Ocular Harpsichord: Colour-Sound Analogy At Large in the Enlightenment

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Rosalind Holmes Duffy
Merton College

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Abstract

The ocular harpsichord was a notable cultural phenomenon of the European Enlightenment, but its precise chronology and contemporary reception have since become obscure. Proposed in 1725 by Louis-Bertrand Castel (1688-1757, a Jesuit scientist and writer at the *Journal de Trévoux*), it was meant to play 'colour music'. However, the exact sensory and aesthetic effect that it was meant to have upon an audience is difficult to gauge, because it inspired such extensive controversy and excitement—evidenced in books, academic lectures, reviews, journal articles, libertine satires, personal anecdotes, and private correspondence. Was it inspired by Newton, and what assumptions did it imply about the senses? While the ocular harpsichord is sometimes mentioned in connection to synaesthesia, there was no eighteenth-century equivalent for this late nineteenth-century term derived from the emerging discourse of psychology, which indicates that contemporary responses to Castel's *clavecin oculaire* had other pre-occupations, motivations and goals. Complicating matters is the fact that Castel was a polarizing and polemical figure in the lives of Voltaire, Diderot, Rousseau, Rameau, Fontenelle and Montesquieu. While some *philosophes* who had quarrels with Castel described him as crazy, or 'fou', they also made perplexing remarks about his contraption that typically resist straightforward interpretation. The ocular harpsichord's mechanics as a concept and as a machine have been further obscured by Castel's elaborate style of writing, whose organizing principles and institutional and cultural contexts are alien to modern readers. Yet Castel wrote many works about his device, using it to construct his persona and generate publicity for his *œuvre* and universal system. This thesis combines close reading of primary sources, intellectual history, and literary analysis using the tradition of classical rhetoric to explain what the ocular harpsichord was, how its history as a material instrument unfolded, and what it meant to Castel and his readers.

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Longer Abstract

The ocular harpsichord was a notable cultural phenomenon of the European Enlightenment, but its precise chronology and contemporary reception have since become obscure. Modern critics have often been confused about how this instrument was meant to look, what it was meant to achieve, whether it was built, and when. Consequently, they have struggled to understand the many references to it that survive in eighteenth-century texts.

The *clavecin oculaire* was an invention of Louis-Bertrand Castel (1688-1757) a Jesuit scientist, writer, and editor at the *Journal de Trévoux*. In 1725, in a short article published in a competing journal, the *Mercure de France,* Castel observed that the analogy between colour and tone, proposed by Kircher in the previous century, had recently been proven by Newton's *Optics*, in which Newton claimed that the proportions of colours as refracted by the prism followed the proportions of tones as divided in the monochord. Castel delightedly asked why people didn't make harpsichords for the eyes as well as for the ears. In addition to creating a new form of sensual pleasure, colour music could make the pleasures of music available to the deaf, and the pleasures of painting available to the blind, provided one could pinpoint the exact correspondence between musical and visual harmonies, and build an ocular harpsichord to perform them both together.

The exact sensory and aesthetic effect that it was meant to have upon an audience is difficult to gauge, because Castel was vague about the details of its construction, and scattered the few references he did make to it across hundreds of pages, written over a thirty-year period. Despite Castel's evasiveness, the ocular harpsichord attracted a great deal of curiosity, as it inspired extensive controversy and excitement evidenced in books, reviews, journal articles, libertine satires, academic lectures, personal anecdotes, and private correspondence. Many of these primary sources were published within Castel's lifetime, and frequently received responses from Castel himself. Yet the most extensive discussions of the idea were written and published after he had died, in an effort to identify the role Castel had played within his culture's journalism, literature, and science, and to account for the ocular harpsichord's significance and notoriety. Most of the texts that comprise the 'canon' of contemporary works about or related to the ocular harpsichord are by writers who, like Castel, are now considered to be 'minor', and so the majority have not been given close examination until now.

This situation has left modern critics in a quandary. What are we to make of the wide variety of reactions to the ocular harpsichord, and their many differences and contradictions? Was it inspired by Newton, or was Castel an anti-Newtonian who proposed his colour-music in an effort to disprove Newtonian physics? Some critics have approached Castel's colour-music in terms of aesthetics, or the history of science, but these approaches mask a more confounding question that overarches both perspectives: what assumptions did colour-music imply about the senses? The ocular harpsichord is sometimes mentioned in connection to synaesthesia, but there was no eighteenth-century

equivalent for this late nineteenth-century term, which derived from the emerging discourse of psychology. This indicates that contemporary discussions of and responses to Castel's *clavecin oculaire* had other pre-occupations, motivations and goals.

We can identify some of these by examining the ideas that Castel developed through his intellectual partnership with the composer and musicologist Jean-Philippe Rameau, with whom he became friends in the 1720s. Rameau and Castel developed their theories and constructed their personas in tandem, supporting one another by exchanging information and making references to each other in their works. Then, in the early 1730s, their growing fame and developing theories began to take them both in new directions, contextualized by the debates on Newtonian physics taking place in the *Académie des sciences.* By studying this quarrel and the way that it unfolded, we can better understand the sensory assumptions behind colour music, and in addition, examine the venomous tone, personal attack, and brazen self-promotion that often characterized Enlightenment debates. This also allows us to explore the practical mechanics of eighteenth-century quarrels, and to learn more about the process by which those texts were written, shared, and circulated.

Castel's ocular harpsichord has often been described by modern critics as anachronistic; either representative of outmoded, seventeenth-century philosophical tastes, or as foreshadowing the aesthetics of Romanticism, the avant-garde, and nineteenth- and twentieth- century interest in synaesthesia. Yet close study of Castel's career and the ocular harpsichord's reception refutes these claims; both man and machine were clearly major figures of their era, and at the heart of Enlightenment debates, not at their peripheries. In addition to having had a long and complicated friendship with Montesquieu, Castel was a polarizing and polemical figure in the lives of Voltaire, Diderot, Rousseau, and Fontenelle. While some of the *philosophes* who had quarrels with Castel described him as crazy, or 'fou', they also made perplexing remarks about his contraption that typically resist straightforward interpretation. It was said that Fontenelle, in concert with Tournemine (then editor of the *Journal de Trévoux*) was responsible for bringing Castel to Paris in the first place; in spite of his nasty quarrel with Castel in the late 1720s, Fontenelle evidently remained friendly towards him, and eager to see the instrument until the 1750s. Upon his arrival in Paris, according to the *Confessions*, Rousseau sought and received social introductions and friendly encouragement from Castel, and saw the ocular harpsichord in person; it then resurfaced as a minor topic during the *querelle des Bouffons*. Diderot visited Castel in his rooms at the Jesuit *collège*, Louis-le-Grand, saw the ocular harpsichord, and wrote about it in the *Lettre sur les sourds et les muets* and the *Encylopédie*, among other works. All three of them described Castel as 'fou', and his ocular harpsichord as impossible, but none went so far as to dismiss him in his lifetime, or forget or ignore him after he was gone; what does this apparent paradox tell us about Castel's persona, and the appeal that his idea held for eighteenth-century readers?

One way that we can understand Castel's persona and the ocular harpsichord's appeal is by examining his history with Voltaire, who famously described him as the 'Don Quixote of Mathematics'. Voltaire and Castel had a

protracted, mutually aggravating quarrel in the late 1730s, which has been largely ignored, and forgotten. This is because the texts concerned have previously been unknown, misidentified, or misunderstood, and because both Castel and Voltaire misrepresented their dealings with one another, as part of their efforts to promote themselves as entertaining writers with profound philosophical expertise. By reconstructing this quarrel's chronology using Voltaire's correspondence, and identifying the major texts that were involved in it, we can better understand the context in which they were composed, and how they relate to Castel. In Voltaire's *œuvre*, these texts include the *Lettre à Rameau*, *Les Éléments de la philosophie de Newton, Les Aveugles juges des couleurs, Micromégas*, and *Candide.* Among Castel's texts, study of this quarrel has led to the discovery of a fascinating work in which Castel offers a master class in subtextual disguise and mockery.

The history of Voltaire and Castel's quarrel also sheds light upon the nature of works of popularization (or 'vulgarization') during the Enlightenment. It offers a case study of two writers carefully positioning themselves and their work, both seeking to be understood and pleasing to a wide readership, without losing the respect and admiration of experts. In the 1730s, this was evidently a difficult needle to thread, and during the period in which they were in direct competition, Voltaire and Castel ridiculed each other for making the effort, and failing. The urgency of this ridicule and the precariousness of the reputations at stake in this period have faded to such an extent that modern critics have been content to take Voltaire's comments on Castel and the ocular harpsichord at face value; this is despite the fact that no one has found a single contemporary repetition of the 'Don Quixote' nickname by which Castel is known today. By telling a more complete story, the new history given here makes it impossible to interpret Voltaire's remarks as those of a disinterested bystander, enriching our understanding of what was involved in becoming a *philosophe*, and Voltaire's relationship to Leibnizian optimism.

Another reason that Castel's *œuvre* has been ignored is that his voice can seem irrelevant, confused, and tedious for modern readers. As a result of Castel's elaborate style of writing, the ocular harpsichord's mechanics as a concept and as a machine have remained entombed within his unappreciated texts. Yet Castel wrote many works about his device, using it to construct his persona and generate publicity for his *œuvre* and universal system. The fact that he had a long and extraordinarily prolific career testifies to the appeal that his writing style held for his contemporaries, who understood the organizing principles and institutional and cultural contexts that Castel was working in. In order to understand what made Castel's writing style pleasing, persuasive, and informative, we need to examine his works armed with an understanding of ancient rhetoric, and specifically the use of that rhetoric by the Jesuits. The Jesuits were self-appointed guardians of this tradition and they taught it extensively in their schools; it was then disseminated by them and their students in journals and books, not to mention the everyday oratory that we have less access to today—public speeches and addresses, pulpit oratory, judiciary argument, etc. The structures, aims, and devices of the rhetorical arts have become obscure to modern readers, and can seem alienating and disorganized to

us now, but when we read Castel's works with them in mind, it becomes obvious that Castel was a master of rhetorical forms.

As a testament to his virtuosic skill, he was able to invent and popularize a totally new rhetorical commonplace within his lifetime, the ocular harpsichord. The ocular harpsichord's existence as a rhetorical device is demonstrated by the way in which other writers appropriated it and used it in their texts, and also by the fact that this use was controversial. There were extensive discussions in the press during and after Castel's lifetime over the way that he had used his famous idea, and the way that he and the Jesuits wrote. These discussions coincided with other historical events and trends; the waning power and eventual downfall of the Society of Jesus, and the rise of experimental philosophy and empiricism, which demanded greater emphasis on the use of logical arguments to persuade. In the rhetorical tradition, logical argument is just one component of persuasion, used alongside appeal to the reader's emotion, and establishing the writer's trustworthiness and goodness of character. Since Castel was writing for a sophisticated readership that was aware of these intertwined demands and accustomed to reading texts that met them, he frequently bent the rules of rhetoric, creating a dizzying effect of wonder and delight in readers whose expectations were continually subverted, in surprising and convincing ways. This dazzling and destabilizing is similar to the spectacle that the ocular harpsichord was expected to have upon audiences. Castel promised no less than a super-sensory show of harmonic proportions and beauty, which would render all lesser aesthetic pleasures obsolete.

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Abbreviations

NE.I-VI	Castel, *Nouvelles expériences,* I-VI
OdC	Castel, *L'Optique des couleurs*
ESS	Castel, *Esprits, saillies, et singularités*, ed. La Porte
Journal	Castel, *Journal historique et démonstratif de la pratique et exécution du clavecin des couleurs*
Explanation	Anon., *Explanation of the Ocular Harpsichord upon Shew to the Public*
Encyclopédie	*Encyclopédie*, eds Diderot and D'Alembert, ARTFL edition
OCV	Voltaire, *Œuvres complètes,* eds Besterman and Cronk
DPV	Diderot, *Œuvres complètes,* eds Dieckmann, Proust and Varloot
OCR	Rousseau, *Œuvres complètes,* eds Trousson and Eigeldinger
KBR	Bibliothèque Royale de Belgique

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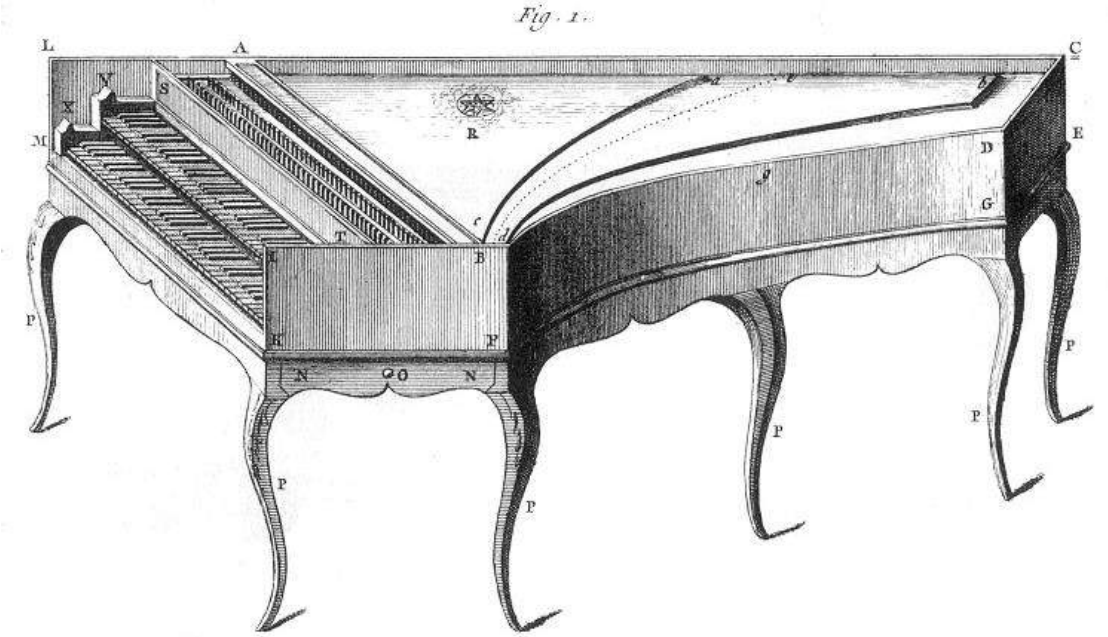

I

A Critical Introduction to Castel and the Ocular Harpsichord

In November 1725, Louis-Bertrand Castel, a Jesuit, journalist, geometer, and teacher at the Jesuits' Parisian *collège*, Louis-le-Grand, published a short article, 'Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pièces de musique'.[1] Castel announced that he had discovered a way to make sound visible and share the pleasures of music with the eyes: an ocular harpsichord, an instrument for playing musical notes and musical colours together. Castel described how his favourite author, Kircher (1602-1680), had in the century before identified analogies between light and sound. More recently, he pointed out, Newton had discovered that the colours of the spectrum were in exact proportion to the notes of the musical scale.[2] In which case, Castel argued, one need only find a way to tune the colour scale, in order to invent a sublime new art: colour music. Castel was sure that colour music was going to be delightful, but more importantly, he noted, it would be mathematically valid. An ocular harpsichord, properly tuned, would paint music, 'avec des couleurs, et avec leurs propres couleurs'.[3]

This article evidently caused a stir, as it was followed soon after by three articles by or involving Castel in February and March 1726, a letter from an anonymous critic in April, and then a response from Castel in July—all in the pages of the *Mercure de France*. The same year, Rameau included a reference to it

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[1] 'Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pièces de musique', *Mercure de France* (November, 1725), 2552-2577. For a brief account of Castel's life and career as a journalist, see Appendix III.

[2] Newton at first identified five colours in the spectrum, but he eventually increased the number to seven, out of a desire to reconcile the proportions of the spectrum with those of the octave. The logic and influences behind this choice are murky, and the extent to which Newton believed in colour-sound analogy, when he believed in it, and why, has remained a subject of debate. For an enlightening recent summary of both the questions at stake, and the critical debate, see, Niccolò Guicciardini, 'The Role of Musical Analogies in Newton's Optical and Cosmological Work', *Journal of the History of Ideas* 74, no. 1 (January, 2013), 45-67. See also, David Topper, 'Newton on the Number of Colors in the Spectrum', *Studies on the History and Philosophy of Science* 21, no. 2 (1990), pp. 269-279.

[3] 'Clavecin pour les yeux', p. 2553.

in his *Nouveau système de musique théorique,* Desfontaines satirized it in *Pantalon-Phoebus,* and someone wrote a poem, *Le Clavecin des couleurs du P. C. transporté dans le monde de la lune.*[4]

Castel was by no means an obscure figure when he proposed the ocular harpsichord. Although he was only five years into his career as a journalist, he was already the *de facto* science and mathematics editor for the *Mémoires de Trévoux* (commonly known as the *Journal de Trévoux)* and a prolific author, journalist and reviewer. By the time this article was printed, he had already published a two-volume theory of gravity, at least twenty-two articles and as many as thirty-seven book reviews.[5] There was nothing to suggest that the ocular harpsichord would prove to be Castel's most famous and enduring work, and he had no way of knowing how complicated that fame would become.

Castel was a well-known, idiosyncratic character, which is problematic, because his idiosyncrasy has frequently obscured his larger relevance within his era. The same can be said of the ocular harpsichord, which came to be synonymous with Castel's literary style and persona. Castel promoted this association, presenting his work as, 'une liste de papiers de toutes couleurs comme mon clavecin, dont la multitude des touches et la variété seraient capables en amusant peut-être les spectateurs, de me pousser à bout moi-même'.[6] References to the ocular harpsichord are found in the work and

[4] Jean-Philippe Rameau, *Nouveau système de musique théorique* (Paris: Jean-Baptiste-Christophe Ballard, 1726), p. v; Pierre-François Desfontaines, *Dictionnaire néologique à l'usage des beaux esprits du siècle, avec l'éloge historique de Pantalon-Phoebus.* (Paris: Philippe-Nicolas Lottin, 1726) pp. 115-6; *Charleval, Charles Jean Louis Fauconde Ris & others,* London, Wellcome Library, MS. 1552, fols. 77-9.

