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*Corps Sonore***

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Jean Philippe-Rameau and the *Corps Sonore*

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Abstract

The fact that Rameau created his revolutionary theory of harmony without the help of acoustical science attests to his innate musicianship. But why was he unaware of the concept of overtones before the *Traité* considering the extensive writings on the subject during the previous century? And how did he become acquainted with the principle of the *corps sonore* after the *Traité*? While his discovery provided him with a natural basis for his *basse fondamentale*—an especially pertinent phenomenon during this particular time in history—it also presented him with significant difficulties regarding other aspects of his theory of harmony such as the minor mode and subdominant chord.

This study examines the principle of the *corps sonore*, its history of investigation, how Rameau became acquaintance with this principle, how he applied it to his theory of harmony, the subsequent positive and negative ramifications it had on his theory, and lastly, Rameau's methodological metamorphosis in the Age of Enlightenment.

Keywords: Rameau, Theory, Harmony, Corps Sonore, Traité, Nouveau Système

Jean-Philippe Rameau (1683-1764) is remembered today as a composer and music theorist. He contributed significantly to the harpsichord literature but those works are often overshadowed by his large dramatic compositions, such as *Hippolyte et Aricie*, *Les Indes galantes* and *Castor et Pollux*. Yet Rameau was most proud of his theoretical writings, in which he defined the principle of his *basse fondamentale*, and he spent the rest of his life revising, explaining and defending his efforts to establish the principle of the *corps sonore* as the scientific foundation of music theory. As the result of his groundbreaking accomplishments he was known as the *Isaac Newton of harmony*.¹ It is the purpose of this paper to examine the principle of the *corps sonore*, the obstacles he faced in applying it to his concept of the fundamental bass, and the philosophical issues he faced in moving music theory from the realms of numerical mysticism to the world of science.

Although he had been in Paris on two previous occasions for brief periods, Rameau permanently relocated there in 1722 from Auvergne, where he had been organist at Clermont-Ferrand Cathedral for seven years, and where he had penned his monumental *Traité de l'harmonie*.² The publication of this work soon after his arrival was like a meteorite streaking across the Parisian sky announcing his presence and quickly gaining him notoriety.³ The *Traité* was revolutionary in that it established the triad as the building block of harmony as opposed to intervallic theory, the basis of which can be traced back to Pythagoras in the sixth century B. C. E. As revolutionary as it was, the *Traité* was predicated on string division in the Pythagorean/Zarlinist tradition because Rameau was not yet aware of the principle of the *corps sonore*.

Rameau had been interested in theoretical studies since his youth. He was at the opera house in Milan one night when he observed a man singing along on the fundamental bass of an air. Rameau later learned that he was a workman whose occupation was hard, and who did not have opportunities to hear music until recently following some good fortune. Yet he was instinctively able to sing the fundamental bass tones of this air.⁴ Thus the concept of the fundamental bass was planted in Rameau's mind at age 18, and is a testament to his exceptional musicianship and astute observation of musical practice.

There are two primary aspects of Rameau's theory of the fundamental bass, chord generation and chord progression. Initially he observed that the first three distinct pitches (1:3:5) derived through harmonic division of the string—according to Zarlino's *scenario*: 1:2:3:4:5:6—are the three pitches of the major triad, regardless of chord position.⁵ Secondly, the same harmonic division of the string determines the priority of the progression of chords. Since

¹Thomas Christensen, *Rameau and Musical Thought in the Enlightenment*, (Cambridge: Cambridge University Press, 1993), p. 759.

²Jean-Philippe Rameau, *Traité de l'harmonie réduite à ses principes naturels* (Paris: J. B. C. Ballard, 1722).

³Girdlestone, Cuthbert, *Jean-Philippe Rameau, His Life and Work*, 2nd ed., (New York: Dover Publications, Inc., 1969), pp. 3-4.

⁴Jean-Philippe Rameau, "Réflexions de Monsieur Rameau sur la manière de former la voix et d'apprendre la musique," *Mercure de France*, Octobre 1752, 87-100.

