century tuning that met the 100% standard would be rather exceptional. Jorgensen's assertion about the inability of most tuners to achieve equal temperament in the 19th century would appear to apply equally well to the 20th century, if we use his own standard.

In a large portion of the book, Jorgensen analyzes many equal temperament procedures of the 19th century, and concludes that the methods of the time could not have produced equal temperament according to his definition, based on the absence of specific

aural tests that were developed in the 20th century. We are asked to accept his conclusion on trust, as he offers no evidence to support it. There are strong differences of opinion in the piano tuning community concerning what procedures work best, and several tuners who were quite successful at the PTG tuning test, achieving 100% or very near, have said that they used methods similar to those documented from the 19th century rather than the 20th century methods favored by Jorgensen. Rigorous experiments would be necessary in order to establish whether one method or another is significantly more accurate, or whether human variability is more of a factor.

But before undertaking such a study, it would be more important to address a related question: to what threshold of accuracy does it really matter in a practical way to musicians whether a tuning is "precisely" equal temperament or not? What level of deviation actually makes an appreciable and significant difference? Jorgensen never addresses this question, simply asserting that the one-cent threshold is the standard because piano technicians listening in a very detailed way are able to discern differences at that level of accuracy. While research in this area is inadequate, published studies suggest that listeners can only distinguish pitch variations considerably larger than one cent under normal circumstances.

The calculations used by Jorgensen to create his emulations of historic tunings based on practical instructions are even more precise than his one-cent standard would suggest. One example is found in Chapter 17, describing the Tuning Rules by Gottfried Keller of 1707. Keller's tuning rules are quite vague. Essentially they boil down to "Observe all the sharp thirds must be as sharp as the ear will permit, and all the fifths as flat as the ear will permit." Jorgensen notes that these words could be interpreted as favoring equal temperament, but contends (correctly) that the intent is mean tone based on the historical context, together with the fact that the bearing plan does not complete the circle of fifths but ends them where the wolf in mean tone would be. Thus, Jorgensen says, the fifths (not including the G#E-flat wolf) "were meant theoretically to each have a ratio of 1.495953506. This fifth is 697.2784046 cents in size, and it is 4.676596245 cents narrow, a little less than one-fifth ditonic comma narrow." The juxtaposition of extraordinarily imprecise tuning instructions and clinically exact figures is rather astonishing. It is also common practice throughout the book, where all beat rates are given to the tenth of a beat per second, and all cents are given to at least three decimal points, regardless of the inexactitude of the materials from which they were derived. It is noteworthy that in a later chapter, on Peter Prelleur, Jorgensen takes what amounts to precisely the same instruction language (in fact he notes that Prelleur quoted Keller almost exactly) and interprets it differently, coming up with an entirely different temperament calculation and procedure of equal precision.

The preceding fairly specific criticisms are symptomatic of the book as a whole, and should be sufficient to suggest that Jorgensen and his book should not be considered a reliable source for historical tuning practice, for either the 18th or 19th century. I will offer a few additional brief comments. The book is extraordinarily unwieldy and badly organized, in dire need of a good editor. The material presented is repetitive and redundant, much of it documenting tuning instructions that were clearly aimed at producing equal temperament, but that don't meet current standards for precision according to the author. Still, to no apparent purpose, he goes to the trouble to analyze many of them and provide precise ways to reproduce their supposed defects, calling them

"quasi-equal" "historical" temperaments. In many cases he pads his evidence for persistence of unequal temperament, as when he presents instructional practice temperaments from the Tuner's Guide, which included a number of just fifths to make things easier for the beginner, as actual tuning instructions for a "well temperament."

Jorgensen's biases and predilections are quite obvious, both in this book and in his other writings. He had a very strongly stated prejudice in favor of unequal temperaments in the style of those of Thomas Young and Vallotti, which he claimed corresponded ideally to the use of "key color" in tonal music. He regularly contrasts the "colorful art" of certain varieties of unequal temperament with the "monochromatic science" of equal temperament. It seems clear that he was motivated more by a wish to "prove" his beliefs than to discover what the evidence has to tell us and to relate that evidence faithfully. Jorgensen appears to have been an enthusiast, who interpreted a limited range of historical materials through the distorted lens of his own preconceptions. He was ignorant of the vast majority of scholarly research in the field, and it is not surprising that his conclusions are very much at odds with those of most reputable scholars. Jorgensen's writings should be avoided by those who are looking for an objective, dispassionate study of the available evidence in hopes of arriving at an approximation of "historical truth."