[5] For the most recent list of Castel's published works, see 'Appendix: Castel's Works', in: Jean-Olivier Richard, 'The Art of Making Rain and Fair Weather: The Life and World System of Louis-Bertrand Castel, sj (1688-1757)' (unpublished doctoral thesis, Johns Hopkins University, 2015). The previous list of Castel's works put the count of his publications by this point at a total of thirty-three, see: Manuel Couvreur, 'Appendixe III: Liste chronologique des écrits publiés par le père Castel', in *Autour du père Castel et du clavecin oculaire,* eds Roland Mortier and Hervé Hasquin, *Études sur le XVIIIe siècle,* XXIII (Brussels: Éditions de l'Université de Bruxelles, 1995), pp. 207-220.

[6] *Projet d'impression,* Brussels, Bibliothèque royale de Belgique (KBR), MS 15747, 1v.

correspondence of almost every major figure of the French Enlightenment, and by the time Castel died, its fame had stretched across Europe and into print in Britain, Holland, Germany, Italy, and Russia. The number and variety of published eighteenth-century references to the ocular harpsichord speak to its immense popularity and controversy as a cultural and intellectual phenomenon.[7] While some contemporary comments praised Castel's fame, illustriousness, and genius, others used the instrument to paint Castel as crazy, conceited, and a charlatan. Still others refused to declare themselves for or against the idea by describing Castel as imaginative, or summarizing his views on the invention without judgment or endorsement.[8]

Castel got into many literary quarrels, and it seems that he was rather good at winning them. The details of his career, which have largely been forgotten and ignored, shine a light upon the quarrelsome and even vicious quality of eighteenth-century debate; a quality that itself is often ignored, and which we need to take into account.[9] During his lifetime, Castel cast a long shadow; the bluntest remarks that I have found about him and his instrument are either private or anonymous. Then, after his death, there was a surge in long and searching discussions about Castel's character, style, and ideas, in journals and in books. Many of the *philosophes,* some of the most prolific and enduring voices of the Enlightenment, had perplexing personal exchanges with Castel, which has often made their comments on the ocular harpsichord difficult to put

[7] See Appendix II, 'Chronology of Published Commentary on the Ocular Harpsichord 1725-1800'.

[8] Several examples of this treatment can be found in the *Journal des Savants*, which conspicuously avoided talking about the ocular harpsichord whenever possible; for instance, when reviewing the posthumous compilation of Castel's works: Review of *Esprit, saillies et singularités du P. Castel*, *Journal des savants* (July, 1763), 462-5. When ignoring the idea was impossible, the *Journal des Savants* kept its commentary to an absolute minimum; for instance, when covering a discussion on the instrument between Le Gendre and Banières (see Chapter II.4).

[9] On this subject, though he does not discuss Castel and is focused on a later period, see: Olivier Ferret, *La Fureur de nuire: échanges pamphlétaires entre philosophes et antiphilosophes (1750-1770)* (Oxford: SVEC, 2007).

in context. This situation, added to the complicated history of Castel's attempts to build his instrument, and his many published works about it, has led to critical confusion over what the ocular harpsichord was supposed to achieve and what it meant to Castel and his contemporaries.

1. What was the ocular harpsichord?

The extent and chronology of Castel's efforts to build his instrument, and the effect that a performance was intended to have upon audiences, has been a source of particular confusion among critics. This confusion seems to be, in many cases, a result of critical ambivalence about how to account for the idea's significance, and reluctance to wade through the overwhelming quantity of texts Castel and his contemporaries wrote about it. Some critics unjustifiably narrow their corpus to one or two of Castel's publications on the ocular harpsichord; in general, the physical instrument is presented as the expression of a theory that did not change over time.[10] Close study of all of the texts concerned, considered in context and in chronological order, shows the opposite: Castel developed his theories on colour music in order to justify and defend the idea of an ocular harpsichord, so that he could use its unexpected popularity to benefit his other, less miraculous ideas.

One example of an unjustifiably narrowed corpus is Schier, who, while noting that the ocular harpsichord served to 'keep Castel's name before his public', claims that the principal sources we should use to understand it are his 1735 series of articles, the 'Nouvelles expériences', and his 1740 book, *L'Optique des couleurs.*[11] This reverses the concept's chronology, presenting Castel's

[10] Mason, for instance, uses the posthumous compilation of Castel's works edited by La Porte as his base text. Wilton Mason, 'Father Castel and His Color Clavecin', *The Journal of Aesthetics and Art Criticism* 17, no. 1 (September, 1958), 103-116.
[11] Donald S Schier, *Louis-Bertrand Castel, Anti-Newtonian Scientist* (Cedar Rapids, Iowa: The Torch Press, 1941), pp. 135 and 140.

colour-music theory as the premise for the instrument. As a result, Schier's chronology of Castel's attempts to actually build the ocular harpsichord is confused as well, and he does not apply in-depth analysis to descriptions of the prototypes. It must be said that this is not Schier's goal; his priority is to explain the reasoning Castel used to arrive at his theories, and to present those theories as clearly as possible. This approach is shared by Chouillet-Roche, who provides diagrams of her own design to explain Castel's ideas.[12] While this approach is very useful, by presenting Castel's theories more clearly than he did himself, it implies that he was for some reason unable to make himself clearer, and ignores the possibility that the choices that he did make were deliberate.

Schier is not alone in his lack of interest in precise chronology and close reading of the texts about the physical instrument. Another example is Gepner, whose study is concerned with comparing Castel's aesthetics to those of other seventeenth- and eighteenth-century writers—in some cases, as Gepner acknowledges, we've no specific reason to connect these thinkers to Castel, apart from their contemporaneity.[13] Gepner's work contributes to our understanding of how Castel fits into other discussions of aesthetics at his time, but her willingness to observe that Castel's plans 'restent vagues', without addressing why they might be vague is problematic.[14] A similar dynamic can be found in Chouillet-Roche, who waves away the problem of establishing the chronology of Castel's prototypes by claiming that he never knew precisely how he wanted it to

[12] Anne-Marie Chouillet-Roche, 'Le Clavecin oculaire du Père Castel', *Dix- huitième Siècle*, no. 8 (1976), 141-166. For another recent work which takes this approach, though it suffers from a lack of engagement with critical literature and debates, see Françoise Roy-Gerboud, *Le piano des Lumières: le grand œuvre de Louis-Bertrand Castel* (Paris: Harmattan, 2012).

[13] Corinna Gepner, *Le Père Castel et le clavecin oculaire: carrefour de l'esthétique et des savoirs dans la première moitié du XVIIIe siècle* (Paris: Honoré Champion, 2014), p. 29.

[14] Gepner, p. 10. This problematic attitude has continued into work that uses Gepner as its sole critical source on Castel; notably: Elisabeth Lavezzi, 'Le clavecin irisé. Le clavecin oculaire du Père Castel et les *Couleurs de l'Iris* de Cureau de La Chambre' *Revue d'Histoire littéraire de la France*, no. 2 (March, 2001): 327- 339.

work. In the introduction to *Autour du Père Castel et du clavecin oculaire*, a collection of papers given at a conference on the subject, she writes:

> Et c'est ainsi que le clavecin ne s'est jamais fait tout en se faisant pendant trente ans. Va-t-on utiliser des rubans, des éventails, des boëtes, des miroirs, des chandelles, des tableaux mouvants, va-t-on mêler la musique des couleurs et celle des sons afin que les sourds puissent voir pendant que les aveugles entendent la même harmonie?[15]

This passage, which is given without any references, raises another recurring issue with critical discussion of the instrument. Many critics have thought that the ocular harpsichord was meant to play colours instead of sounds.[16] Noulet is a notable example of this phenomenon; two paragraphs after quoting a contemporary text that clearly states, 'au même instant que vous entendez un son, vous voyez une couleur relative à ce son', she writes: 'Loin de compter sur des sens raffinés et hypersensibles, le clavecin oculaire s'adresserait plutôt aux sourds à qui il offrirait, en guise de compensations, des fugues de teintes dégradées et des sortes de symphonies coloriées.'[17] Castel's first prototype was silent, but the instrument was intended to play sound and colour simultaneously, as he made clear on the second page of his first article about it: 'qu'un sourd puisse jouir et juger de la beauté d'une musique, aussi bien que celui qui l'entend, et que réciproquement, malgré le proverbe, un aveugle puisse juger par les oreilles de la beauté des couleurs.'[18]

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[15] Anne-Marie Chouillet, 'Le père Castel et son clavecin oculaire,' in *Autour du père Castel*, eds Mortier and Haskin, pp. 9-12 (p. 11).

[16] See, for examples: Gepner, p. 11; Huguette Cohen, 'The Intent of the Digressions on Father Castel and Father Porée in Diderot's "Lettre sur les sourds et muets"', *SVEC,* 201 (1981), 163-183 (p. 169). Thomas L Hankins and Robert J Silverman, *Instruments and the Imagination* (Princeton, NJ: Princeton University Press, 2006), pp. 72-85 (p. 74) (first publ. in *Osiris* 9 (1994), 141-156).

[17] Emilie Noulet, 'Le Père Castel et le clavecin oculaire', *La Nouvelle Nouvelle Revue Française* 1, no. 9 (September, 1953), pp. 553-559 (p. 559).

[18] 'Clavecin pour les yeux', p. 2553.

To some extent, these kinds of oversights are understandable, as Castel made it very difficult to pin him down on details. Writing of his 'Journal du clavecin oculaire', an unpublished manuscript in multiple drafts, Van Hercke observes, 'Les indications précises fournies par le père Castel pour prouver que le clavecin oculaire peut être fabriqué ou l'aurait été sont rares et lacunaires.'[19] We can apply this description to everything Castel wrote about the ocular harpsichord, adding that these indications are spread thinly and confusingly throughout his work. When we do find them, they can be difficult to trust, because Castel routinely employed literary devices like paradox and contradiction. Added to which, contemporary descriptions by people who either saw the prototypes or spoke to people who did, only make sense in context, located within the same chronology that Castel's work obscures.

Some critics, notably Chouillet-Roche and Franssen, avoid making disprovable assumptions about the ocular harpsichord by quoting descriptions of the instrument without glossing or interrogating them.[20] Their meticulous and rich research has highlighted the need for an account of the ocular harpsichord that provides a coherent history of the physical instrument, in addition to explaining why Castel was so evasive on the subject of construction, scattering his clues across hundreds of pages and over a thirty-year period. Chapter II of this thesis addresses this first concern, charting the history of the ocular harpsichord as a material instrument—the details we have about his prototypes, and the other objects, experiments and spectacles that were associated with it. The rest of the thesis presents arguments, supported by evidence from primary sources that have previously not been given close examination, to explain the motivations Castel had to make that history so difficult to reconstruct.

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[19] Karine Van Hercke, 'Le journal du clavecin oculaire: démonstration philosophique, esthétique, apologétique ou poétique?' in *Autour du père Castel,* eds Mortier and Haskin, pp. 17-21 (p. 18).

[20] Maarten Franssen, 'The Ocular Harpsichord of Louis-Bertrand Castel', *Tractrix* 3 (1991), 15-77.

2. Castel's Persona and Quarrels

Much of the critical work on Castel is preoccupied with the question of how seriously we should take him as a thinker; thus multiple historians look at the same material, the same correspondence, the same texts, and come to different conclusions about them, purely because they disagree on whether Castel's attitude was reasonable.[21]

Research on the *Journal de Trévoux* and its editorial staff typically characterizes Castel as a demanding and mercurial figure who made things difficult for his colleagues. The *Dictionnaire des journalistes*' entry on Castel (authored by Chouillet-Roche and Hardesty Doig) writes that the Jesuits frequently disagreed with Castel's dogmatic and conservative views, but does not provide references or evidence.[22] Sometimes, his influence is portrayed as varied and dynamic, as in Sgard and Gilot's description of Castel's entrenchment at the journal in the 1730s:

> De l'ensemble disparate de ces extraits se dégage une conception universaliste et syncrétique de la culture; tous les domaines sont abordés avec une curiosité et un esprit d'examen qui ne va pas sans naïveté ni imprudence: le journal est aussi miroitant que le clavecin oculaire de son inspirateur, le P. Castel.[23]

At other times, Castel is portrayed as a cranky, embarrassing fool, as in Pappas' study of Berthier (cited and echoed by the the *Dictionnaire des journalistes*) which uses the unknown causes of their quarrel to draw a speculative contrast between their personalities: 'The chief reason for the rift probably lies in Castel's

[21] For an example, compare the accounts of Castel's dispute with Fontenelle in: John Bennett Shank, *The Newton Wars and the Beginning of the French Enlightenment* (Chicago: University of Chicago Press, 2008), pp. 202-9; and Alain Niderst, *Fontenelle.* (Paris: Plon, 1991), pp. 313-5.
[22] See 'Castel' in Jean Sgard, *Dictionnaire des journalistes 1600-1789*, 2 vols (Oxford: Voltaire foundation, 1999) <http://dictionnaire-journalistes.gazettes18e.fr>.
[23] Jean Sgard and Michel Gilot, 'Le Renouvellement des Mémoires de Trévoux en 1734', *Dix-huitième siècle*, no. 8 (1976), 205-214 (p. 211).

temperament which, unlike Berthier's steady, deliberate approach, led him to hastily formed and frequently untenable conclusions.'[24] Pappas' characterization is demonstrably unfair; it differs markedly from his accounts elsewhere (for example in his chapter on Voltaire) of articles in the *Journal de Trévoux* that we know were authored by Castel, and bear the unmistakable hallmarks of his literary voice, but which Pappas does not attribute to him.

It is possible that modern critics referring to Castel's disagreements with his colleagues at the *Journal de Trévoux* are alluding to various polemical quarrels that Castel was involved in throughout his career, and the Jesuits' attempts to placate infuriated members of the *Académie des sciences* by censuring Castel—treating him 'shabbily', in Schier's words, and 'sacrific[ing him] tranquilly in the interests of peace.'[25] It is difficult to say, because critics seldom give evidence for these claims, and when they do, they cite specific instances and letters out of context.[26]

Northeast's extremely valuable study of the Parisian Jesuits gives Castel a more even-handed treatment, but she keeps her distance by avoiding characterization or description of his work. This leaves us with a number of important questions. What was Castel actually like to work with? If he was so difficult, so prone to quarrel, error, and dispute, then why was he able to retain his position for so long, even when members of the *Académie* were clamouring insistently for his removal? Due to the scarcity of primary resources on eighteenth-century publishing and decision-making at the *Journal de Trévoux*, most of these questions can probably never be answered. Yet we do have almost every issue of the *Journal de Trévoux* itself, an incomparably valuable resource which is very far from being exhausted by historians; the digitization of these journals is now making them much easier to access and sort through.

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[24] John N Pappas, *Berthier's Journal de Trévoux and the Philosophes* (Oxford: SVEC, 1957), p. 25.
[25] Schier, p. 34.
[26] See Pappas, p. 25, n. 29.

Our knowledge about how much of the *Journal de Trévoux* was written by Castel is also increasing, thanks to on-going effort by historians of science to rehabilitate his work, notably taken up by Greenberg and Healy in the last century, and continued today by Shank and Richard.[27] Shank's work frames Castel as an influential and 'stridently critical' voice in the French reception of Newton, writing that his 'critical interventions shaped French discussions of Newtonianism in important ways.'[28] By focussing on the internal coherence of Castel's theories (a 'Castelian' system he was working on throughout his life) Richard's study provides much-needed context for understanding his articles:

> In theory, historians should have an advantage over Castel's contemporaries and successors when grappling with his intellectual contribution. Distance offers an opportunity to embrace his writings as a whole, rather than to make sense of them piece-meal. Yet it is also a distance that makes it difficult for modern readers to appreciate the integrity of Castel's thought and the reasons why he wrote what he did, and how he did.[29]

Close reading of Castel's literary quarrels can enable us to answer a different, but no less important set of questions: What was it like to quarrel with Castel? What made him defensive, and what techniques did he have at his disposal when he wanted to attack? What might have made these quarrels interesting for contemporary readers? Northeast writes, 'Dominique Bouhours (1628-1702), the leading Jesuit *bel-esprit* of his day, was responsible for the belligerent and stylistically sophisticated polemics which had recently come to characterise the Society's response to Port-Royal.'[30] Chapters III and IV of the present thesis show

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[27] John Greenberg, *The Problem of the Earth's Shape from Newton to Clairaut: The Rise of Mathematical Science in Eighteenth-Century Paris and the Fall of 'Normal' Science* (Cambridge: Cambridge University Press, 1995); George Robert Healy, 'Mechanistic Science and the French Jesuits: A Study of the Responses of the *Journal de Trévoux* (1701-1762) to Descartes and Newton' (unpublished doctoral thesis, University of Minnesota, 1956).
[28] Shank, pp. 131 and 194.
[29] Richard, p. 15.
[30] Catherine M. Northeast, *The Parisian Jesuits and the Enlightenment, 1700-1762* (Oxford: The Voltaire Foundation, 1991), pp. 3-4.

that this claim can also be made about Castel, if we study his responses to subjects as wide-ranging as physics, music theory, literary style, and philosophy. Chapter III explores how Castel developed his ideas on colour music, through his friendship and quarrel with the composer, Jean-Philippe Rameau. Voltaire was an attentive observer of that quarrel, and Chapter IV gives the history of Castel and Voltaire's dealings with each other. In so doing, these chapters shed light upon how these types of quarrels worked in practice, and offer new avenues of inquiry into Rameau's musicological concepts and disputes over the role poetic license ought to play in popularizations of philosophical and scientific theories.

3. The Don Quixote of Mathematics

Modern critics who want to take Castel seriously as a thinker often ignore the ocular harpsichord. Healy, Greenberg and Shank do not mention it at all; Northeast and Richard mention it only in passing. Those who do not ignore the instrument tend to marvel that Castel's contemporaries paid him any mind: Donald Schier comments, after summarizing a 1726 article Castel wrote on the possibility of mermen: 'It is difficult to believe that such arrant nonsense could have been seriously advanced, but there appears to be no doubt that it was, and what is more, that it got a hearing.'[31] Schier's chapter on the ocular harpsichord uses a similarly dismissive tone.