⁵Rameau, *Traité de l'harmonie*, p. 49.

the first distinct interval generated is the fifth, Rameau recognizes progression by a descending fifth as the most natural progression since it is the first distinct interval generated through string division. A progression by descending fourth is also acceptable, he determines, because it is the inversion of the original fifth. Thus, Rameau sees in these two root progressions the only progressions possible within a *modulation*, or tonality.¹ Root movement by thirds, or sixths by inversion, is also sanctioned since the third is the next distinct interval generated in string division, but this movement is allowed only in moving from one modulation to another.² He also grants root movement by seconds and sevenths by license, such as in the case of a deceptive cadence and a few other circumstances.

Four years after the publication of the *Traité* Rameau publishes a second treatise entitled *Nouveau système de musique théorique*, which was intended as an introduction to the *Traité*.³ In this work Rameau is clearly excited over his recent discovery that nature validates his theory of the fundamental bass through science since sonorous bodies actually produce the three tones of the major triad, precisely the same tones he had derived by string division. In the Age of Enlightenment, in which the watchword was *raison* and the essence of authenticity was *nature*, the discovery of the principle of the *corps sonore* was of astounding significance for Rameau. The delight of this discovery can be heard in the preface to the *Nouveau système*:

*There is actually in us a germ of harmony which apparently until now has not been perceived, nevertheless, is easily heard in a string, a pipe, etc., in which the resonance produces three different sounds at once.*⁴

The application of acoustical science as proof of his previously established theory of the fundamental bass then represents the beginning of a basic shift in music theory from a dependence on numbers to a foundation in acoustical science. The basic tenants of his theory of the fundamental bass did not change with the advent of the *corps sonore*; in fact, they remained constant throughout his life. What did change, however, was his explanation of certain aspects of his theory due to their incompatibility with acoustical science. The *Nouveau système* then represents the first step in a lifetime of revision and evolution.

How, then, did Rameau learn of the principle of the *corps sonore*? Certainly he was unfamiliar with it when he wrote the *Traité*, else he would have incorporated it from the beginning. He cites the acoustical writings of Joseph Sauveur (1653-1716) in the *Nouveau système*, but he does not explain

¹Ibid. p. 50.

²Ibid. p. 51.

³Jean-Philippe Rameau, *Nouveau système de musique théorique, Où l'on découvre le Principe de toutes les Regles nécessaires à la Pratique: pour servir d'introduction au Traité de l'harmonie* (Paris: J. B. C. Ballard, 1726).

⁴Ibid. p. iii.

how he became aware of Sauveur's writings.¹ Hans Pischner suggests that Jean-Jeaques d'Ortous de Mairan (1678-1771) acquainted Rameau with Sauveur's writings in 1724,² and that Rameau took the title of his second treatise from a report by Fontenelle on Sauveur's system, entitled *Sur un nouveau système de musique*.³ However, there are other indications that Rameau might have learned of it from a different source.

Père Louis-Bertrand Castel (1688-1757), a Jesuit priest, mathematician, journalist, and physicist, found Rameau's *Traité* fascinating and sought out the author through a mutual friend and in order to study with him. Castel then authored the long and glowing review of the *Traité* published later the same year in the *Journal de Trévoux*. This review proved to be particularly significant for Rameau since this journal was widely read, therefore gaining him notoriety throughout Europe.⁴ In his review Castel casually states that M. Sauveur had already witnessed in nature what M. Rameau has discovered in numbers, and that *...this is precisely the agreement of ratios and ear that Rameau is stressing in the whole of his work*.⁵ It must have been bitter-sweet news for Rameau to learn of the principle of the *corps sonore*; sweet because the *corps sonore* was nature's way of validating his theory of the fundamental bass; bitter because he, the self-proclaimed expert in the field, was unaware of this relationship and had learned of it from his amateur-musician student, Père Castel.