That said, Jorgensen deserves credit for raising questions that deserve further investigation. Prior to his writings, most temperament scholars ignored the period from 1750 to 1900, assuming that it was enough to say that equal temperament prevailed fairly early during this period. A closer look at the documentation shows that this simplistic view is flawed. The best overview of this period appears in Patrizio Barbieri's article "Temperaments-Historical" in *The Piano, an Encyclopedia*.[xii] It covers the period 1700 to 1900, treats Germany/Austria, France, Italy, and Great Britain/United States in separate sections, and makes clear that unequal temperaments persisted longest in Italy and England, well into the 19th century, while equal temperament was firmly established in Germany by the second half of the 18th century. Many details of the transition period remain to be laid out in an organized manner and analyzed, to the extent that there is enough surviving evidence to reach clear conclusions. In many instances, the best that can be done is to suggest a range of possibilities, and to outline regional differences. But it is quite clear that Jorgensen's main theses are not supported by the surviving historical evidence.

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[i] Michigan State College Press, East Lansing, Michigan 1951

[ii] Mark Lindley, in a short review in *Early Music* (July, 1978, page 453), about a half page in length, says, "The least satisfactory aspects of the book are its historical account and its choice of temperaments."

The review by Rudolf Rasch, in *Stimulus* (a musicology journal published at the University of Utrecht in Holland),1980, pages 32-37, covered Jorgensen's Tuning the Historical Temperaments by Ear and Claudio Di Veroli's Unequal Temperaments, which were published in 1977 and 1978 respectively. It was generally critical of Jorgensen's scholarship and methodology, as the following quotes will make clear:

"Yes, he even knows how to write history without any historical data."

"Jorgensen must have examined almost no historical sources. The only historical sources mentioned are those of Smith (Harmonics, 1749), Malcolm (Treatise, 1721), and the English translation of C. Ph. E. Bach's Treatise. His knowledge of historical temperaments is taken entirely from Barbour's book, and follows all of his errors and limitations."
"Jorgensen's book is in many ways the opposite of Di Veroli's, unwieldy, incomprehensible on first impression (after having read it, this impression is lessened), with a lack of a firm theoretical basis, lack of evaluation, lack of any sense of responsibility for historical veracity."
(The original review was in Dutch. The translation is my own).

[iii] Michigan State University Press

[iv] Norton, New York 2007.

[v] Dover reprint, 1954 of the original 1885 translation by Alexander Ellis.

[vi] The bibliography is fairly large, but there is little if any evidence that he actually read and made use of many of the works listed. In fact, in many cases it seems very clear that he did not. For example, Claude Montal's 1836 L'Art d'Accorder Soi-meme son Piano is listed, but obviously was neither read nor taken into account.

[vii] Its basic outline of the theoretical history remains essentially valid, though somewhat flawed and incomplete.

[viii] The procedure was developed by a 19th century Englishman named Paul White in order to divide the octave into 53 parts, and it relied heavily on the minor third. The apparent citation is as follows: "As the 5th and 6th partials are involved in the beats, the method will suit only qualities of tone, like reed tones, with strong upper partials." This is the only mention on that page of the words 'partial' or 'reed,' so we must assume that this is the passage being referred to. Obviously it says nothing whatever about historic practice or knowledge – it is merely Ellis' comment about a tuning procedure developed during his own time. Furthermore, it entirely contradicts the point Jorgensen is trying to make, as it specifically notes the partials where the beats are occurring, and is referring to the weakness of the beats of minor third, not to the more obvious major third and major sixth beats commonly used in tuning, which are louder due to the fact that lower partials are involved.

[ix] These tunings are known today as "Broadwood's Best" (sometimes "#4) and "Representative Victorian Moore" (the harmonium, which was made by the Moore Company).

[x] Footnote number 13 on page 3.

[xi] Currently 45 minutes are provided to tune a total of 24 strings in the mid range; in 1991, at the time he was writing, the test allowed 90 minutes to tune 85 strings, one string per unison of almost the entire piano. In general, most piano technicians spend about 90 minutes or less to tune an entire piano, some 225 strings.

[xii] 2nd edition, ed. Robert Palmieri. Routledge, New York and London 2003.