By treating Castel and his most important work this way, modern critics follow in the footsteps of Enlightenment writers who described him as crazy. Rousseau and Diderot wrote of Castel, respectively, as 'fou, mais bonhomme au demeurant', and 'fort original, moitié sensé, moitié fou'.[32] Chief among these

[31] Schier, p. 17.
[32] Jean-Jacques Rousseau, *Œuvres complètes* eds Raymond Trousson and Frédéric S Eigeldinger (Geneva: Slatkine, 2012) I, p. 398; hereafter OCR. Diderot, Denis, *Œuvres complètes,* eds Herbert Dieckmann, Jacques Proust and Jean Varloot (Paris: Hermann, 1975) III, p. 276; hereafter DPV.

characterizations, in terms of its enduring popularity, came from Voltaire in the *Lettre à Rameau*: 'c'est le Don Quixote des Mathématiques, à cela près, que Don Quixote croyait toujours attaquer des géants, et que le Révérend Père se croit un géant lui-même.'[33]

Voltaire's nickname is frequently mentioned alongside passing references to Castel.[34] It appears less often in the work of historians and critics of the French Enlightenment, who are, perhaps, more wary of presenting Voltaire as a consistent authority on Enlightenment opinions. Trousson, for example, wisely provides a list of Voltaire's epithets:

> Quant à Voltaire, il apprécia fort le jésuite, le nomma 'un philosophe ingénieux' dans les *Eléments de la philosophie de Newton*, et 'Euclide-Castel' dans une lettre à Thiériot (18 nov. 1736), jusqu'au jour où Castel se permit contre lui de vives attaques dans le *Journal de Trévoux.* Dès lors Voltaire, jamais à court d'épithètes, ne parlera plus que de 'ce misérable fou' (à Maupertuis, 15 juin 1736), de 'Zoïle-Castel,' du 'Don Quichotte des mathématiques,' pour conclure: 'Ce Castel-là est un chien enragé, c'est le fou des mathématiques, et le tracassier de la société'.[35]

Although Trousson has them slightly out of chronological order, Voltaire deployed all of these epithets at successive stages of a quarrel he was having with Castel in the late 1730s, the history of which is given in Chapter IV of the present thesis. The extent, complexity, and significance of this quarrel has not previously been known, but its crowning glory has: Voltaire's *Lettre à Rameau.* This resolute evisceration of Castel's character and work is a rich resource for scholars, so it is conspicuous that the only collection of critical essays on Castel

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[33] Voltaire, *Œuvres completes,* eds Theodore Besterman and Nicholas Cronk (Oxford: Voltaire Foundation, 1968-) vol 18C, p. 480; hereafter OCV.

[34] For recent examples, see Bernard Roukhomovsky, 'Des Effets merveilleux de l'optique', *Féeries*, 2 <http://feeries.revues.org/index123.html> [accessed 5 April 2012] n. 31; Richard, p. 8; Bender, John, 'Enlightenment Fiction and the Scientific Hypothesis', in *Eighteenth-Century Genre and Culture: Serious Reflections on Occasional Forms* (Newark: University of Delaware Press, 2001), pp. 236-60 (p. 249).

[35] Raymond Trousson, 'Deux lettres du P. Castel à propos du "Discours sur les sciences et les arts"', in *Essays on Diderot and the Enlightenment in Honor of Otis Fellows,* ed. John Pappas (Geneva: Droz, 1974), pp. 292-301.

mentions it only once, in a footnote, which sends the reader to another footnote in Chouillet-Roche's article, where she writes, in a significant understatement, that it contains things that are 'très dur pour Castel (C. ne les a pas lues ou a voulu les ignorer)'.[36] It seems that, just as the ocular harpsichord causes an embarrassed silence among historians of science who want to take Castel seriously, polemical attacks like Voltaire's cause the same silence among modern critics who want to take the ocular harpsichord seriously, too.

If scholars have been consistently unable to accommodate these elements, all of which are unavoidably present and interwoven in the primary sources, then this must mean that our assumptions about what qualifies as 'serious' have been inadequate, or that we approach these sources with the wrong priorities in mind. As Robertson writes, on the subject of how we approach and define 'the Enlightenment',

> Important studies of individual thinkers and of their contexts continue to be written, but the question of their contribution to the Enlightenment has become secondary. It is hardly surprising that many intellectual historians have left the field to their colleagues working in social and cultural history, allowing these to refashion the Enlightenment in their own images, to the detriment of its once primary intellectual character.[37]

If we consider the ocular harpsichord on its own terms; that is, by amassing as many primary sources that discuss it as possible, and then considering all of them together, then we find that its history is, at times, best told intellectually, at others, socially or culturally, and in most cases by a combination of all three at once. In the case of the ocular harpsichord, none of these perspectives needs to dominate; in fact, prioritizing one over the others forces modern critics to tell only part of its story, with the result that major primary sources get left out in order to accommodate a predetermined and restrictive critical perspective.

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[36] Chouillet-Roche, p. 162.
[37] John Robertson, *The Case for the Enlightenment: Scotland and Naples 1680-1760* (Cambridge: Cambridge University Press, 2005), p. 16.

By taking a richer and more fluid critical approach, we can correct one of the greatest misconceptions about the ocular harpsichord: that it was anachronistic, and in some way does not belong to the Enlightenment. Critics have described it as old-fashioned, a hangover from seventeenth-century philosophical tastes, and as ahead of its time, a vanguard to nineteenth- and twentieth-century interest in synaesthesia.[38] Thus even work as exquisitely researched as Franssen's argues that eighteenth-century interest in the ocular harpsichord was due to a transition in the history of science and aesthetics. His study undertakes to, 'systematically trace the extent of its impact on contemporary thought and to follow its appreciation in the world of science and as part of the gradual evolution of eighteenth-century aesthetics towards early Romanticism.' [39] Similarly, Hankins and Silverman position the ocular harpsichord as an instrument caught 'on the margin'[40] between natural magic and science:

> If we approach the Scientific Revolution through a study of experimental method, we recognize an important divergence between the aims of natural magic and those of experimental philosophy—the goal of natural magic was to emulate the wonders of nature and glorify their 'wondrousness'; the goal of the experimental philosophy was to establish 'matters of fact'. If, on the other hand, we study instruments, we see a continuity. […] Instruments have a life of their own. They do not merely follow theory; often they determine theory, because

[38] For a recent example of this first line of argument, see Warszawski: 'Il est aussi un effet de bizarrerie qui réside en grande part dans l'anachronisme. Le clavecin oculaire de Castel, aussi virtuel qu'il fût, eût trouvé une place honorable un siècle plus tôt.' Jean-Marc Warszawski, 'Le Clavecin pour les yeux du père Castel', in *La couleur réfléchie,* eds Jacques Le Rider, François Soulages and Michel Constantini (Paris: L'Harmattan, 2000), pp. 147-159 (p. 152). For an example of the second, see Alain Montandon, 'Castel en Allemagne: Synesthésies et correspondances dans le romantisme allemand', in *Autour du père Castel,* eds Mortier and Haskin, pp. 95-103; see Daniel Bariaux, 'Le clavecin oculaire du père Castel: Out,il d'exploration du geste artistique', *Autour du père Castel* eds Mortier and Haskin, pp. 23-33, for a combination of the two: 'À partir d'efforts déployés pour mener un combat d'arrière-garde, le père Castel aurait-il débouché sur des conceptions d'avant-garde?' (p 30).

[39] Franssen, p. 15.

[40] Hankins and Silverman, p. 73.

instruments determine what is possible, and what is possible determines to a large extent what can be thought.[41]

Hankins and Silverman see Castel's instrument as a *non-sequitur* in Enlightenment thought whose appearance nonetheless 'determined' discussion of colour-sound analogy, prompting a calibre of interest that Castel was unable to respond to meaningfully, which made him look like a fool. The ocular harpsichord is thus a discarded oddity in the teleological history of scientific progress, in which the transformative, unanimous awakening to 'matters of fact' known as the Enlightenment is key: 'Castel was certainly not a child of the Enlightenment.'[42]

Other critics see the ocular harpsichord as a casualty of the transformation of modern science by Newton. Most notable among these is Schier, whose extremely valuable doctoral thesis on Castel has long been the only full-length study of his life and work. While such accounts are not exactly incorrect, and, of course, reflect the critical assumptions of their own historical moments, they suggest that the ocular harpsichord cannot be taken seriously as a concept and phenomenon belonging to its time, because the ideas that underpinned it are, in an ahistorical sense, 'wrong'. This stance demonstrates an unconstructive arrogance before the past, but more importantly, it corrodes our ability to interrogate the fraught and nuanced process by which ideas come to be understood as 'right'.

Working in this vein, critics often seek to position Castel as having been for or against Descartes or Newton, typically settling on 'anti-Newtonian'. As Ehrard points out, it isn't quite so simple:

Comme les cartésiens, notre savant Jésuite réclame donc une physique vraiment explicative, comme eux il accepte de voir en Newton un géomètre, non un véritable physicien. Mais l'analogie est peut-être plus apparente que profonde:

[41] Hankins and Silverman, p. 5.
[42] Hankins and Silverman, p. 76.

reste à savoir, ajoute en effet le P. Castel, 'si un système vraiment physico-mathématique peut être regardé comme un vrai système de physique'. Rien de moins cartésien que cette dernière remarque où se trahit le goût persistant du P. Castel pour la physique qualitative: pour Fontenelle le système de l'attraction est faux *malgré* son langage mathématique; pour Castel il est aberrant *parce que* mathématique. Les cartésiens reprochent à Newton de n'être que géomètre, les Jésuites l'accusent de l'être trop.[43]

The project of retracing the precise contours of these scientific and mathematical debates is unarguably important, as are the philosophical and methodological structures that both supported and emerged from them. Yet none of these avenues of inquiry can tell us who Castel was—for his journal, his supporters, his opponents, or his undecided public—and they cannot explain why there is so much, nearly obsessive chatter about the ocular harpsichord in eighteenth-century texts. In order to understand that, we have to look extremely closely at what Castel wrote about the ocular harpsichord, and ask ourselves why readers might have liked it; in large part, this comes to down to what we make of Castel's rhetoric and style.

4. Rhetoric and Writing for the Public

Some critics emphasize the literary qualities of Castel's writing, but typically do not explore the critical perspectives that belong to Castel's time and institutions.[44] A remarkable, and very useful exception is Roveda's analysis of Castel's *Mathématique universelle,* which focuses on his use of rhetorical tools, and what it meant to use them in a work on mathematics. She writes:

Il n'hésite pas à insérer un trait d'histoire, un bon mot, une digression et même 'une inutilité', autant de zones d'ombres qui dédommagent l'esprit 'du trop grand éclat des trait lumineux' propres aux éléments de géométrie. Cette esthétique de

[43] Jean Ehrard, *L'Idée de nature en France dans la première moitié du XVIIIème siècle,* 2 vols (Paris: S.E.V.P.E.N, 1963), II, p. 156.
[44] See Noulet; Jean Roudaut, 'Les Logiques poétiques au 18e siècle', *Cahiers du Sud* 48, no. 350 (April, 1959), 10-32; Bariaux.

la variété puise ses sources dans le monde éthique de la galanterie, caractérisé par une certaine honnêteté affichée et par l'art de plaire.[45]

Roveda observes that Castel's use of rhetorical techniques to adapt to readers' changing tastes situates his work within a Jesuit agenda.[46] Roveda uses Perelman's twentieth-century work on rhetoric as her base text; to some extent, this suppresses the institutional and cultural contexts of Castel's era. To this viewpoint, we can supplement Fumaroli's encyclopaedic work on rhetoric, which shows the extent to which its study had long been an especially Jesuit enterprise.[47] Similarly, Barthet's fascinating work on Jesuit esotericism situates Castel in a tradition that valued rhetoric not only for its persuasive powers, but for its revelatory capacities as well.[48] More generally, there is reason to believe that Jesuit rhetorical strategies played a role in their astounding downfall, which, in France, began in 1762. In his illuminating chapter on the Jesuit role in French intellectual life before their suppression, Burson writes,

The Jesuits' self-fashioned role as scholar-apostles ultimately threatened their political influence at court, among the learned public, and in French education. These contradictory impulses – their role as both *savants* and *anti-philosophes* – drastically intensified in the middle third of the eighteenth century, thereby creating an anti-Jesuit climate of opinion easily mobilised by Jansensists and *philosophes* during the run-up to the attack on the Society of Jesus in France.[49]

Burson does not explain why the roles of 'savant' and 'anti-philosophe' are contradictory; figures like Castel testify to the many ways in which they were

[45] Lyndia Roveda, 'Le P. Castel et l'ethos du mathématicien', *Rhetorica* 25, no. 2 (2007), pp. 159-182 (p. 170).
[46] Roveda, p. 174.
[47] Marc Fumaroli, *L'Âge de l'éloquence: Rhétorique et 'res literaria' de la Renaissance au seuil de l'époque Classique* (Geneva: Droz, 2009).
[48] Bernard Barthet, *Science, Histoire et thématiques ésotériques chez les jésuites en France (1680-1764)* (Bordeaux: Presses Universitaires de Bordeaux, 2012), pp. 43-5. See also the section on Castel, pp. 149-164.
[49] Jeffrey D. Burson, 'Between Power and Enlightenment: The Cultural and Intellectual Context for the Jesuit Suppression in France', in *The Jesuit Suppression in Global Context: Causes, Events, and Consequences,* eds Jeffrey D. Burson and Jonathan Wright (Cambridge: Cambridge University Press, 2015), pp. 40-64 (p. 40).

not. Burson continues, 'In the eighteenth century, philosophy was becoming, at best, the fickle and estranged mistress of theology rather than her stalwart handmaiden; accordingly, the Jesuit role as scholar apostles became more conflicted.'[50] Even if we are to accept this familiar but simplistic narrative, we must recognise Castel as a significant exception to that rule. Study of Castel's career suggests that the Jesuits made enemies among both Jansenists and *philosophes* precisely because they were both *savants* and *anti-philosophes*, both scholars and apostles, and perceived no contradiction in those roles. Indeed, the *Journal de Trévoux* is full of quarrels because it sought a middle path, and was willing to do battle with anyone and everyone who held ideas it saw as too extreme. So it is not surprising that the Jesuits should have been resented by a wide array of groups.

Castel was the most famous and respected Jesuit scientist in France at the time, and probably its most prolific writer.[51] As he developed his own distinctive voice, he increasingly found himself in conflict with his order. In the 1730s, arguably the height of Jesuit influence in Parisian literary life,[52] he was already struggling to reconcile Jesuit ideology with the philosophical and stylistic trends that were taking hold in the work of figures like Montesquieu, with whom he formed a friendship largely driven by a shared need to pacify and outmanoeuvre censors.[53] Castel believed that he could see the tides turning against the worldview that the Jesuits' power depended upon, and despaired of his inability

[50] Ibid., p. 55.
[51] Barthet, p. 150.
[52] Northeast, p. 21.
[53] Marco Caccavo, 'La Correspondance du Père Castel avec Montesquieu', *Correspondances 1600-1800 (Seminar, 15-16 March 2012, Université Lyon-Lumière 2* < http://1718.fr/wp-content/uploads/2013/03/Caccavo-Castel.pdf> [accessed July 27, 2017] (p. 3). See also Schier, p. 32. Castel's closeness to Montesquieu did not last long; it seems that as Montesquieu saw the limits of what Castel could do to help him, he began to hold him at a distance. Montesquieu apparently called Castel to his deathbed to receive his confession, whereupon the Jesuit higher-ups seized control of the situation. For an account of this unpleasant story, see Robert Shackleton, *Montesquieu* (Oxford: Oxford University Press, 1961) pp. 392-8.

to convince them to adapt or modernise. In personal notes from the 1750s, he wrote:

J'ai trois raisons de me hâter d'imprimer: 1. J'ai beaucoup d'ouvrages faits. 2. On me vole beaucoup et beaucoup, et actuellement pis que jamais. 3. Le déisme gagne, triomphe, va en avant, et personne ne l'arrête, et je me crois capable de l'arrêter tout court. J'en ai la meilleure volonté. Les jésuites, je le leur déclare, seront responsables surtout de ce dernier article. Les jésuites sont bien les premiers à me dire d'imprimer. Mais ils sont les premiers à ne pas m'y aider, à m'y traverser.[54]

Enlightenment debates were more complex and polyphonic than we typically give them credit for, and it is possible that the reason that Castel's *œuvre* has largely been forgotten is that he simply doesn't fit into the common narrative of the Enlightenment as a war between freethinking *philosophes,* and close-minded men in robes. Castel himself had some interesting thoughts on this subject; attacking Rousseau in the 1750s, he wrote:

Si j'égoïse un peu et me cite humblement, et pour me dédommager un peu du vis-à-vis de M. R. c'est qu'effectivement je le trouve toujours en une contradiction spéciale avec moi, avec mes ouvrages et avec toute ma façon de penser. Mon propre plan de tout temps a été d'agrandir les arts et l'esprit humain, selon M. de Voltaire même, de donner de l'esprit à tout le monde, de faciliter tout, l'invention même de toutes choses.[55]

Castel saw himself in contradiction to the philosophes, but this was not so much about which ideas, texts, and thinkers they supported, and more about how they wished to bring those subjects into public currency. When Castel alludes to expanding the human spirit and facilitating progress, he is talking about vulgarization, or to use a less pejorative term, popularization. The project of

[54] *Plan d'impression*, Brussels, Bibliothèque royale de Belgique, Ms. 20753-20756, 115[r]. (This document is transcribed in *Autour du père Castel,* eds Mortier and Haskin, pp. 153-9.)