It was also Castel who six years later wrote the review of the *Nouveau système*, but unlike the review of the *Traité*, which had appeared shortly after its publication, the review of the *Nouveau système* did not appear until March 1728, almost two years after its publication—quite an unusually long delay for such a review. This time Castel's tone is dramatically different; his unlimited praise of the *Traité* is now replaced by substantive criticism.⁶ While it is not known why the review was delayed so long or why Castel's attitude changed so drastically, there are two theories. One is that Rameau was seeking someone else to write this review, perhaps a professional musician; the other is that Castel felt slighted because Rameau had not credited him for calling his attention to the writings of Sauveur and thus not so anxious to write another review.

In the early 1730's Rameau, apparently feeling he had exhausted his efforts to speculate on music theory—or possibly wishing to concentrate on his new career in opera composition—offered to give Castel all his theoretical

¹Rameau, *Nouveau système*, p. 17.

²Hans Pischner, *Die Harmonielehre Jean-Philippe Rameau* (Leipzig: Breitkopf & Härtel, 1963), p. 88.

³Christensen, *Rameau and Musical Thought*, p. 138.

⁴Sadler, Graham, *The Rameau Compendium* (Woodbridge, Suffolk: The Boydell Press, 2014), p. 54.

⁵Bernard Le Bovier de Castel, "Review of *Traité de l'harmonie* by Jean-Philippe Rameau," *Mémoires de l'Académie Royale des Sciences*, (Paris: October-November, 1722), 1713-43, 1876-1910 (also known as the *Journal de Trévoux*).

⁶Castel, "Review of *Nouveau système de musique théorique* by Rameau," *Journal de Trévoux*, (March 1728), 472-81.

papers. Castel refused to accept them claiming his views had diverged from Rameau's. After that they seem to have parted ways. Then in 1735 Castel published an article in the *Journal de Trévoux* implying that Rameau ...*had not sufficiently acknowledged his debt to certain earlier scholars.*¹ A public polemic followed in a series of letters to the editor that, while basically polite, revealed an obviously strained relationship. In 1737 Castel wrote a not-so-flattering review of Rameau's next treatise, *Génération harmonique*, and Rameau responded with such sarcasm that the *Journal de Trévoux* refused to print it. However, it was printed in *Le Pour et contre* the following year.² Voltaire even showed interest in this war of words, writing to a friend and suggesting he might be amused by the controversy ...*that Orpheus Rameau is having with Euclid Castel. Orpheus is said to have beaten Euclid. In point of fact, I consider our musician quite strong in his own field.*³

This argument between Rameau and Castel seems not to be an isolated event, at least not for Rameau. According to musicologist Erwin Jacobi, Rameau had a similar falling out with his pupil Therese Deshayes, who had written a review of *Génération harmonique*.⁴ Also, Hughes Maret, who delivered Rameau's eulogy many years later, said he learned from the secretary to the Academy of Clermont of an incident in Rameau's early life that seems to confirm his cantankerous personality. It seems that Rameau, having signed a twenty-nine year contract as organist at Clermont, asked to be released after seven years in order to move to Paris, citing his intent to publish his *Traité de l'harmonie* as rationale for his release. When the church fathers denied his request he determined that he would make them as unhappy as they had made him by denying his request. At the next service he selected the harshest and loudest organ stops and proceeded to play discords, continuing to do so after repeated signals to stop. The fathers rebuked him for his actions, but Rameau simply refused to play at all. Eventually the fathers gave up and agreed to release him from his contract, after which he reportedly played more beautifully than ever until his departure.⁵ It seems that he was quite capable of offending those who disagreed with him, and this personality trait was to affect his relations with others throughout his life.

In answer to the question of how Rameau became acquainted with the principle of the *corps sonore*, considering: (1) that Castel's review of the *Traité* was published in 1722 while Rameau's meeting with Mairan was in 1724, (2) that Castel implied in an article that Rameau had not properly acknowledged his debt to other scholars, and (3) that Rameau had a history of abusing those

¹Sadler, *Rameau Compendium*, p. 54.

²The complete texts of the letters to the editor of the *Journal de Trévoux* and *Le Pour et contre* are reprinted in facsimile in: *Complete Theoretical Writings of Rameau*, Edited with Introduction by Erwin R. Jacobi, 6 Vols. (Rome: American Institute of Musicology, 1966-72) Vol. VI, pp. 69-125.