[55] Louis-Bertrand Castel, *L'Homme moral opposé à l'homme physique de M. R. Lettres philosophiques où l'on refute le déisme du jour* (Toulouse: n.p., 1756), p. 226.

creating popular works about philosophy and science is one he shared with the *philosophes*—using entertaining and attractive literary genres and techniques to advance ideas before a public that might otherwise find them tedious, irrelevant, and alienating. These works, which lay at the heart of Enlightenment discourse, posed difficult and crucial questions about genre, tone and style. One might even argue that Castel was a kind of hybrid *philosophe*; he repeatedly declared himself a *philosophe-géomètre.* On this point, he understood that readers sometimes saw his position as conflicted:

> Pour ce qui me regarde, […] je vous avoue qu'ayant toujours fait profession d'allier les belles lettres à la géométrie et à la physique, je me suis quelquefois trouvé entre deux feux: quelques géomètres m'ayant reproché d'être trop littérateur dans la géométrie, et des littérateurs d'être trop géomètre et philosophe dans la littérature.[56]

Today, as in his own time, it is very difficult to categorize Castel's style, which is likely why it is so often overlooked: one recent anthology of literary science excerpts minor writers like Poncelet (who was himself inspired by Castel), but not Castel.[57] If we are to reconcile our ambivalence before his work with the undeniable primary evidence of the ocular harpsichord's notoriety, we need to understand what Castel offered to eighteenth-century readers. What were the precise mechanics of his particular combination of geometry and literature, and what rhetorical strategies did he use to achieve it? Castel's style is a recurring theme throughout the history of the ocular harpsichord, because he used it as a literary device. In order to explain why this stylistic element was so important, and how it worked, Chapter V is a close analysis of Castel's use of rhetoric in his first articles about the ocular harpsichord.

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[56] Louis-Bertrand Castel, 'Réponse du P. Castel, Jésuite, à M. l'Abbé Goujet auteur de la *Bibliothèque française*', *Journal de Trévoux* (July, 1740), 1440-1453. This article was also edited as a chapter, 'Du style', in *ESS,* p. 274.

[57] Frédéric Charbonneau, *L'Art d'écrire la science: anthologie de textes savants du XVIIIe siècle français* (Rennes: Presses Universitaires de Rennes, 2005)

5. The Many Voices of Castel's Contemporaries

Modern critics often speak in general terms about how Castel's ideas were received by his contemporaries, placing special emphasis on commentaries by the *philosophes*. This thesis departs from previous work on the ocular harpsichord by assembling all found references to it from published eighteenth-century sources, and putting them in one (and surely by no means exhaustive) annotated list. Many of the references in Appendix II have not been known or considered before; this allows us to put contemporary writers' comments into conversation with Castel, and with each other. On multiple occasions, we can see them forming miniature quarrels and disputes.

Thinking about Castel's work in terms of its reception is especially appropriate because of his stylistic liminality; caught, in his words, between the two fires of geometry and literature. Castel deliberately pushed at what Jauss refers to as 'aesthetic distance,' the space between a reader's 'horizon of expectations' and where they end up after a 'horizon change'. Here, we do not need to invent ideal readers or reconstruct a canon to prove that Castel challenged readers' expectations. Instead, we have primary evidence of readers reacting to precisely that experience; some with delight, and some with irritation. On the reception of Richardson's *Clarissa,* Keymer writes:

> Critics concerned to stress the creative or participatory activities of readers are often taken to task for lapsing into stores about a hypostatized or ideal reader, and stories, moreover, in which this reader is in fact manipulated and constrained by the text, forced into a preordained sequence of responses. Richardson's case, however, provides a rare opportunity to combine theoretical recognition of the text's openness with empirical observation of the diverse responses activated by it at the time of its first appearance. The surviving records of early reception are unusually copious and rich, offering intriguing evidence not only of particular responses arrived at by particular readers but

also of the larger terms of reference within which their readings were typically framed.[58]

Castel's ocular harpsichord is a similar case to that of *Clarissa*, in that its 'openness' made it an attractive topic for discussion, as we can see from the wide array of reactions that survive in print. Keymer argues that Richardson chose his epistolary format in order to leave room for readers to draw their own conclusions. For different reasons, Castel refused to provide an authoritative, full account of how the ocular harpsichord was supposed to look or work, but this also left his readers to fill in his blanks and argue over the details amongst themselves. Furthermore, Castel's readers clearly played an active role in what he did write about the instrument, because he was constantly resisting and responding to them over the thirty years that he was working on it. Due to the constraints of space and in the interest of concision, most of his contemporaries' comments and conversations do not receive individual attention in the body of this thesis. However, it is hoped that this annotated bibliography can testify to eighteenth-century interest in the idea, and serve as a basis for future scholarship to build upon.

[58] Tom Keymer, *Richardson's Clarissa and the Eighteenth-Century Reader* (Cambridge: Cambridge University Press, 1992), pp. xix-xx.

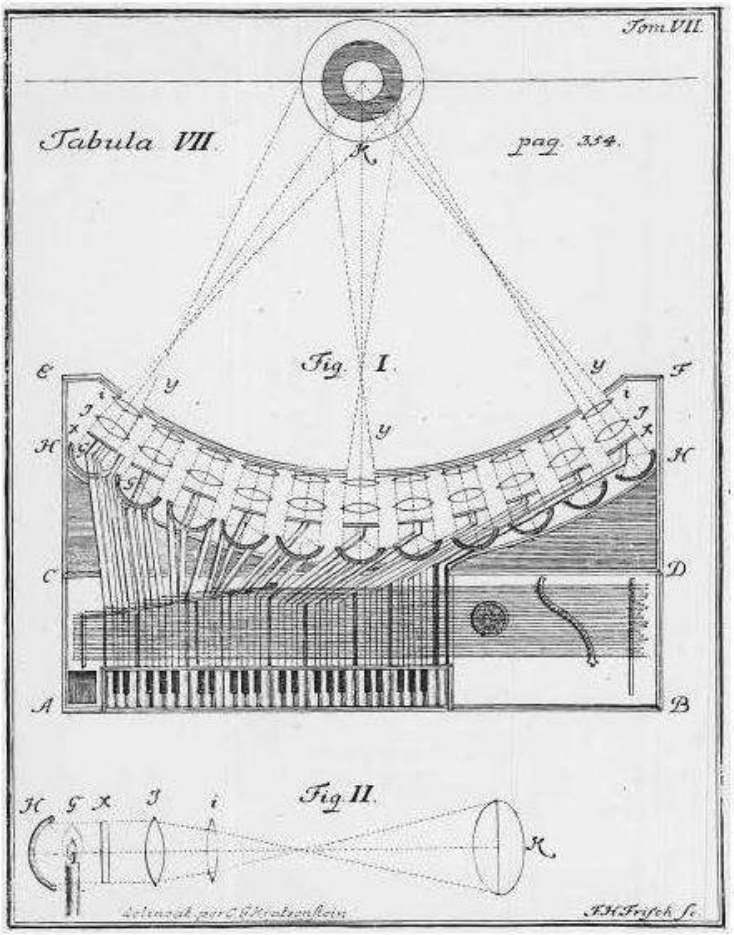

Illustration 2. Krüger's Ocular Harpsichord

II

The Material History of the Ocular Harpsichord

Castel's texts on the ocular harpsichord vary in length and format; I have identified eleven discrete works.[1] They range in length, from an informal three-page note, to a five-hundred-page, lavishly published book, to an unpublished manuscript in multiple drafts; and they cover a variety of tones and genres, from light-hearted to polemical, and from geometrical proof to poetry. In these texts, Castel wrote almost nothing about what the ocular harpsichord was meant to look like, or how he intended it to work. Insisting that he was a 'philosopher-geometer', and not a mechanic, Castel frequently declared that he was unqualified to build it, and under no obligation to try: 'je ne suis pas d'avis de me faire maçon pour faire mes preuves d'architecte.'[2] He nevertheless repeatedly attempted to construct it, claiming that the public's passion for the project had been irresistible. Ten years after he'd proposed it, he wrote:

> En proposant ce clavecin comme une chose qu'on pourrait faire, je n'avais pas eu la première pensée d'y toucher du bout du doigt, et pendant 9 ans je ne bandai pas de là. Je n'étais point machiniste ni trop mécanicien […] après 9 ans il est vrai que le pied me glissa. On me fit accroire que je voulais, que je devais faire cette machine, et je citais mon vers favori, Horace *nonumque prematur in annum* avec d'autre vers qui marquaient bien que je me prêtais à cette mécanique malgré moi.[3]

Over a twenty-year period, Castel built two prototypes, both of which were performed and demonstrated for visitors and guests. Following Castel's ideas, someone else built their own ocular harpsichord and displayed it in London. This

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[1] For my corpus of Castel's texts on the ocular harpsichord, see Appendix I.

[2] 'Difficultés sur le clavecin oculaire, avec leurs réponses', *Mercure de France* (March, 1726) 455-463 (p. 455).

[3] *Journal historique et démonstratif de la pratique et exécution du clavecin des couleurs, et des découvertes et machines nouvelles qui l'ont fait et perfectionné depuis 27 ans en style épistolaire du P.C.J. à Mr. L.C.D.M*. Brussels, Bibliothèque royale de Belgique (KBR), Ms. 15746, fols. 1-54 (fol. 3v). Hereafter, *Journal*.

anonymous person published an English explanation of their instrument and account of their friendship with Castel in a 1757 pamphlet, after Castel's death.[4]

We have very few descriptions of these instruments from people who saw them in person. There are no known diagrams of either of Castel's prototypes, or of the ideal he envisioned. The only image of which I am aware is a caricature drawn by Saint-Aubin, which depicts Castel using his second prototype to discharge an enema syringe into his face.[5] Apart from that, we've no other drawings, no plans, and no technical descriptions of Castel's models or the related objects he produced in his workshop at Louis-le-Grand. This is probably in part because the models Castel produced didn't meet his expectations, but Castel also claimed that the idea of the instrument ought to be sufficient proof that colour music was possible. According to this logic, an ocular harpsichord was not a physical instrument to be assembled, but rather the gateway to a new form of music:

> Je n'avais d'abord annoncé qu'un clavecin de couleurs: Dieu merci mes promesses ne sont pas revenues en arrière dans l'espace de dix ans de délai, de critique même et de contradiction; et dans cette dernière reprise du projet, j'ai pu annoncer tout ouvertement une nouvelle musique toute entière.[6]

With passages like these, Castel attempted to draw the public's interest off the physical instrument and onto his theories, redefining the phrase 'clavecin oculaire' as a way of thinking instead of a machine. He even suggested that he was holding the instrument hostage, arguing that he couldn't possibly produce it until after the public had embraced the concepts he insisted it would prove. When Montesquieu advised him to focus on completing it, Castel apparently refused:

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[4] *Explanation of the Ocular Harpsichord Upon Shew to the Public* (London: S. Hooper and A. Morley, 1757). Hereafter, *Explanation.*
[5] Colin Jones and Juliet Carey, *The Saint-Aubin 'Livre de caricatures': drawing satire in eighteenth-century Paris*, *SVEC*, no. 2012:06 (2012), pp. 221-3.
[6] NE.VI, p. 2717.

J'avais l'honneur de lui dire et redire, par écris même, que je ne pouvais faire mon clavecin à moins que le public le crut faisable. *Faites le, on le croira*, me disait-il toujours, à quoi je prenais toujours la liberté de répliquer, *on le verra, mais on le croira pas*.[7]

Castel kept the details of his instrument a secret, while publishing extraordinary claims for the grand performances he thought it held in store. On its own, the ocular harpsichord promised an intense effect upon its audience, with its mission to, 'rendre visible le son, et de faire les yeux confidents de tous les plaisirs que la musique peut donner aux oreilles.'[8] In addition, Castel proposed ways of amplifying colour music to produce light shows on a massive scale, through the use of mirrors, fireworks, and public illuminations, appealing to his readers' appetite for magnificent spectacles and over-the-top entertainment: 'Je ne vois partout, Monsieur, que des gens qui se font de fête, et qui me promettent après de l'être bien promis à eux-mêmes, que du premier coup d'œil ils vont décider la question.'[9]

Castel's attempts to extensively promote his idea as an entertaining pleasure while retaining tight control over its theoretical significance made the subject ripe for ridicule, discussion, satire and dispute. While some eagerly awaited colour music, critics who denounced Castel claimed that even if it were possible, it would be awful. As the anonymous author of the 1757 pamphlet put it:

In a word, the Father Castel saw himself, like the lion in the fable, exposed to all the slings of his censors, without the power of eluding them, and a public butt of their witticisms. There was not even the lowest scribbler but what had his lash at him.[10]

[7] *Journal,* fol. 10[r].
[8] 'Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pièces de musique', *Mercure de France* (November, 1725), 2552-2577 (p. 2553).
[9] NE.II, p. 1621.
[10] *Explanation*, p. 9.

Struggling to refute and convert these 'incrédules', Castel claimed Saint Thomas the Apostle (Doubting Thomas), as the ocular harpsichord's patron saint.[11] Yet even though the ocular harpsichord's appeal was in doubt, its coherence as an idea, surprisingly, was not. Writers in the eighteenth century typically referred to the 'famous' or 'celebrated' ocular harpsichord, as though they could assume their readers had a clear idea of what it was. So what did people expect an ocular harpsichord to look like?

1. What is an Ocular Harpsichord?

When proposing the idea, Castel defined an ocular harpsichord as a keyboard of colours that appeared at the same time as their corresponding sounds. The main technical problem was making the colours disappear immediately after they had been 'sounded'—he suggested using a similar mechanism to magic lanterns, but didn't say much else about the instrument's mechanics.

Castel couldn't have anticipated how this instrument would dominate his life when he proposed it, and his first article glossed playfully over the subject of construction problems with the airy tone of a person who hasn't considered that they might be biting off more than they can chew. 'Le clavecin n'est pas si facile à exécuter,' he observed, ominously, 'par un endroit que je vous laisse à deviner: l'exécution en est pourtant certaine, au moins que jusqu'à un certain point qui peut suffire; mais je n'ai pas eu encore le temps de le porter au point où je vise.'[12]

Three months later, a letter to Castel was published, written by a curious member of the public named Rondet.[13] Rondet's letter proposed a way of constructing the instrument, which he claimed to have discussed in previous

[11] NE.VI, pp. 2722-3.
[12] 'Clavecin pour les yeux', p. 2574.
[13] Rondet then became the harpsichord's most devoted public supporter, and Castel's longtime collaborator; I suspect that his article was, at least in part, written by Castel (see Chapter V.2)

conversations with Castel. This proposal is the only attempt at a technical discussion that I have been able to find, which was both developed with Castel and published in his lifetime. In the absence of other accounts, Rondet's letter offers our best way of understanding what contemporary readers expected the instrument to look like. This is problematic, because Rondet's technical suggestions are at once extremely complicated and extremely vague. Interpreting his letter as the ocular harpsichord's main technical document goes a long way to explaining Castel's disappointment in his prototypes and his resistance to describing them in detail. The spectacle promised in this letter is almost unbelievably ambitious.

Imagine a harpsichord that shoots rainbow lasers. The lasers come from a box on top of the instrument, and are directed either at the performer, or at a network of mirrors that project the show onto a stage. They also vary in intensity and brightness in concert with the force and volume of the musical notes. In the interest of clarity, I have tried to rationalise and simplify this account where possible, as, of course, Castel and Rondet would have had opportunity to do in person, and I signal when Rondet is especially unclear.

2. The Pulley System

To make Rondet's ocular harpsichord, first take an ordinary harpsichord, and adjust each key to accommodate a string attachment, either by elongating them, or reshaping them as ovals or semi-spheres:

> Je prends donc un clavecin ordinaire, et je n'y fais aucun changement, qu'à l'extrémité des touches, que je rends, ou plus large, ou ovale, ou demi-sphérique, ou plus longue, selon qu'il me convient, et j'y attache un cordon, qui passant par une poulie, qui est inférieure à ces touches, va se rendre au clavecin oculaire.[14]

[14] 'Lettre écrite de Paris le 17 Février 1726 par M. Rondet au R.P. Castel, Jésuite, en réponse au clavecin oculaire', *Mercure de France* (April, 1726), 650-660 (p. 656).

Once you have attached each string to a pulley, position your ocular component on top of the ordinary harpsichord. This component is a box made of wood or tin with a little stained-glass window for each of the harpsichord's keys.[15] Each coloured window has a curtain attached to a string, which rises when its corresponding key is pressed, and automatically lowers when the key is released. To make the curtain drop automatically, Rondet suggests using a spring mechanism similar to a window blind, but does not go into detail. The curtains attach to little triangles strung through with axles, with two little pulleys on their ends. Alternatively, Rondet writes, you can also hang your curtains from large pulleys above each window, which are also strung through with axles, again with two little pulleys on their ends.[16] In either case, the strings attached to the two little pulleys then connect to the first pulley attached to the key on the regular harpsichord.

Evidently, this idea involves a lot of pulleys. Eighteenth-century harpsichords typically had five octaves, and so sixty keys; if there are to be three or four pulleys to each key, you will require between 180 and 240 pulleys manipulating sixty strings, wrapped around the whole contraption in an undisclosed configuration. At this point, the details of Rondet's description become suspiciously vague. For instance, when Rondet instructs you to install your first series of pulleys leading away from the keyboard, 'inférieure à ces touches', it is far from clear exactly where you are supposed to put them.

Perhaps *inférieure* means below the keyboard, and the adjustment to the key is done on the near end, where your fingers rest. Yet this means that pressing the key will release tension on the string, rather than creating it, which is not how pulleys work. Perhaps, you might reason, *inférieure* means 'behind' rather than 'below', and the string and pulley are located further down the key

[15] Ibid., p. 657.
[16] Ibid., p. 658. This part is especially unclear – on first reading, it seems as if Rondet is describing multiple parts of one mechanism, but he is actually proposing alternatives to perform the same function.

mechanism, either at the far end of the exposed part, or inside at the end of the key lever. In which case, you will find yourself wondering why Rondet is so specific about modifying the keys' shape or size in order to attach the string. He writes that this change is the only alteration you need to make to the ordinary instrument, but if the string is attached somewhere inside it, then won't you have to make further changes to the frame or mechanism? If, instead, you attach your string to the far end of the external part of the key (having in some way reshaped it), you are likely to do so while wondering whether this placement provides sufficient leverage to be dynamic or precise enough to lift the little curtains.

However it is meant to work, it is important that you do not get too tangled up in strings and pulleys, because the pulley system isn't nearly as complex as the ocular component that it operates, described by Rondet as 'une boîte dioptrique'.

3. The Dioptric Box

I have not found other references to dioptric boxes outside of Rondet's letter. According to the *Encyclopédie*, a catoptric box is a machine that uses mirrors to make small objects appear larger, which would seem to suggest that dioptric boxes use lenses to concentrate and magnify light.[17]

[17] État des planches, 'Optique', in *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers, etc.,* eds Denis Diderot and Jean le Rond d'Alembert, in University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), ed. by Robert Morrissey and Glenn Roe, <http://encyclopedie.uchicago.edu/> XXII, I, p. 2.

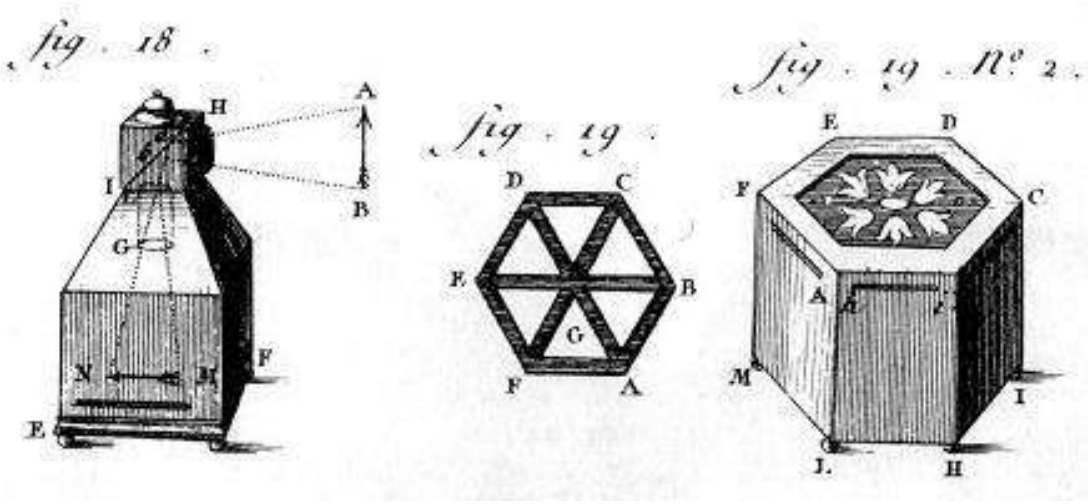

Illustration 2: A Catoptric Box in the *Encyclopédie*

Rondet writes that the dioptric box is lined with both lenses and mirrors. He doesn't specify a light source, and at one point mentions using sunlight, so it is unclear whether the box is lit from within by candles or uses and intensifies ambient light.

> Maintenant j'élève au-dessus de ce clavecin, et perpendiculairement, à l'extrémité des touches, une boîte dioptrique, percée par autant de couleurs qu'il y a de touches au clavecin. Cette boîte est une espèce de coffre, fait de bois, ou de fer blanc, de telle figure qu'il convient, pour faire jeter un grand foyer de lumière sur les couleurs: car c'est de là d'où dépend la réussite de ce clavecin. On pourra même le garnir de glaces et de miroirs convexes et de miroirs concaves, comme je l'expliquerai ci-après.[18]

The dioptric box's interior system of mirrors and lenses is mobile, controlled by the harpsichord's pedals, so the player can control the light's intensity and brightness. As a further enhancement, Rondet also proposes to place a cone lined with faceted glass in front of each coloured window, with the small opening facing outward. These cones are the first clue to the laser-like quality of the harpsichord's play: this machine is not meant to produce a flat blinking colour, but a concentrated beam of light that flashes when the curtain is raised, vanishes when it is lowered, and is strong enough to be projected. Rondet reports that

[18] 'Lettre par M. Rondet', p. 657.

Castel wanted to keep this effect secret, but it becomes explicit when Rondet refers to a brilliant, extended, agile 'point' of light:

> Mais le coup de maître est dans le mouvement des miroirs, dont vous m'avez parlé; pour rendre les couleurs plus étendues, plus brillantes, et leur donner une pointe et une légèreté capable de réveiller ceux qui ont le moins de facilité à comprendre le plaisir que ce clavecin peut leur faire goûter. Mais je n'en dirai pas davantage là-dessous, puisque vous avez jugé à propos de le supprimer.[19]

In order to blend the colours together and multiply them (whether for a chord-like effect or amplification is unclear), Rondet also suggests directing the lights at a spherical mirror of faceted glass, which essentially sounds like a disco ball.[20]

Clearly, the practical considerations of engineering this lighting effect in the eighteenth century were complex and expensive to the point of impossibility, because despite twenty years of work, Castel never managed to complete it. Yet Castel encouraged his readers to think of the ocular harpsichord as not just an imaginative, but a technical marvel, made possible by the technological innovations of its historical moment:

> Notre siècle est heureux de voir éclore tout d'un coup une musique complète et assortie d'une aussi grande variété qu'une quarantaine de siècles en ont pu enfanter pour la musique vulgaire. En disant cela, je n'ignore pas que la musique des couleurs trouvée il y a 4,000 ans, si toutefois elle était physiquement trouvable en ce temps-là, aurait été tout aussi imparfaite que la musique des sons.[21]

In moments such as these, Castel claimed that the instrument could be finished quickly and with minimal fuss, provided that a suitable expert in mechanics undertook its construction,[22] but his confidence wasn't ironclad, and he gave up

[19] Ibid., p. 660.
[20] Ibid., p. 659.
[21] NE.VI, p. 2721.
[22] Castel, 'Difficultés', pp. 455-6. Vaucanson would have been a good collaborator—Castel apparently approached him at some point around 1740, unsuccessfully proposing the idea of building a 'pneumatic harpsichord'. See Appendix II, nos 39 and 40.

on the instrument at least twice. The first time was in 1726, less than a year after Castel had proposed it, and lasted until 1734.

4. Colour Scales in Paper and Silk

In 1734, Montesquieu encouraged Castel to resume work on his instrument again, and introduced him to an aristocrat, the Comte d'Egmont. The young Comte became the instrument's first patron, collaborating with Castel as an assistant and, perhaps, funding their experiments. They first set about identifying the correct colour octave. Once Castel had decided how to tune the ocular harpsichord, he built his first prototype. Arguing that the colour octave system was its most important part, he then presented his conclusions as a new theory of optics in his 1740 book, *L'Optique des couleurs*.

The logic that Castel used to generate his system was rather elaborate, and has been discussed in depth by both Schier and Chouillet-Roche. Here, for the purpose of imagining the physical instrument, it suffices to summarise it very briefly. Blue is the fundamental note of Castel's colour scale. There are three 'essential' colours: blue, yellow, and red, to which Castel adds green and violet to produce the five 'toniques' or 'principales'. To complete the octave, he then adds fawn, grey, and another blue. Finally, he adds olive, nacarat, and cranberry to complete the chromatic scale: *bleu* (C), *celadon* (C#), *vert* (D), *olive* (D#), *jaune* (E), *fauve* (F), *nacarat* (F#), *rouge* (G), *cramoisi* (G#), violet (A), *agathe* (A#), *gris* (B), and *bleu* (C).

To complement his colour scale ('coloris'), Castel also developed a scale of black, grey and white ('clair-obscur'). A colour keyboard combined these two scales so that the colour octave became brighter as the musical notes got higher. Each octave was a rainbow that began and ended on blue, with the blackest

rainbow to the left with the lowest notes, and the whitest rainbow to the right with the highest.[23]

Castel's calculations led him to conclude that the proper number of octaves was twelve, which meant a full keyboard would require 145 notes and colours. The process of discovering all possible colours involved three kinds of materials, and several different games. First, he laid out bits of coloured paper in order, seeking out the shades with the biggest apparent gaps in between them, and attempting to produce the right nuances to fill them—this produced strips and grids of colours and shades of grey.[24] When he produced a 'quartertone' that didn't fit the place it had been made for, Castel turned the process of finding its appropriate place into a kind of puzzle he played alone, and with twenty other people.[25]

Next, he began dying slips of silk in order to discover how his colours mixed together. This turned the earlier game into a kind of optical illusion trick, where Castel presented players with 'un bel orangé', and asked them if it wasn't a nice red. When they agreed, he showed them 'un beau rouge couleur de feu', leading players to conclude the first one was an orange. Finally, Castel produced 'un cramoisi', at which point players would declare that the first one was 'l'aurore'.

> J'ai fait la même illusion à vingt personnes avec d'autres couleurs, leur faisant prendre l'orangé pour le jaune, le celadon pour le bleu, un vert ou un violet pour l'autre, ou pour des bleux ou des rouges; et je m'y trompe sans cesse moi-même.[26]

Castel played this game between different colours, between shades of the same colour, and then between the combinations of the two. To find more nuances and explore the effect of shade upon colour, Castel then began weaving together

[23] NE.VI, p. 2726.
[24] OdC, p. 232, and p. 272.
[25] NE.I, pp. 1475-1477.
[26] OdC, p. 142.

threads (usually of silk, sometimes of wool) in different shades and colours, attempting to make the gradations imperceptible.[27] This process of weaving coloured threads resulted in numerous ribbons.

5. Ribbons

Most of Castel's ribbons were 'clair-obscur' ribbons in shades of red, meaning that they were black on one end, became bright red in the middle, and then faded to white on the other end. One was wool and less than one foot long. Another was the colour of grey fire, five or six feet long.[28] Another was of crimson silk, eight or nine feet long, and, according to Castel, had four or five hundred nuances. The most impressive red ribbon was silk and over ten feet long; Castel claimed to be able to identify between eight hundred and a thousand nuances within it.[29] Another ribbon, about two feet wide and seven to eight feet long, gave the nuances between a deep scarlet, 'le vineux le plus foncé', and a sort of beige Castel called 'couleur du chair le plus mourant'.[30]

The prevalence of red ribbons seems to have had something to do with the availability of red thread, rather than a preference for the colour, as Castel mentions making them 'avec des couleurs prises au hasard chez le Marchand.'[31] What he really needed was a blue ribbon, since blue was his 'couleur mère et primitive'. Intending to produce it, he dyed sixty skeins of indigo in various degrees of *clair-obscur*—he claimed to have had enough to weave a ribbon of between two and three hundred feet, or, 'ce qui est bien plus difficile, un ruban d'un pied et d'un demi-pied.'[32]

[27] NE.IV, pp. 2020-1.
[28] OdC, pp. 251-4.
[29] NE.IV, pp. 2046-9.
[30] OdC, p. 267.
[31] OdC, p. 251.
[32] OdC, p. 250.

The most exciting ribbon was seven or eight feet long, purple at either end, and with the colours of the rainbow in between.[33] Castel described this ribbon as a 'cercle des couleurs', but acknowledged that when put into his colour octave system, it was actually a spiral, not a circle.[34] This observation was accompanied by one of the only illustrations Castel provided in his book on optics, 'une figure de limaçon qu'on voit ici, et qui est très circulaire, qui s'engendre par un point qui tourne autour d'un centre comme un cercle, en s'écartant toujours de ce centre peu à peu, et avec mesure et proportion.'[35]

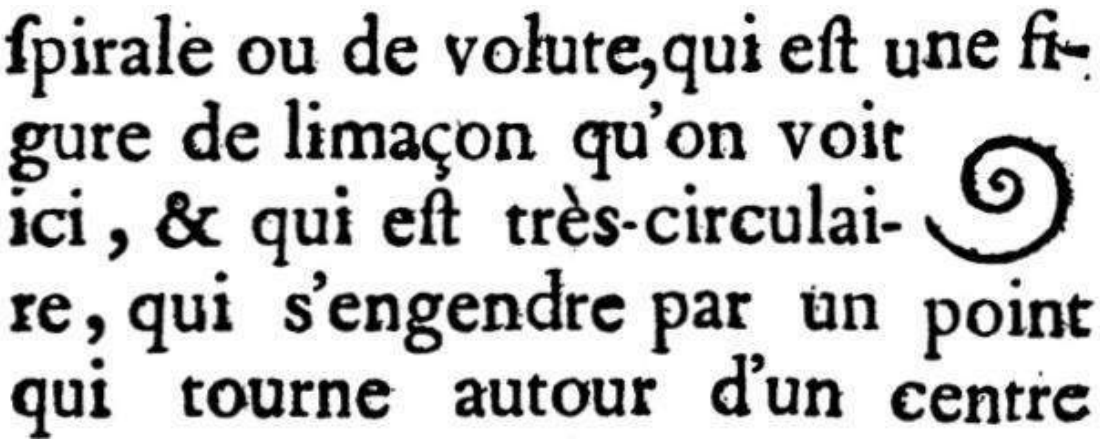

Illustration 3: Figure de limaçon

This tiny illustration and the explanation that accompanies it suggests that Castel's 'cercle' showed transitions between the colours of the rainbow spiralling outwards, positioned so that the shades between each colour radiated out. This may have been one of the ways Castel presented the ribbon to visitors, but the primary game he played with the ribbons was a kind of proto-animation: Castel would roll up a ribbon on a map and then gradually unspool it, so that its colours seemed to change imperceptibly.

[33] NE.IV, pp. 2048-9, and OdC, p. 177.
[34] On the relationship of Castel's ribbon to Newton's colour wheel, and another reading of the optical games he played with it, see Edward Nye, *Literary and linguistic theories in eighteenth-century France: from nuances to impertinence* (Oxford: Clarendon, 2000), pp. 19-25.
[35] OdC, p. 165.

Quand on voyait d'un peu loin rouler ce ruban sur une carte ou le dérouler, on aurait juré qu'on voyait toujours la même couleur, par exemple, d'abord du violet. Cependant au trois ou quatrième tour, on voyait son œil transposé sur du bleu, le tour suivant était encore en apparence du bleu.[36]

Castel apparently played this game with Diderot, when the encyclopaedist came to see him in his rooms. Diderot used the ribbon game as a metaphor for the chain of beings in the *Encyclopédie* article, 'Animal':

Où les êtres s'élèvent au-dessus ou s'abaissent au-dessous les uns des autres, par des degrés imperceptibles, en sorte qu'il n'y ait aucun vide dans la chaîne, et que le ruban coloré du célèbre Père Castel Jésuite, où de nuance en nuance on passe du blanc au noir sans s'en apercevoir.[37]

And again in *Le Rêve de d'Alembert*:

Tout animal est plus ou moins homme; tout minéral est plus ou moins plante; toute plante est plus ou moins animal. Il n'y a rien de précis en nature… Le ruban du père Castel… Oui, père Castel, c'est votre ruban et ce n'est que cela.[38]

Castel was very proud of the technical accomplishment represented by the rainbow ribbon. He at first attempted to produce it himself, using a loom a 'manufacturier' had prepared for him with beige thread. Castel used a sponge to dye the threads directly on the loom, changing colours every two inches. To his surprise, this method was somewhat successful, however, it ruined the loom.[39] The final result was made by preparing 190 shuttles with careful combinations of coloured threads, and handing them in order to a weaver who handled the loom, according to a table Castel included in *L'Optique des couleurs*.[40]

Once he had found the 144 possible colours, it was Castel's intention to put them all together into a 'cabinet chromatique', which he hoped could be used

[36] OdC, p. 178.
[37] Diderot, 'Animal' in *Encyclopédie*, I, p. 468.
[38] DPV XVII, p. 138.
[39] OdC, pp. 180-1.
[40] OdC, pp. 184-7.

by dyers and painters to discover new colours.[41] Extending this concept, he imagined a chromatic cabinet that would occupy an entire apartment of five to twelve rooms. Walls, upholstery, curtains, and bedspreads – all would be covered in rainbow tapestries, which became progressively more nuanced as one went from room to room.[42] This idea for a chromatic cabinet may have been related to a series of mobile 'lanternes diapasonnées' that Castel had in his workshop in the 1730s.[43] Castel thought these lanterns could produce public spectacles of illumination: 'Par les lanternes surtout on peut faire des merveilles avec des verres, des cornes, des gazes, des taffetas, des papiers même huilés ou plutôt vernis: surtout si l'on donnait à ces alternes la mobilité qu'ont les miennes.'[44]

6. The First Prototype

Castel's first prototype was declared complete on the feast day of Saint Thomas the Apostle, 21 December 1734.[45] While proud to have built it, Castel emphasized that it was very far from perfect, because the idea was still new and he didn't really know what he was doing: 'Or quand j'ai monté pour la première fois il y a un an mon nouveau clavecin, je ne le savais pas monter; il y a-t-il quelqu'un au monde qui le sache?'[46] This model was made of coloured pieces of paper that popped up from behind a barrier. Getting the year wrong, the anonymous builder of the 1757 model writes:

> In 1730, he made a trial of it with coloured slips of paper masked with cartridge. I have often seen this essay in his apartment, handled and considered it. An easy spring, upon the stress of the fingers upon the keys of the harpsichord, raised the coloured paper above its cover, so as to make the colour appear and vanish like

[41] OdC, pp. 337-8.
[42] OdC, pp. 341-2.
[43] Castel, 'Lettre […] sur un feu d'artifice où les couleurs bien diversifiés feraient un vrai clavecin oculaire', *Journal de Trévoux* (August, 1739), 1675-1678.
[44] Ibid., pp. 1677-8.
[45] 'Vers philosophiques', *Mercure de France* (December, 1735), 2802-3.
[46] NE.II, p. 1626.

lightning. This little essay made a prodigious noise in Paris; everyone ran to see it, and the Father Castel was so overwhelmed with the confluence it drew, that he was obliged to shut up his apartment and to lay this attempt by for some time.[47]

A traveller named Alban Butler who saw this model in the mid-1740s wrote:

I saw in his room the famous instrument invented and made by himself, that produces colours by the sound which is analogical to each colour. It is like a harpsichord set up against a wall; when you touch a string or key, to produce a particular note, the whole instrument evidently assumes the colour that corresponds to it by analogy, which Sir Isaac Newton and Voltaire &c. give us hints of, though the cause is mysterious: This instrument is not finished, and gives only three colours. The father pretends to entertain hopes of making it complete; though I scarce believe he will, at least in haste.[48]