³Ibid. Vol. III, p. xvii.

⁴Ibid.

⁵Girdlestone: *Jean-Philippe Rameau*, pp. 6-7.

close to him, it seems most likely that it was indeed Castel who acquainted Rameau with the principle of the *corps sonore*.

Looking back over the century prior to the publication of the *Traité*, much had been learned in the science of acoustic, and much of the research was done in Paris. The work of Marin Mersenne (1588-1648) is nothing short of spectacular considering the lack of equipment at his disposal and the stubborn metaphysical tradition still in control of most avenues of scientific endeavor in the early seventeenth century. His discovery of the presence of overtones in a single tone was accomplished by his ear alone and is phenomenal despite his own rejection of its scientific explanation.¹ Interestingly, Rameau cites Mersenne in the *Traité*, although he had not yet comprehended the phenomenon of overtones.²

Several others worked in this area of scientific research between the time of Mersenne and Rameau. Claude Perrault (1614-1688) concluded that sound is provoked by atmospheric stimulation.³ Jacque Rouhault (1620-1675) determined that the resonant capacity of the ear, which is dependent on the brain, was the basis of musical perception.⁴ John Wallis (1616-1703) appears to have been the first to explain the phenomenon of nodes in a letter published in London in 1677.⁵ Francis Robartes (ca. 1650-1718) attempted to unite phenomena from resonance, flageolet tones, and the trumpet series, from which he correctly identified the succession of tones in the harmonic series.⁶ And Christiaan Huygens (1629-1695) may have independently discovered the existence of nodal points in 1688.⁷ But it was the Joseph Sauveur who laid the scientific groundwork for the field of acoustics and, although not a musician, actually made the connection between acoustics and music. He was cognizant of the need for new terminology and further investigation in the new field of acoustics, which the academy acknowledged by setting up a new section in its *Mémoires* under the heading *acoustics*. Sauveur claimed that all resonant bodies obey the law of harmonics. He realized that the odd-numbered harmonics were easier to hear than the even-numbered ones, that the ear tends to recognize the intervals of the fifth and third as well as the fundamental, and that the harmonic series contains the notes of the major chord in its two possible inversions in addition to its root position; however, he did not build a

¹Marin Mersenne, *Harmonie universelle, contenant la théorie et la pratique de la musique*, 2 Vols., (Paris, 1636), Facsimile ed. 3 Vols. (Paris: Editions du centre National de la Recherches Scientifique, 1963), Book IV, "On instrumens," Proposition XI, p. 210.

²Rameau, *Traité de l'harmonie*, pp. 9, 18, 20.

³Claude and Pierre Perrault, *Oeuvres diverses de physique et de mécanique*, Vol. II; "Du bruit" (Leyden: Pierre Vander, 1721), pp. 163-89.

⁴Jacque Rouhault, *Traité de physique*, 2 Vols., 12th ed. (Brussels: Friex, 1708).

⁵John Wallis, "Dr. Wallis' Letter to the Publisher," *Philosophical Transactions of the Royal Society of London*, XII (1677), 839-42.

⁶Francis Robartes, "A Discourse concerning the Musical Notes of the Trumpet, and the Trumpet-Marine, and of the Defects of the Same," *Philosophical Transactions of the Royal Society of London*, XVI (1692), 559-63.

⁷Christiaan Huygens, *Oeuvres completes*, Vol. XIX: "Méchanique théorique et physique de 1666 à 1695," (The Hague: Nijhoff, 1937), pp. 66-67.

system of harmony on these facts.¹ So it was only a short step from Sauveur's writings to Rameau's principal of the *corps sonore* as the proof of his theory of the fundamental bass. Considering all that had been learned about acoustics during the prior century, why did Rameau not know about the principle of the *corps sonore* prior to writing the *Traité*?