Either it was mostly broken by the time Butler saw it, or it only ever performed three colours—probably Castel's fundamental colours; blue, red, and yellow. The 1757 account implies the latter, when discussing Castel's response to a criticism that the prototype's three colours didn't blend:

Fifthly, that it is very true, that to judge by the essay he had made, three colors starting at once, could not unite in the eye so as to form one single individual color, like the unity of three sounds in the ear; but it is to be observed, […] that one might then determine a fixed point (this too the cavillers will treat as a paradox) or a common center that should be the focus of all the colored glasses; that then three colors starting at once, coming to unite in one center, would present to the eye one only and individual color.[49]

If the instrument was up against a wall, as Butler describes, then it was not a complete harpsichord, and did not play sounds. Diderot would have seen this prototype alongside Castel's ribbons; as a result, his *Encyclopédie* article, *Clavecin*

[47] *Explanation*, pp. 2-3.
[48] Alban Butler, *Travels Through France and Italy and part of Austrian, French, and Dutch Netherlands: during the years 1745 and 1746* (Edinburgh: J Moir for Keating, Brown and Keating, 1803), p. 65.
[49] *Explanation*, pp. 6-7.

oculaire, describes it as an alternative to auricular harpsichords, rather than an instrument that can play both sound and colour simultaneously.[50]

In 1737, the composer Telemann also came to see the instrument, and he published a description of it for German readers, which was then translated and republished in France. Strangely, in Telemann's account, all of the essential parts—the optical element, the material that attaches it to the harpsichord, the mechanism by which the attachment is effected—are still being designed. The strings, pulley mechanism, and dioptric box are still there, but now are presented alongside multiple alternatives:

> Le P. Castel s'est servi de cordons de soie, de fils d'archal, ou de languètes de bois, qui étant tirés ou poussés par le derrière ou le devant de la touche ouvrent un coffret de couleurs, ou un compartiment, ou une peinture ou une lanterne éclairée en couleurs.[51]

Since we know that Castel had finished a prototype years before Telemann's visit, it is odd that this description is so vague. Telemann probably did see all the materials and mechanisms in his list in Castel's workshop, and three bouncing bits of paper would have been a disappointment after the dazzling light show Rondet had described a decade earlier. Perhaps Castel asked the composer not to go into specifics about this prototype, because he thought he was about to have a much more impressive instrument on his hands, made by an actual luthier. In a 1735 letter to Montesquieu that is full of complaints about the impossibility of finding good collaborators, Castel wrote that he was determined to ensure that the new prototype would play both sound and colour:

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[50] Diderot, 'Clavecin oculaire' in *Encyclopédie*, III, 511-2 (p. 468).
[51] Georg Philipp Telemann, 'Description de l'Orgue ou Clavecin Oculaire du P. Castel, traduite de l'Allemand du célèbre M. Telemann Musicien', trans. by Lefebvre de Saint Marc, *Le Pour et Contre* XVIII, no. CCLXVI (1739), 313-326 (p. 323). Originally published as: Georg Philipp Telemann, *Beschreibung der Castellischen Augenorgel, oder des Augenklaviers, aus dem Französischen übersetzt* (Hamburg, 1739).

Le bruit, le mouvement, la diversité amuse toujours. Rien de cela ne manquera à mon nouveau clavecin, parce que je suis absolument résolu d'y joindre un petit clavecin ordinaire. L'oreille aidera à l'œil, et les deux sens réunis rempliront une partie de l'attente.[52]

7. Failed Attempts, and Colour Organs

At the end of his 1735 articles, Castel announced that he was working with a talented luthier named Touroude to build a definitive version, and that it was nearly complete.[53] Castel was so confident about this collaboration that he concluded the series by writing, 'Ne reculons pas, notre siècle est capable de tout. Et voilà tout ce que j'avais à démontrer à l'esprit, consentant désormais à donner aussi à l'œil sa satisfaction par le clavecin même qui est comme fini en même temps que mes écrits.'[54] However, it apparently collapsed without result, as for the next fifteen years his only finished prototype was the one he'd built himself.

We do not have details on why or how things fell through with Touroude, but there are clues in Castel's account of his attempt to build a colour-organ. The idea of creating a colour-organ appealed to Castel because it could play during church services,[55] and because it was thought of as a master instrument whose range encompassed all the others.[56] He spent some time trying to master its construction, and at some point built a kind of reed organ himself,[57] but he found this notoriously complicated instrument very difficult to understand, and was annoyed when he could not communicate effectively with the craftsmen who built them, known as 'facteurs'.

[52] Montesquieu, *Œuvres completes*, ed. Jean Ehrard (Lyon: ENS Editions, 2014), XIX, p. 82.
[53] NE.VI, pp. 2722-3.
[54] NE.VI, p. 2767.
[55] *Journal*, fol. 24r.
[56] NE.VI, pp. 2718-9.
[57] 'Lettre du Père Castel, à M. Rondet, mathématicien, sur sa réponse au P. L[augier] J[ésuite] au sujet du clavecin des couleurs', *Mercure de France* (1755), 144-158 (p. 148).

With the exception of artistic professions (painters and musicians), Castel thought very little of the artisans and craftsmen he interacted with, and attributed their scepticism and resistance to laziness, stupidity, and jealousy.

> Des ouvriers n'y réussiront jamais. J'en ai l'expérience: de cent fois que je m'en suis rapporté à eux, ils n'y ont pas réussi une seule. Ils y perdraient plutôt la tête, et encore en ont-ils si peu: sans parler que d'un autre sens, ils en ont plus que trop. Il faut leur donner toutes choses faciles, et toutes les difficultés aplanies. Il faut aller à la source, et apprendre aux teinturiers à nuancer, soit en coloris, soit en clair-obscur.[58]

Nowhere is Castel's contempt more apparent than in his account of his interactions with *facteurs*:

> On a deux difficultés à vaincre avec ces gens de métier, l'une qu'ils ignoraient en effet, et ce qu'on leur dit, et ce qu'ils doivent répondre. Je le dirai, comme je l'ai constamment observé. […] Outre cela, ils sont malins, comme ils disent eux-mêmes, et dès qu'on les questionne sur leur art, ils tournent leur ignorance en finesse, croyant qu'on veut leur enlever leur secret, et presque leur gagne-pain. Ils ne veulent, ni ne savent, ni ne peuvent parler.[59]

Castel had decided (based on calculations) that the number of possible octaves was between twenty and twenty-five, and alludes to an odd negotiating process as the *facteurs* attempted to bargain him down to under ten. Most organs in Paris had tubes of eight or sixteen feet, and the maximum size was thirty-two feet, though the *facteurs* he spoke to told him that the biggest and smallest tubes on 32-foot organs made almost no sound. Castel concluded that he would like a 64-foot organ. When told that a tube 1/64 of a foot would certainly be silent, he reasoned that you can make a sound by blowing through a pinhole in a cherry pip so long as you blow hard enough.[60] While this is true, it would not have been a very helpful observation for a professional attempting to conclude an eccentric

[58] OdC, pp. 259-60.
[59] OdC, pp. 288-90.
[60] OdC, p. 294.

conversation and get on with his day. If Castel's tone in these passages is a reliable indication of how he treated workmen, then he cannot have had many supporters among those who were equipped to help him, even aside from his money problems, which were, at times, substantial.

Whether he was embarrassed at failing to produce the instrument that he had promised, or for other reasons, in the late 1730s Castel became hesitant to show his prototype to visitors. This attitude caused him to miss an opportunity to make a useful connection on at least one occasion, when the Prince de Conti came to visit Louis-le-Grand in 1739. The Prince, a wealthy patron of the opera and Rameau's former protector, said that he would like to see the instrument, but Castel was too nervous to show it to him.[61] Then, in 1743, the Comte d'Egmont died.[62] Castel regarded this event as a deathblow to the instrument: 'Le clavecin serait fait et parfait s'il avait vécu.'[63] He again abandoned the ocular harpsichord and began refusing to show it to visitors, 'pour ne pas me donner le fracas et le devoir de retirer tout cela d'un tas de poussière, de rouille et d'ordure où je le laissais croupir et dépérir.'[64] For a decade, Castel refused to work on his famous idea.

It seems that Castel's withdrawal from society and its ocular harpsichord mania was abrupt. When he returned to it again, and launched his final attempt at building his instrument, he felt he had to apologize to former friends for his behaviour: 'Madame, croirez vous que je vais gravement vous rendre compte de ma conduite envers vous et envers bien d'autres depuis quelques années. C'est une espèce de manifeste que je tiens depuis deux ou trois mois.'[65]

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[61] MS 15747, p. 19. See also Schier, p. 179.
[62] Manuel Couvreur, 'Aperçus d'un naufrage: les ouvrages perdus ou inédits du père Castel, in *Autour du père Castel et du clavecin oculaire,* eds Roland Mortier and Hervé Hasquin, *Études sur le XVIIIe Siècle*, XXIII (Brussels: Éditions de l'Université de Bruxelles, 1995), pp. 107-127 (p. 125, note 53).
[63] *Journal*, fol. 4r.
[64] Ibid., fols 9r-10v.
[65] This letter is drafted to an unidentified friend. Ms 20758, p. 27.

8. The Second Prototype

Castel's last period of work on the ocular harpsichord began on 13 September 1751, when he was stirred back into action by news of the birth of Louis XV's first grandson:

> Réellement à la naissance de M.gr. le duc de Bourgogne j'étais à la campagne autour de Paris, lorsque la canon de la Bastille et des invalides tirant à force à 2 ou 3 heures du matin, j'étais réveillé par ceux qui criaient *vive le Roi, vive Mr. le Dauphin* et dans l'instant je me mis à la fenêtre pour répondre à ce cri en y ajoutant *et vive aussi mon clavecin fait pour célébrer une si heureuse époque.* Toute la journée et pendant huit jours et plus je répétais à tout venant que j'allais faire mon clavecin.[66]

Castel claimed that he wanted to present the finished instrument to the future king, as 'le premier joujou digne de son berceau royal.' For his final stage of work, Castel had the patronage of a powerful aristocrat and military expert, the comte de Maillebois. This relationship was rocky—in March 1753, Castel wrote a desperate letter to the comtesse, imploring her to send him the money he had been promised by the comte, or risk bankrupting the project.[67]

Three years later, on 18 December 1754, a prototype was demonstrated for a few friends and colleagues, including Rondet, who agreed that it was ready. A demonstration was scheduled on 21 December, the feast day of the instrument's patron, St Thomas the Apostle, twenty years to the day since his first model was finished. Castel invited fifty people and lit a hundred candles. The performance caused so much talk around Paris that the next day he found himself inundated with visitors, who demanded another performance. He put

[66] *Journal*, fol. 7v. In 1749, Castel wrote to Montesquieu claiming that he was working on the instrument; critics sometimes give this letter as evidence that he was. However, this brief detail is dropped in at the end of a long request for help on something else. In context, it is much more likely that Castel mentions the instrument to pique Montesquieu's interest and reassure him that his support will not go to waste. *Correspondance* II, p. 82-9.

[67] See below, page 61.

them all off until 5pm, 1 January 1755, when two hundred people pressed in to see it.

Castel wrote at least three accounts of these events. In a personal letter, dated April 1755 and translated into English in the *Explanation*, Castel describes them as a splendid success. In the *Mercure de France* of the following July, he also claimed success, writing that the fifty people at the first performance had applauded for four encores.[68] But in his *Journal historique*, unpublished but intended for publication and addressed to Maillebois, he describes the first performance as a terrible disaster. In the *Explanation*'s account,

> I gave an invitation to fifty persons of the house, and from abroad, and lighted a hundred wax candles. There was nothing but acclamation and clapping of hands in consequence for the space of half an hour that I played, and all that composed what I called the pit owned that the harpsichord was made, and for ever makeable. The most incredulous I had invited in part of the number of my fifty spectators, and it was precisely these who paid me the greatest compliments upon my success, whilst I laughed at their preceding incredulity, and they laughed at it themselves.[69]

In the *Journal*'s account, which is the longest, and apparently written only days after the second performance,[70] Castel is much less jolly. He describes a busy process of preparing his materials for a 'practical demonstration' (not a performance) on 21 December, while the audience assembled around him:

> Je m'arrangeais en effet pour cette démonstration pratique, et j'avais tout au sérieux et au ton du public préparé des transparents et des bougies, des couleurs et des lustres, des paravents et des soupapes de lumière, des tambours même et des cuvettes avec des marteaux et des chambres sonantes et voyantes, pour n'annoncer une si grave époque qu'au bruit du tonnerre et à la lueur des éclairés, sans parler des foudres, des flots, des nuages, vents et tempêtes, le tout harmonieux comme j'eus l'honneur de vous l'expliquer il y a un mois, et de fait je procédais à cette terrible expérience qui m'épouvantait un peu par l'embarras.[71]

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[68] 'Lettre du père Castel, à M. Rondet' (1755), pp. 144-5.
[69] *Explanation*, pp. 12-13.
[70] Castel writes of the '200 personnes à qui je le démontrai pratiquement l'autre jour.' *Journal*, fol. 34r.
[71] Ibid., 8r.

Stepping back momentarily from his preparations, Castel overheard murmurs in the audience—voices saying that the ocular harpsichord was impossible and would never be finished, and that all he had to show was theoretical:

Non il n'en fera rien, disait-on à mes oreilles, presque à mes yeux, *il ne fera point cette expérience décisive, elle ne réussira pas non plus que tant d'autres. Son clavecin en un mot est très impossible, il ne fera pas son clavecin: il n'en démontrera que la théorie &c.*[72]

Castel was furious and made a scene, impulsively declaring his work to be complete, and inviting everybody to come and see the fruits of his labours the following day:

Non je ne la ferai point, ai-je dit, *cette expérience fatale qui allait me mener au tombeau: ça, je la déclare faite et refaite, sinon parfaite: non je ne ferai point le clavecin, car il est fait, et par conséquent démontré possible à refaire et parfaire*. Oui j'ai dit cela à 60, 80, ou 100 personnes en leur donnant un rendez-vous à demain dans une salle ou j'ai produit à leurs yeux les fameux rubans et étoffes pittoresques et harmoniques, nuancés à la navette en coloris et en clair-obscur, comme au pinceau, avec mes expériences de il y a 15 ans, mes modèles, clavier, mouvements, soupapes, éventails, soleils, boëtes, lanternes, tableaux &c.

The *Explanation*'s account makes it sound as though people followed him to his rooms of their own accord, rather than because they had been invited, and with no mention of his outburst: 'everyone wanted to see, and see again this novelty.'[73] In the *Journal*, he writes that when he showed his visitors the objects he had made in the service of the ocular harpsichord, everybody was convinced that it was finished:

C'étaient tous gens d'esprit, mus[illegible], éclairés, la plupart incrédules, mais qui voyant enfin ont répété comme moi *le clavecin est fait et possible à faire, à refaire, à parfaire*. Musiciens même l'en sont enthousiasmés et m'ont suggéré

[72] Ibid., p. 8v.
[73] *Explanation*, p. 13.

bien des façons de le mener à bien et de le perfectionner. Et depuis ce moment bien d'autres l'ont vu et revu avec la même satisfaction et la même persuasion de la possibilité démontrée par le fait même.[74]

It is possible, however, that the ocular harpsichord was not played until 1 January, which the *Explanation*'s translated letter describes as the decisive event:

The Harpsichord stood, as you know, before my anti-chamber, and blocking up my apartment, in the front of the gallery. Precisely at five o'clock, the gallery was full of Jesuits, abbots, seculars, of gentlemen and ladies. There was the President de Quinsonas, his brother the commandant, Madam the Marshaless of Lowendahl, etc. The harpsichord played, and two hundred persons owned that they had never seen anything more beautiful or more brilliant, and all concluded that the harpsichord was *executable*, *possible*, *true*, and even *made*: I alone assuring them, that this was not even a sketch, a beginning of it, so far was it from perfect.[75]

It appears that Castel had not intended to declare his instrument finished until, humiliated by his guests' continued scepticism, he threw his tantrum. If the embarrassment he caused himself and Maillebois required an apology or explanation, then we can account for his tone in his *Journal*. In contrast, the general readership of the *Mercure de France* and a personal correspondent in a foreign country could more plausibly be given a cheerful version of events.

This second performance is likely what we see depicted in the Saint-Aubin book, a series of humorous and obscene cartoons drawn by the royal embroiderer Saint-Aubin for the private amusement of himself and his friends. Castel is shown seated at his instrument, surrounded by a palette, compass, ruler, saw, papers—an assortment of objects reminiscent of the list that is quoted above. Like the earlier prototype, this instrument uses strips of coloured card, which seem to be pushed up by a mechanism located behind them, and its colour keyboard is incomplete, and only has one octave. In contrast, it is connected to an actual harpsichord, so it would have played both sound and

[74] *Journal*, p. 8[v].
[75] *Explanation*, pp. 13.

colour. However, we cannot be sure that this drawing is reliable, as the specifics of the instrument were clearly not of interest to Saint-Aubin: his illustration shows the colour scale beginning on violet (following Newton)[76] rather than the blue that Castel always insisted should be first, and only has seven colours, instead of a full octave.

Saint-Aubin's drawing focuses on how unknowingly foolish Castel looks while playing the ocular harpsichord. The many objects that surround him suggest a long introductory speech about his theories, and their disarray at his feet implies that it was rambling or incoherent. Worst of all, even though the instrument's pedals operate an enema syringe that sprays into his face, Castel nonetheless bears a smiling, even smug expression. 'Que n'ont-ils tous employés leur temps à la même machine', reads the caption, 'le Père Castel—rapport des sons et des couleurs'. The 'they' refers to the Jesuits, who had long been known for public demonstrations of experiments, and were viewed with increasing suspicion and dislike, due to their extensive political and economic influence. Less than ten years later, they were expelled from France, and their assets liquidated. If only the whole lot of them spent their time on harmless, crazy projects, the caption insinuates, instead of sticking their noses in other people's business.