Rameau was born the seventh of eleven children to an organist in Dijon, and while Burgundy has a rich history and is a lovely region, it certainly did not have the cultural and intellectual advantages of Paris. Rameau seemed to be a bright and unusually talented child for it was said he knew his notes before he could read. However, he evidently spent more time making music than studying for it was reported his parents were asked to remove him from school due to his disruptions and deplorable performance.² This lack of formal education then may explain why the *Traité* was so poorly organized and so difficult to comprehend. Of that, Philip Gossett, translator of the *Traité* into English in the mid-twentieth century, writes:

*The prose is awkward and difficult while the vocabulary is small and mostly technical. Sentences are poorly constructed, and it is not unusual to find seven or eight independent ideas strung together with conjunctions.*³

It is obvious that Rameau attempted to improve his writing in the *Nouveau système* by organizing his thoughts in a more logical fashion; however, it is still rough and unpolished with many misspelled words, and consists of a very limited vocabulary.

So was it his poor formal education that precluded Rameau's knowing about the *corps sonore*? It is possible, but to be fair to Rameau, no other musician had made this connection before him, not even those living and working in Paris. Therefore, it is more likely that Rameau's unawareness of acoustical science is attributable to the fact that: (1) virtually all musicians of the time were solidly steeped in the Pythagorean-Zarlinists tradition; (2) prior to the 1700's the field of acoustical studies pertained primarily to the process of hearing and not to the study of sound; and (3) scientific research in this field was conducted by scientists who were not primarily musicians, thus the results were less likely to be on the horizons of musicians.⁴

As elated as Rameau was to learn that nature validates his theory of the fundamental bass through the principle of the *corps sonore*, it was to prove problematic for certain aspects of his theory. For instance, in the *Traité*

¹Joseph Sauveur, "Système general des intervalles des sons, et son application à tous les systèmes et à tous les instrumens de musique," *Mémoires de l'Academie Royales des Sciences*, 1701; 2nd ed., Paris, 1743, 299-366.

²Girdlestone, *Jean-Philippe Rameau, His Life and Work*, pp. 2-7.

³*Treatise on Harmony by Jean-Philippe Rameau*, Translated with an Introduction and Notes by Philip Gossett (New York: Dover Publications, Inc.; 1971), pp. xxii-xxiii.

⁴Berdette L. Green, *The Harmonic Series from Mersenne to Rameau* (Ph.D. Diss., Ohio State University, 1969), p. 405.

Rameau had derived all the notes of the major diatonic system from chords built on the fundamental, C, and the dominant, G, except for the sixth scale degree, A. That scale degree he took from his *chord-of-the-added-sixth*, F-A-C-D, the source of which he interprets as a seventh-chord built on the second scale degree, D.¹ From these chords he deduces his diatonic scale: C, D, E, F, G, A, B, C.

In the *Nouveau système* his goal is to associate the pitches of the scale with the principle of the *corps sonore*, which he indicates is feasible through the geometric relationships that exist between a fundamental and its third and fifth harmonics, 1:3:5. Not only does such a relationship add unity to his theory, it also gives it a natural basis. In the *Nouveau système* he describes his fundamental tones differently, referring to them as the tonic and its two dominants, one above and one below. He coins the term *sou-dominante* for the one below tonic, which has evolved from his *chord-of-the-sixth* in the *Traité*. He then reasons that since each of these fundamental tones in turn contains the germ of harmony, 1:3:5, it is from the triads of these three fundamental tones that the notes of the major scale are established.

In order to demonstrate the harmonic relationship of the two dominants around the tonic, he assigns tonic to the number 3 rather than the number 1 as he had done in the *Traité*. Then he assigns the dominant above tonic to the number 9 and the dominant below, or subdominant, to the number 1, resulting in the ratio 1:3:9. From the triads formed on the subdominant on C, the tonic on G, and dominant on D, he now deduces the major scale: G, A, B, C, D, E, F#, G.² The problem with this arrangement is that tonic, based on the number 3, is no longer the progenitor of the other fundamental tones, but rather the subdominant is the progenitor of the tonic and the dominant. This is contrary to the principle of unity in regards to the *corps sonore* in which the fundamental is the source of all the other pitches. It is also a significant derivation from the Cartesian methodological premise of unity. The fact that the subdominant chord is not generated by the tonic was to haunt Rameau the remainder of his life.

Equally problematic for Rameau with the coming of the *corps sonore* is the justification of the minor mode. In the *Traité* he expressed the interval of a minor third mathematically in the Zarlinese tradition, in which a harmonic division of the fifth yields a major third as the primary while arithmetic division of the fifth yields the minor third as primary. However, since the *corps sonore* only generates a major triad Rameau begins to rationalize. Since we only hear the major third in a vibrating string, he reasons, *the minor third subsists, nevertheless, in a new comparison, which must be made between this major third and the fifth.*³ In other words, the minor third exists as the result of subtracting the major third from the fifth, and for Rameau that is enough to consider it a primary consonance. It is by the same reasoning that he justifies the fourth and sixths as secondary consonances. When a system of harmony is

¹Rameau, *Traité*, p. 144.

²Rameau, *Nouveau système*, p. 38.

³Ibid. p. 21.

so tightly interwoven as Rameau's, a problem in one area is sure to entangle itself in related areas, and he is to struggle with these issues for the remainder of his life.

Rameau began his theoretical writings as an empiricist; he knew what he wanted to prove and searched for the rationale to support it. Yet with the advent of the *corps sonore* in the *Nouveau système* he begins to conduct selective experiments to prove his theory, including experiments with bowed and plucked instruments, both in listening and in visual observations.¹ Through experimentation Rameau observed that harmony does, in fact, exist in nature; and while he recognizes its importance he was just beginning to learn the extent to which it would haunt him. Nevertheless, the *corps sonore* was to be his guiding light throughout the remainder of his life.

Rameau published the aforementioned *Génération harmonique*² in 1737. In it he seeks to synthesize and present the conclusions of his reasoning from the first two treatises. He also emphasizes the point that music is both a science and an art, and as such requires both theoretical speculation and practical methodology.³ Much of the 1737 publication is taken up with his continuing efforts to bring the subdominant chord and the minor mode more securely in line with his principle of the *corps sonore*, and to that end he introduces two new concepts: the *double emploi* and the *reciprocal action*. If a subdominant chord C-E-G-A progresses to a dominant chord, D-F#-A-C, then through the principle of the *double emploi* the C-E-G-A chord is reinterpreted as an A-C-E-G chord in first inversion. This reinterpretation allows the chord to progress by a fifth rather than a second and thus adhere to his theory of chord progressions. According to Rameau the *double emploi* is permissible because the dissonance pitch A, added to the subdominant chord, may be interpreted either as an added-sixth above, or as an added-third below the fundamental bass tone C.⁴

The theory of *reciprocal action* is predicated on the incorporation of Mairan's hypothesis of air particles. He explains that a fundamental sound sets air particles in motion and these particles in turn set other bodies in motion at the largest common factor of 1, and at faster speeds according to the factors of its aliquot parts: 1/2, 1/3, 1/4, 1/5, etc., and that by discarding the octave duplications the major triad is derived.⁵ Then he mistakenly asserts that the air also produces slower vibrations at the factors of 2, 3, 4, 5, etc., through the process of *reciprocal action*, from which he reasons that the *corps sonore* also produces the minor triad—a mirror of the major triad below the fundamental.⁶

¹Rameau, *Nouveau système*, pp. 17-20.

²Jean-Philippe Rameau, *Génération harmonique, ou Traité de musique théorique et pratique* (Paris, Prault Fils, 1737)

³Deborah Hayes, *Rameau's Theory of Harmonic Generation: An Annotated Translation and Commentary of Génération Harmonique by Jean-Philippe Rameau*, (Ph.D. Diss., Stanford University), p. 256-7.

⁴Rameau, *Génération harmonique*, pp. 107-119.

⁵Jean-Jacques Mairan summarized his thoughts on this topic in a paper later read before *l'Académie* entitled: "Discours sur la propagation du son dans les differens tons qui le modifient," *Mémoires de l'Académie royale des sciences*, 1737 (Amsterdam, 1740), 1-87.