The consensus among those who saw the prototypes is that they were disappointing, a far cry from the marvels he had promised. One posthumous biography of Castel confides, ruefully: 'Bien des témoins oculaires m'ont assuré que l'exécution n'avait pas répondu à la Théorie.'[77] Even so, the spectacle of colour and light that Castel managed to deliver was, in some ways, impressive. In

[76] Newton's colour octave begins on red and ends with its unison, violet; he calculates that red and violet have the same proportions as the unison in a monochord. Isaac Newton, *Opticks* (London: Sam Smith and Benj. Walford, 1704), p. 18, pp. 93-4.
[77] Aimé-Henri Paulian, *Dictionnaire de physique,* 3 vols (Avignon: L. Chambeau, 1761), p. 317.

Illustration 4. Saint-Aubin's Caricature

his obituary for Castel, Berthier made a point of reminding readers that even Castel's failures had been dazzling: 'Dans les ébauches d'exécution qu'on a pu voir de ce clavecin, les couleurs variées presque à l'infini, combinées savamment,

jointes à l'éclat des miroirs et à l'effet des bougies, faisaient un spectacle au moins extraordinaire, et qui mériteraient d'être exécuté en grand.'[78]

9. The London Instrument

It is unclear why the author of the 1757 'Explanation of the Ocular Harpsichord Upon Shew to the Public' is anonymous, and why Castel made no mention (which I have found) of this apparently very involved collaborator. The author claims to have purchased supplies and employed and overseen the workmen who built the second prototype, and relates a plausible account of a warm and longstanding friendship with Castel, including the translation of a personal letter, which he claims to be ready to show anyone who is interested.[79] However, he also makes multiple mistakes, so the history he gives in his pamphlet's first part cannot be totally trusted. He also claims to have inspired Castel to begin work on the second prototype in July 1754 by relaying compliments from Fontenelle, in contradiction to Castel's own account and correspondence, which shows he started three years earlier; perhaps Castel had once again given up work in the interim.

The second part of the pamphlet describes the ocular harpsichord the author built himself, and happily, several of its details are remarkably consistent with the plan Rondet had outlined thirty years before. The ocular component is similar to the dioptric box, and is also placed on top of an ordinary harpsichord. It plays music and colour simultaneously, not just colour music on its own. The cones of faceted glass are also there, and the performance that it is meant to give evokes Rondet's extended 'point' of light. I earlier described the ocular

[78] Guillaume François Berthier, 'Éloge historique du P. Castel', *Journal de Trévoux* (April, 1757), 1100-1118 (p. 1112).
[79] *Explanation*, p. 11.

harpsichord's intended play as being like a laser; this box, we learn, shoots 'coloured lightning':

> This Ocular Harpsichord, to enter into particulars of the pieces that compose it, is in form of a beaufet, of the height of five feet eight inches, breadth three feet four inches, and in depth two feet, placed perpendicularly upon the fore part of a common harpsichord. The backboard contains in the space of three feet square five hundred and odd lamps, which will form a very brisk light, so that the coloured lightning will full sufficiently illuminate the show-room. The fore-board, that fronts the spectators, carries sixty coloured glasses, every one analogous or answering to the sound that is to be heard by the ear, at the same time that the coloured lightning will act upon the eye. For the same touch that produces the sound will, at the same time, start the luminous colour. The sound, as being the less subtle, will be the first put in motion, with proper allowance for the interval; so that the sound may make itself heard by the ears, at the same instant that the light will strike upon the eye. The coloured glasses are transparent enamels of an elliptic form, of two inches and a half in diameter, and cut in such proportion as to form a luminous cone, of which the base will be brought to bear on the eye of the spectators.[80]

There is one major difference: the London instrument was ordered according to Newton's system, beginning with violet instead of Castel's blue. The author explains this choice by noting that Castel's system, 'to which he was ever obstinately attached, not-withstanding all the demonstrations and experiences he had in favour of Newton's system, alone cost him more difficulties to encounter, than all the rest of his undertaking.'[81]

Yet the author makes this observation from a position of sympathy and reverence for Castel, and asks the reader to 'represent to himself the difficulties to be overcome, the obstacles to remove, the pains and attention requisite to be taken,'[82] before he judges Castel for having failed to complete his instrument. 'Obliged to attend the functions of his ministry, he could not but miscarry in all the essays he made, because he could not be always with the workmen to direct their operations.' At one point in the translated letter, Castel again complains

[80] *Explanation*, pp. 17-8.
[81] Ibid., p. 19.
[82] Ibid., p. 21.

about his workmen, while revealing that he knew of his British correspondent's scheme to build an ocular harpsichord, was supportive and even playfully competitive with him: 'You failed in your trial of August? Did not I tell you that I should get the better, at this bout, of my harpsichord scheme? I have been tossed from bad workmen to bad workmen for some months.'[83]

This pamphlet made its way to Paris and was reviewed by the *Journal de Trévoux*, whose editors were evidently mystified by the author's identity. Their *compte rendu* points out numerous errors, speculates that it was written by one of Castel's former students, and observes (plausibly) that certain mistakes in the writer's English grammar suggest that it was written by a Frenchman.[84]

Whatever time and resources this writer had to build his instrument, he doesn't appear to have been much more successful than Castel. While explaining the general shape of his ocular box, he apologetically leaves out major details, and also articulates a fear of 'over-raising' his public's expectations. Notably, he gives no explanation for how the ocular harpsichord attaches to the 'auricular' harpsichord, which is probably because it was not attached, and therefore was not functional. A handwritten note from the first owner of the copy in the British Library reveals that the instrument was not performed:

> The idea of this instrument is something very extraordinary, not to say extravagant; I was admitted among a select party to a sight of it at the great concert room in Soho square, but to a sight only of this instrument, for nothing was then performed, nor afterwards, as ever I heard, neither did I ever know why.[85]

[83] Ibid., p. 12.
[84] Review of *Explanation of the Ocular Harpsichord, Journal de Trévoux* (February, 1759), 486-496.
[85] *Explanation of the ocular harpsichord, etc.*, London, British Library, General Reference Collection 1651/1782 1042.h.4. This note is inside the front cover.

10. Imagined Performance

Wealthy eighteenth-century Parisians had a great appetite for astonishing and complicated spectacles. Baroque theatre, ballet, and opera competed to give audiences ever more lavish sensory experiences, and public illuminations and firework displays were fairly common. It would have taken quite a lot to impress these audiences, and Castel's public apparently remained interested in the show he'd promised them for thirty years. When Castel tried to back out of any obligation to take on the project of building it, he complained that he was under pressure from people who weren't interested in his theories, but only in being amused:

> J'ai eu beau le protester: le côté sensible de mon analogie, la seule pensée d'une musique de couleurs avait saisi les esprits, et je dois avouer qu'un certain gros du public peu soucieux de théorie et fort curieux d'amusement, statua, après bien des dissertations de conversation, qu'on ne jugerait de tout cela définitivement et en dernier ressort que par les yeux.[86]

In order to obtain maximum exposure from his readers' interest in the instrument, Castel had to avoid both disappointing them and satisfying them, so he scattered details about the instrument throughout his texts, ensuring that curious readers had to pay close attention to his other ideas. He apparently felt fully justified in doing this, arguing that people couldn't be expected to appreciate his instrument, if they didn't understand the theory that it stood for:

> Car c'est là que pris naissance il y a 12 ou 15 ans cette belle distinction d'un clavecin possible en idée, impossible en pratique, comme si ce n'était pas l'idée même qui soit sous la possibilité des choses, comme si la théorie d'une chimère n'était pas une chimère elle-même. […] Car de dire abstraitement qu'il y a une harmonie de couleurs, je veux croire que ce n'est que Théorie.[87]

[86] NE.I, p. 1445.
[87] *Journal historique,* fol. 4v.

Castel's contemporaries were well aware of this dynamic, and some of them resented being strung along with promises of a performance that Castel wasn't going to fulfil. According to one anecdote, Castel was ready to admit as much in public when put on the spot:

> Un bel esprit, ayant un jour fort pressé le père Castel de convenir que son clavecin oculaire … était une imagination, et qu'un ouvrage que ce bel esprit avait publié, et qu'il citait en opposition, n'en était point une; le Jésuite lui répondit, puisqu'il le voulait, qu'il était près de signer sa proposition et de l'adopter. Son antagoniste n'en voulait pas tant; car il se fâcha tout de suite de l'excès de complaisance du bon père, sans doute parce que la compagnie y donna un mauvais tour, en souriant à l'idée qu'elle comprit que le père Castel avait dans l'esprit.[88]

This little story is an excellent illustration of the polarising effect that Castel's ocular harpsichord had upon eighteenth-century readers: what was aggravating and evasive to some, was charming and delightful to others. It also serves as interesting evidence that not only were Castel's readers willing to wait, (some of them good-naturedly) for the spectacle he'd promised; but that they were entertained by the very experience of waiting, and imagining. As the owner of the London pamphlet marvels, the 'idea' in and of itself, was 'very extraordinary, not to say extravagant'.

Most modern critics have thought that the ocular harpsichord was merely meant to light up, like a screen, with the exception of Franssen, who compares it to a discothèque.[89] However, the use of panes of coloured glass lit from behind was nothing new—set designers had been using this technique since the sixteenth century.[90] The additional element of animated 'music' would have been novel, but if all that was at stake was a colourful, rhythmic twinkling, then it is

[88] Honoré Lacombe de Prezel, *Dictionnaire des portraits historiques, anecdotes, et traits remarquables des hommes illustres,* 3 vols (Paris: Lacombe, 1768), I, pp. 231-6 (pp. 232-3).
[89] Maarten Franssen, 'The Ocular Harpsichord of Louis-Bertrand Castel', *Tractrix* 3 (1991), 15-77 (p. 71).
[90] Gösta M Bergman, *Lighting in the Theatre* (Stockholm: Almqvist & Wiksell, 1977), pp. 57-8; pp. 117-20.

unclear why so many other writers thought that the experience would be exhausting and unpleasant. 'Dans les airs de mouvements et dans les batteries de couleurs,' wrote one of Castel's posthumous biographers, 'le spectateur ne pourra par conséquent saisir que quelques notes éparses, ou il se tourmentera si fort pour les saisir toutes, qu'il en aura bientôt la berlue, et adieu la mélodie et l'harmonie.'[91] In much repeated comments from the *Éléments de la philosophie de Newton*, Voltaire worried that, 'ce passage rapide devant les yeux semble peut-être devoir étonner, éblouir, et fatiguer la vue'.[92] Yet, as is often the case with entertainment that is meant to overwhelm, the thing that repelled some people was splendid and exciting for others. Undeterred by Voltaire's hesitation, one ode to the *Éléments* opined, 'L'accord de rayons, ô merveille ! | Forme un concert harmonieux. | Ce que les tons sont à l'oreille, | les couleurs le sont à mes yeux.'[93] Some even attributed concerns like Voltaire's to the small-mindedness of conventional tastes, as did Granet, defending the ocular harpsichord: 'On sait combien cette invention, que de petits esprits ont essayé de ridiculiser, étonne et charme des yeux philosophes, et combien elle a contribué à la célébrité de la réputation du P. Castel.'[94]

The promise of projected, concentrated, mobile, coloured light appears to have been what made the idea so appealing to some, so dreadful to others, and so difficult to execute with the lighting tools available in the eighteenth century. One recent scholar argues that one cannot even apply the term 'lighting' to pre-electric theatre technology, as it was capable only of 'illumination' using static, oxidising light sources, like candles—it was not until well into the nineteenth

[91] Lacombe de Prezel, pp. 236.
[92] Voltaire, *Éléments de la philosophie de Newton*, OCV 15, p. 393.
[93] 'A M. de Voltaire, sur les *Éléments de la Philosophie de Newton*, par M. de C. Conseiller au Parlement de *', *Mercure de France* (July, 1738), 1644-1646 (p. 1645).
[94] François Granet, review of *L'Optique des couleurs*, *Réflexions sur les ouvrages de littérature* 12 (1740), 3-15 (p. 5).

century that such an effect became possible.[95] Castel's colour music must have been astonishing to imagine because nothing similar had ever been produced.

11. Other Ideas, the Cabinet of Colours, Fireworks

The ocular harpsichord's reputation was entwined with the panoply of other novelties that Castel enthusiastically proposed. As one might expect from someone who spent his long career making mathematics interesting for students and casual readers, he had a knack for sparking the imagination. He apparently constructed mechanical butterflies for no other reason than to delight his visitors: 'Mes papillons par leur battement d'ailes se font prendre pour de vrais papillons; et quoiqu'ils ne soient qu'esquilles, tel les a trouvés mieux dessinés que les vrais papillons.'[96] He conceived of a harpsichord for the nose, with a scale of perfumes covered with valves that opened in time with the keys, and a touch harpsichord with a scale of textures, arranged on a board small enough to 'play' upon the hand.[97] He suggested using embroidery or varnish to tune textures with colours on textiles or paper.[98] Castel believed that once the harmonic proportions in music had been quantified, they could be applied to make music using sizes, distances, and shapes—shapes of living creatures, imaginary creatures, geometric shapes, and flowers. 'J'ai dit qu'on pouvait faire autant d'instruments de couleurs que de sons; on en peut faire d'un million de goûts plus différents que ceux de la musique vulgaire.'[99] One could make an ocular harpsichord using only flashes of light, without any colour at all. One could also make an instrument that used mirrors to multiply the image of an object as many times as desired (a harmonic fun-house mirror?), or a 'faux-jour' that could

[95] George C Izenour, *Theater Technology* (New Haven: Yale University Press, 1996), pp. 34-5.
[96] *Journal,* fol. 30r.
[97] 'Difficultés', p. 459.
[98] NE.VI, p. 2720.
[99] NE.VI, pp. 2748-50.

brighten or darken a room at will (a musical dimmer switch?). His analogy went in the other direction, as well—at some point after 1748, Castel promised to send the academy of Rouen a description of new inventions that would have the same effect on ears that lenses have on eyes.[100]

Castel was fond of referring to 'un vrai clavecin oculaire', whenever he wanted to identify an idea or a phenomenon that operated on the same principle his instrument depended on. Dance, for instance, was a real ocular harpsichord.[101] Moments like these read as attempts to make the phrase 'clavecin oculaire' signify a philosophical concept and aesthetic stance, instead of the technically bedevilling machine that everyone was waiting for:

> Mais au public qui contient toutes sortes d'esprits et plus de bons, c'est-à-dire d'impartiaux que de mauvais, je réponds enfin nettement que j'ai vu ce clavecin mille et mille fois; et que dès 1725, je l'avais vu et revu, sans quoi je n'aurais pas été assez imprudent pour l'affirmer. J'avais vu un parterre jonché de fleurs: un doux Zéphire avait soufflé, et saisissant cet instant, j'avais vu le clavecin. J'avais vu une prairie semée de gouttes de rosée: le soleil s'était levé, j'avais fait un mouvement de tête, et mon œil m'avait dit, voilà le clavecin.[102]

Even though he had periods when he gave up on the instrument, Castel doesn't seem to have lost faith in colour music and the objects and events it could produce. In addition to the ocular harpsichord and his rainbow tapestries and ribbons, Castel had many other ideas for other spectacles and projects that could use his colour octaves. For instance, here he is describing an idea for a 'trompette voyante':

> Voici l'avantage inestimable qu'aura ma nouvelle Musique sur la Musique ordinaire, qu'on la verra de 2, 3, 20 et 100 fois plus loin qu'on n'entend celle-ci, et qu'à l'aide de ma trompette voyante, on jouira du spectacle à une, deux et trois lieues peut être.[103]

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[100] Claude-Nicolas Le Cat, 'Éloge du P. Castel, Jésuite', in *Précis analytique des Travaux de l'Académie Royale de Rouen, 1761-1770* (Rouen: P. Periaux, 1817), p. 240.
[101] NE.VI, pp. 2761-2.
[102] NE.VI, pp. 2699.
[103] *Journal*, fol. 38[r].

He also made 'tableaux mouvants' showing various shades of the same colour: 'Ce sont autant de prestiges à l'œil: j'en ai un peint en rouge fort simplement. Dès qu'il joue avec le plus petit bout du doigt, tous le monde se récrie qu'il voit un feu, des flammes, un volcan.'[104] Colour music could even be used to make musical portraits.[105]

Castel also proposed to use fireworks to produce colour-music performances. He wrote about using different substances (oils, metal filings) to engineer multi-coloured flame shows.[106] He wrote about an idea for a pyramid of fire, a sort of triangle-shaped ladder with smoky, reddish black fires at the bottom, and each rung of flames becoming increasingly brighter, smaller, and more numerous, up to the top where one would see,

> Peu à peu de gros lampions entremêlés de plus en plus avec les pots à feu, aboutissant graduellement à ce qu'il y a de plus petits lampions en nombre comme infini, d'un feu blanc, clair et très vif, formerait, si je ne me trompe, une belle illumination, et avec un peu d'entente, un embrasement, une fournaise, un volcan, un Vésuve, plusieurs même si on voulait; pourtant en eux-mêmes leurs réchauds de clair-obscur. *Non fumum ex fulgore, sed ex fume dare lucem* en serait la devise ou l'emblème.[107]

In the same article, Castel suggested other illuminated shapes, and a pyramid of rainbow-coloured fires, and fireworks that could show, among many other things, angels descending, and 'des démons vomis de l'enfer.'[108] Castel's fascination with fireworks was due to their potential for colour-music performances on a massive scale, as he also hoped to amplify the harpsichord, with mirrors, to entertain all of Paris, and even all of France:

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[104] *Journal,* fol. 30[r].
[105] NE.VI, p. 2709.
[106] 'Lettre […] sur un feu d'artifice', pp. 1676-7.
[107] 'Arts résultats du clavecin oculaire', *Mercure de France* (December, 1751), 7-21 (pp. 8-9).
[108] *Journal*, fols 29[v]-30[r].