⁶Rameau, *Génération harmonique*, pp. 4-6, 22-24.

Although he would later retract this explanation, Rameau's idea was taken up by Hermann Helmholtz in the nineteenth century and used as the basis for his theory of undertones.¹ Modern day theorists have raised questions as to why Rameau avoided addressing any of the implications arising from the concept of the downward generation of the minor triad, such as whether or not the root of the chord would be at the top.²

Rameau had long wished to be inducted into the *Académie royale des sciences*, and was disappointed that his dedication of the *Génération harmonique* to the Academy did not gain him admission, but remained hopeful for the future, especially since Denis Diderot (1713-1784), a chief editor and contributor to the *Encyclopédie*, had agreed to assist him in preparation for an upcoming lecture before the Academy on 19 November 1749 entitled *Mémoire ou l'on expose les fondements du système de musique théorique et pratiqué*. In speculation as to why Diderot might offer to assist Rameau with his speech, Thomas Christiansen suggests that certainly Diderot admired Rameau's work, and since he was preparing the first volume of the *Encyclopédie* gaining the alliance of such an influential public figure as Rameau could be beneficial. Being familiar with many members of the Academy and knowing that Rameau had just been turned down for membership earlier that year, Diderot possibly saw this as an opportunity to help him gain membership. He probably also perceived how Rameau's theory related to some philosophical ideas with which he was actively engaged at the moment and thus potential for furthering his own initiatives.³

It is while working with Diderot that Rameau is introduced to Lockean epistemology, and through this philosophy he finds the sensory evidence of the *corps sonore* so persuasive that he begins to expand his views of its principle. Wondering if the *corps sonore's* harmonic proportions could be found in the other fine arts, Rameau discovers the research of architect Charles Etienne Briseux (1680-1754), who had concluded that classical architecture must be laid out along simple geometric proportions, and that the proportions of Rameau's *corps sonore* appeared to be the natural phenomenon that conveys proportions most directly to the mind.⁴ Rameau is now convinced that his principle of the *corps sonore* does, in fact, apply to all the fine arts.⁵

The speech went very well and received the Academy's approval, thanks in large part to an enthusiastic report by d'Alembert and others.⁶ Buoyed by the the response, Rameau uses the same speech as the basis for a new treatise, albeit highly revised, which he publishes in 1750 under the title *Démonstration*

¹Hermann Helmholtz, *On the Sensation of Tone as a Physiological Basis for the Theory of Music*, 1863; Translated by Alexander J. Ellis with an Introduction by Henry Margenau (New York: Dover Publications, Inc., 1954).

²Joel Lester, *Compositional Theory in the Eighteenth Century* (Cambridge: Harvard University Press, 1994), p. 129.

³Christensen, *Rameau and Musical Thought in the Enlightenment*, p. 215.

⁴Ibid. p. 232

⁵Jean-Philippe Rameau, *Novelle réflexions de M. Rameau sur sa Démonstration du principe de harmonie*, (Paris: Durant et Pissot, 1752), pp. 62-63.

⁶Sadler, *The Rameau Compendium*, p. 75.

du principe de l'harmonie.¹ This work is beautifully written, reading much more smoothly than any of Rameau's previous works, due primarily to Diderot's assistance with the earlier speech. With the *Démonstration* Rameau hoped above all to confirm his principle of the *corps sonore* as the scientific basis for music and thus quiet his detractors once and for all, and he hoped finally to be accepted into the Academy. In this treatise he admits that the minor triad does not actually sound as a result of *reciprocal action* as he had claimed in 1737, but he still maintains that the minor perfect chord is *indicated* by nature.²

While the *Encyclopédistes* were pleased with Rameau's speech before the Academy, they were offended by his audacity in using the word *démonstration* in the title of his new publication. To them this term meant *proof*, and that was not what was presented in his speech, or what they had approved. Yet that was just the beginning of his difficulties with the *Encyclopédistes*, for at about the midpoint of the century many intellectuals, primarily the *Encyclopédistes*, fervently rejected Cartesianism.³ Therefore, whereas Rameau had been praised as a true philosophe before this time because he shared with Diderot and d'Alembert the desire to apply science and reason to the arts, now he was highly criticized as a false philosophe because he continued to use certain tenets of Cartesian methodology.⁴ The irony is that Diderot and d'Alembert were both still quite Cartesian in certain aspects of their methodology despite their avowed Lockean epistemology. They, like Rameau, insisted upon the necessity of a simple and unique principle upon which to base facts, the complete interdependence of physical events, and the necessity and simplicity of natural law.⁵

Feeling attacked from all sides, Rameau spent the remainder of his life defending his theories, going to greater and greater lengths to justify his principle of the *corps sonore*. He further isolates himself from the *Encyclopédistes* by coming under the influence of Nicolas Malebranche's Occasionalism, in which he sees God in everything. This is most vividly illustrated in Rameau's attempt to identify his three sounds of nature with the Christian Godhead, the Trinity.⁶ By paralleling God as the first cause of the universe with the principle of the *corps sonore* as the first cause in music, Rameau generalizes mathematical reasoning to its ultimate conclusion.

¹Jean-Philippe Rameau, *Démonstration du principe l'harmonie, servant de base a tout l'art musical théorique et pratique* (Paris: Durand et fils, 1750).

²Ibid. pp. 24, 63.

³Rond d'Alembert, "Discourse préliminaire," *Encyclopédie ou dictionnaire raisonne des sciences, des arts et des métiers*, 6 Vols, (Paris: Briasson, David, Le Breton et Durand, 1751-80), I, i-lxxxiv.

⁴James Doolittle, "A Would-be Philosophe: Jean-Philippe Rameau," *Modern Language Association of America LXXIV* (June, 1959), 239.

⁵Armen Vartanian, *Diderot and Descartes, A Study of Scientific Naturalism in the Enlightenment* (Princeton: Princeton University Press, 1953).

⁶Rameau, *Code de musique pratique*, p. 196; "Lettre de M. Rameau aux philosophes," *Journal de Trévoux*, August 1762, 2041.

In the early part of his life Rameau, like Descartes, sought to establish everything on one unique principle. With the publication of the *Nouveau système* Rameau accepted a version of Cartesianism influenced by a wave of Newtonianism that had swept across France in the 1730's. For Rameau the *Nouveau système* with the arrival of the *corps sonore* was an attempt to reconcile Cartesian tenets with Sauveur's experiments with overtones. He had sensed that the mathematical proportions of the harmonic division of a string explained his theory while the association of the fundamental tone with the overtone series experimentally proved his system in nature. With the *Génération harmonique* he felt he had sufficiently demonstrated his theories experimentally. But in his later years, the more embattled he felt, the further he would go in his efforts to defend his principle of the *corps sonore*. So from Cartesian deductivism and rationality, by way of Fontenelle's *esprit gréométrique*, through Newtonianism and Lockean epistemology, he reaches Melbranche's Occasionalism, encompassing the whole of the universe.

There are numerous inconsistencies in Rameau's writings, but that does not diminish the magnitude of Rameau's contribution to music theory. One must consider the fact that he was working in uncharted territory in his efforts to establish a scientific basis for the theory of music. He overcame many obstacles and he was not afraid to change his mind when research, experimentalism or logic revealed a better explanation. Yet through it all he never lost sight of these essential goals: (1) adherence to a unique principle, (2) the expression of his principle and its implications in mathematics, and (3) the pragmatic exploitation of musical theory in order to serve musical practice.¹ Regarding the significance of his work, Jacque Chailley, on the occasion of the 200th anniversary of Rameau's death, said:

*In 2,500 years of written history, music has perhaps known only two true theoreticians...of whom the others have scarcely done anything except add to or take away from the propositions of these two. One, in the sixth century, B. C., was the incredible Pythagoras. The other.... was Jean-Philippe Rameau.*²

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¹Paul, *Rameau's Musical Theories*, p. 135.

²Jacque Chailley, "Rameau et la théorie musicaux," *La revue musicale*, numéro special 260 (1964), 92-93.

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