Mais nous pouvions les surpasser en fait de spectacles de la vue, qui sont les vrais spectacles, faire jouir de tous les agréments de la Musique et de l'harmonie tout Paris rassemblé, toute la France rassemblée dans la plaine des sablons ou dans tout autre cirque et amphithéâtre préparé pour cela, sans parler qu'à l'aide de Miroirs artistement disposés on peut multiplier le spectacle, la lumière et la couleur pour lui donner en lui-même une richesse, une amplitude, une suite même et une profondeur qui à nos yeux égale l'univers.[109]

The epic magnitude Castel imagined was not limited to the scale of individual performances, and extended to their potential number and variety, should ocular harpsichords become an ordinary fixture in all Parisian homes:

Que tout Paris ait des clavecins de couleurs au nombre de huit cent mille, on peut sans se mettre beaucoup en frais d'invention et d'imagination, faire qu'il n'y en ait pas deux qui se ressemblent, et cela sans qu'il en coute plus, de les faire d'une façon que d'une autre.[110]

Castel was not alone in thinking that people would want their own ocular harpsichords. In 1743, Johann Gottlob Krüger designed his own ocular harpsichord in Halle, though he gave no attribution to Castel.[111] In 1769, Guyot's *Nouvelles Recréations* described how to build a toy version, which was also for sale.[112] At some point in the 1740s, Castel apparently turned down a lucrative offer to manufacture his invention:

The Father Castel himself was so disgusted from resuming this undertaking, either for having twice failed in it, or on account of the jests made of it by his adversaries, that he refused being at the head of a company, who came to offer him ten thousand crowns to be the chief director of it, on communicating his secret and ideas, and obtaining an exclusive patent.[113]

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[109] *Journal*, fol. 38[r].
[110] NE.VI, p. 2750.
[111] Johann Gottlob Krüger, 'De novo musices, quo oculi delectantus, genere', *Miscellanea Berolinensia, ad incrementum scientarium ex scriptis Societati Regiae Scientarum exhibitis edita*, no. 7 (1743), 345-357. For an account of this version, see Franssen, pp. 38-9.
[112] Guillaume-Germain Guyot, *Nouvelle récréations physiques et mathématiques,* 4 vols (Paris: Gueffier, 1770) III, pp. 234-40. Also discussed by Franssen, p. 35.
[113] *Explanation*, p. 10.

Castel's resistance to this plan may have been caused by disgust; also, as a Jesuit, he was explicitly forbidden from undertaking this genre of commercial enterprise. However, it is unclear to what extent this rule would have been enforced upon Castel; the Jesuits were in need of money, and they engaged aggressively in colonial moneymaking in this period.[114] In any case, the ocular harpsichord offered Castel something that he may have valued more than money: a tantalising foothold in his readers' thoughts and dreams, and thus, a way to keep them listening to what he had to say.

12. Publicity and Money

Castel's continued promises to build the ocular harpsichord provided him with significant publicity; this publicity sustained the public's appetite for new articles and books about the ocular harpsichord. In turn, these books and articles provided him with access to money that he could use to build the ocular harpsichord.

The ocular harpsichord prototypes, and their associated objects and experiments, were located in Castel's workshop in his rooms at Louis-le-Grand. There, visitors discovered the instrument while gaining intimate insight into the life of its inventor, surrounded by the evidence of his many other activities, all packed into the same room. In Diderot's first draft of his *Lettre sur les sourds et les muets,* he described visiting Castel's apartment in Louis-le-Grand with a friend, and the friend's stunned reaction upon meeting the extraordinary beings who lived there, side by side:

Je conduisis donc le mien rue Saint-Jacques dans la maison où l'on montre l'homme et la machine aux couleurs. Ah! Monsieur, vous ne devinerez jamais

[114] See: D.G. Thompson, 'The Lavalette Affair and the Jesuit Superiors', *French History* 10, no. 2 (1996), 206-239.

l'impression que ces deux êtres firent sur lui, et moins encore les pensées qui lui vinrent.[115]

Berthier, in Castel's obituary, described his rooms in a similar fashion:

Sa personne, ses livres, ses écrits sans nombre, son atelier pour le clavecin oculaire habitaient le même réduit; et il fallait avoir, comme lui, l'esprit de calcul pour distinguer quelque chose dans cet amas prodigieux de pièces de toute valeur, qui composaient son trésor physique et mathématique.[116]

Berthier's allusion to 'treasure' is significant, as he also described the ocular harpsichord as extremely expensive to construct:

Dresser la machine du clavecin chromatique, ce devait être l'entreprise de quelque curieux millionnaire. Le P. Castel se chargea de tout, et la meilleure partie de ses jours s'est écoulée dans l'exercice presque mécanique de cette construction qui n'a point réussi.

Castel was continually seeking ways to make the ocular harpsichord less expensive to construct. The builder of the London instrument claims that at some point after 1735, Castel received a thousand crowns from the Spanish ambassador, the Duc de Huescar,[117] but in 1755, Castel reported an astounding reduction in the cost of producing the instrument:

En 1725, on ne l'aurait pas fait pour 100,000 écus par les mains des ouvriers et artistes qui s'offraient assez à moi, mais avec des bouches plus qu'avec des mains, et avec plus d'appétit que de savoir faire. En 1735, je n'estimais plus la facture du clavecin que 20,000 écus: en 45, 10,000 écus ou même 1,000 guinées, disais-je aux Anglais. Il y a 3 ans que le voyais faisable pour 100 louis, quelqu'un le mettait à 2,000 écus; et voilà qu'aujourd'hui je viens de le faire sans ouvriers pour 50 écus.[118]

[115] Denis Diderot, *Œuvres complètes*, ed. Laurent Versini (Paris: Robert Laffont, 1994), I, p. 19.
[116] Berthier, 'Éloge', p. 1114.
[117] *Explanation,* p. 7.
[118] 'Lettre du père Castel, à M. Rondet' (1755), p. 150.

Castel's work on the instrument evidently did attract the attention of at least a few curious millionaires, and it was funded by various patrons. One of these was the comte du Maillebois, and Castel's letter to the countess offers insight into what his relationships with patrons were like. Castel writes to ask for money, referring to a number of different sums, and culminating in a desperate demand for fifteen Louis. He also refers to his publications and books as a potential source of income to supplement the cost of the harpsichord, in particular a book on warfare dedicated to the count:

> Le roi, disait Mr le comte, voulait lire l'ouvrage de la Guerre, Mr le marquis de Paulmy me fit l'honneur il y a un an de me dire qu'il voulait le lire, le public si je le lui donnais m'en récompenserait peut être et m'aiderait à faire mon clavecin. Me voilà sans ressource, et personne n'a pitié de moi. Je n'ose me plaindre à personne.[119]

The ostensibly uncomplaining Castel also offers his services as a lobbyist to secure support for Maillebois' canal project, writing that his endorsement had secured large amounts of capital for similar projects in the past. His attempts to elicit an emotional reaction from the countess are unrestrained: at one point he writes that one of the associates the count trusted to provide Castel with the funds he was promised has instead left Paris, 'laissant ici une pauvre femme mourir de faim et de froid etc. Et adieu la femme et mon clavecin.' This either testifies to genuine financial desperation, or a profound lack of perspective (or both); however, he did not exaggerate when he said that aside from patronage and income from his writing, he was without resources to build the ocular harpsichord.

Though the Jesuits were powerful, and Louis-le-Grand was their wealthiest and most important college, they subsisted on donations and rents from properties they owned, while providing their services and schooling free of

[119] Brussels, Bibliothèque royale de Belgique (KBR), Ms. 20753-20756. This document is transcribed in *Autour du père Castel,* eds Mortier and Hasquin, pp. 187-9 (p. 188).

charge. When Castel arrived, life at the college was austere. In his study of everyday life in the college, Dupont-Ferrier writes:

> Aucune luxe: ni serviteurs étrangers, ni écuries montées, ni objets d'art, en dehors de ceux qu'offraient de généreuses amitiés. Une économie stricte. Si bien qu'on ne manquait pas d'accuser les pères de ladrerie.[120]

The college was cold and dark, as they regulated their use of fuel and candles carefully, and expected to get the most out of their investment in the Jesuits' black robes, which were themselves considered an indulgence—they'd originally used un-dyed cloth before deciding that they looked too shabby. The buildings, a jumble of different ages and architectural styles, were crumbling, and their roofs and ceilings were all of different heights. Dupont-Ferrier comments that the necessity of stooping at every other doorway, 'donnait une perpétuelle leçon de modestie à ces habitants: ils devaient s'y faire tout petits.'[121]

It is not difficult to imagine what an incongruously lavish sight Castel's workshop would have presented in such a parsimonious environment. Alongside the papers he was working on, books he was reading and reviewing, and instruments like prisms, visitors would have seen rainbow ribbons of various lengths, specially woven to Castel's specifications; bits of silk curing in pots of dye, hung to dry, and assembled in order of *chromatique* and *clair-obscur*; and harpsichords in various states of disassembly, with networks of pulleys and levers connecting them to paintings and stained glass cabinets designed to be illuminated by a dazzling series of candles.[122] These items and the equipment used to make them would have been very expensive, and Castel would not have received financial support for such endeavours from the Jesuits: if they were

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[120] Gustave Dupont-Ferrier, *Du Collège de Clermont au lycée Louis-le-Grand (1563-1920), La vie quotidienne d'un collège Parisien pendant plus de trois cent cinquante ans,* 3 vols (Paris: E. de Boccart, 1921), II, p. 93-4.
[121] Ibid., p. 97.
[122] '[Castel] vivait au milieu de ses livres, de ses écrits, et de son atelier pour le clavecin oculaire'. (Lacombe de Prezel, Vol. I, p. 236.)

carefully rationing their candles, they would not have indulged in Castel's magic lantern. Indeed, Castel's letter to the countess suggests that candles were seen as a luxury for a Jesuit: Castel refers to a gift of coffee, candles, sugar, and chocolate, received as thanks for lobbying for an infrastructure project on behalf of a Mr. Barillon.[123]

Castel's project had to be funded by other means. Fortunately, the ocular harpsichord was not only a way to spend money, but also a means of making it. Public interest created a demand for articles on its on-going development, which would have provided Castel with income as a journalist, and a reputation he could use to attract patrons. In 1720, newly arrived in Paris, Castel would not have had to look far for this source of income: Louis-le-Grand is on the rue Saint Jacques, which was then Paris' book quarter, so the college was surrounded by bookshops, publishers, and printers. Castel immediately began publishing articles in journals, and preparing his first book for publication.

In many ways, Castel was typical of eighteenth-century journalists: born into a bourgeois family (the son of a doctor) in a provincial capital and port-town (Montpellier), he was educated by the Jesuits, and then selected to become one.[124] However, he was unusual in that he remained a Jesuit throughout his life; many eighteenth-century journalists were educated at seminaries and joined religious orders, but they tended to change their minds, and most went into journalism because they needed money after they had left. Of this phenomenon, Censer writes:

> It is difficult to believe that some aspect of seminary training encouraged people to turn eventually to journalism. Rather, my suspicion is that schoolteachers, who were themselves most often members of the clergy, identified their brightest pupils for the first order. Consequently, many who took up this calling

[123] It is worth noting, however, that Castel describes this present with bitterness, in order to illustrate Mr. Barillon's cheapness and ingratitude.
[124] See Jack Richard Censer, *The French Press in the Age of Enlightenment* (London: Routledge, 1994), especially chapter 4, 'Eighteenth-Century Journalism and Its Personnel', pp. 121-137.

possessed substantial intellectual capacities and inquisitiveness, traits that prepared one splendidly for any sort of career in lettered society.[125]

Such was the case with Fréron, Desfontaines, and La Porte; Fréron's one-time collaborator, and Castel's posthumous compiler.

Journalism was not a defined profession in this period, and was seen as a somewhat disreputable way of making money,[126] but there was also a hierarchy of publications, and of the writers who published in them. The overwhelming majority of Castel's articles appeared in only two journals: the *Mercure de France* and the *Journal de Trévoux*. These were two of the eighteenth-century's most influential, widely-distributed, and long-standing periodicals. They were also some of the most expensive, so Castel was one of an elite group of journalists addressing a readership of wealthy elites.

Most of Castel's articles throughout his long career were published in the *Journal de Trévoux*, but his early articles on the ocular harpsichord were all published in the *Mercure de France*. This means that Castel wanted to appeal to a specific audience*;* as Sgard puts it, 'aux jeunes gens et aux dames, mais [aussi] à l'ensemble du public cultivé'.[127] His early articles on the ocular harpsichord were therefore not intended to present a coherent scientific system to specialists—if they were, the *Journal de Trévoux* would have been a better place to publish. Instead, they were intended to drum up publicity for a charming new idea, and to help him make a name for himself.

This strategy was more successful than Castel could have predicted. His public's hum of interest in the ocular harpsichord motivated Castel to use it to draw attention to his other works and projects, making it the symbol of his style and persona. In personal notes outlining his plans for publication, Castel wrote,

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[125] Ibid., p. 128.
[126] Jack Richard Censer and Jeremy D Popkin, *Press and Politics in Pre-Revolutionary France* (Berkeley: University of California Press, 1987), p. 20.
[127] See, 'Mercure de France 1 (1724-1778)', in *Dictionnaire des journaux: 1600-1789,* ed. Jean Sgard, 2 vols (Oxford: Voltaire Foundation, 1991) <http://dictionnaire-journaux.gazettes18e.fr>.

'C'est par mon clavecin que mes feuilles vont donc commencer. Comme c'est mon ouvrage favori, et l'ouvrage favori du public, il me servira de texte et d'introducteur dans tous mes autres ouvrages.'[128]

Focussing on producing the ocular harpsichord as a material instrument was never going to serve Castel's ultimate goal of securing a readership, and establishing his persona as a philosopher-geometer. After all, once the instrument was definitively finished, there would be no demand for new texts about the concept, as the object itself would serve as proof of his system's failure or success.

If its primary value to Castel was as a source of publicity, a pretext for publishing new articles, and a way of positioning his writing as a cross between *belles lettres* and *philosophie*, then the ocular harpsichord should be understood as a successful and fully-realised rhetorical device, rather than an unrealised physical one. Of course, as it also had a material history, these twin existences are necessarily intertwined and mutually dependent. Castel couldn't keep writing about the ocular harpsichord if he didn't develop his plans to build it, and he couldn't secure the means to build it if he didn't keep writing about it.

[128] KBR MS 15747, pp. 15-18.

III

Castel's Quarrel with Rameau

Although Castel developed his own optical theory to support the ocular harpsichord, colour music derived from music, and not optics.[1] He remarked that he had often found musicians to be more amenable to the notion than painters, which was not surprising, as 'ce n'est pas tant ici une peinture des sons qu'une musique des couleurs. Ce n'est pas une peinture, c'est tout court une musique.'[2] Castel's ideas on music were adapted from the musicological theories of his close friend and collaborator, the composer Jean-Philippe Rameau. Rameau shot to fame late in his career, when he produced his first opera, *Hippolyte et Aricie* (1733). Prior to this, Rameau had spent years attempting to attract interest in his theoretical works, and apart from the support of Castel and the Jesuits, he had not had much success. Once he started using his theory of the *basse fondamentale* to compose opera, he created a new style and sound that divided audiences.

In the mid-1730s, Rameau's newfound fame attracted the attention of prominent members of the *Académie des sciences*, who were in the midst of the embattled process of discussing, testing, and adapting to Newtonian experimental philosophy.[3] Rameau took the opportunity to forge alliances and partnerships with thinkers who could provide him with cutting-edge physics to

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[1] For this reason, this thesis emphasizes Castel's engagement with musical theories and reliance on Rameau, not his indebtedness to previous debates on colour and discussions of nuance. On this subject, see chapter 1 of, Edward Nye, *Literary and Linguistic Theories in Eighteenth-century France: from nuances to impertinence* (Oxford: Clarendon, 2000). On Castel's engagement with his contemporaries' discussions of colour see Martin Kemp, *The Science of Art: Optical themes in Western Art from Brunelleschi to Seurat* (New Haven: Yale University Press, 1990), pp. 287-90.

[2] NE.II, p. 1640.

[3] I refer to the general, historical connection between Newton's physics and experimental philosophy, rather than Newton's own use of the phrase. See John Bennett Shank, *The Newton Wars and the Beginning of the French Enlightenment* (Chicago: University of Chicago Press, 2008), especially chapters 3 and 4. See also, Betty Jo Teeter Dobbs, and Margaret C Jacob, *Newton and the Culture of Newtonianism* (New Jersey: Humanities Press, 1995), p. 107. On Newton's own use, see: Alan Shapiro, 'Newton's "Experimental Philosophy"', *Early Science and Medicine* 9, no. 3 (2004), 185-217.

enhance his musicology. At the same time, Castel was using Rameau's fundamental bass to differentiate his own optical experiments and theories from Newton's. Castel needed to ensure that his ideas would not be undermined by the experimental vocabulary that Rameau was beginning to adopt. So, when he laid out his colour-music theory in a six-part series, the *Nouvelles expériences*, Castel declared that Rameau's fundamental bass was not an original discovery, as he'd initially claimed. Affronted, Rameau published a response, and the two became embroiled in a bitter public quarrel.

The fate and fame of the ocular harpsichord in this period is woven into the personal reputations at stake in this quarrel, and the positions each man wished to take, or to be seen to take, on contemporary debates on empirical science and Newton. As these debates accelerated, Castel was building his persona as a *philosophe-géomètre* combining specialist knowledge and literary skill to enlighten and entertain the public, promoting the ocular harpsichord as both its crowning glory and its symbol. For his part, Rameau sought recognition as philosopher-musician creating visceral and powerful new music drawn from a single principle that united both theory and practice: the fundamental bass. Castel and Rameau had developed their signature theories together, so when they began to evolve them in different directions, conflict ensued.

1. Castel and Rameau's Early Friendship

During their quarrel, Castel and Rameau both attempted to paint each other as an ungrateful beneficiary of friendly generosity and intellectual condescension. A mutual friend introduced them; later, they both claimed that this was at the other one's request. Rameau entered into the quarrel by writing,

> Le *Traité de l'harmonie* ne parut pas plutôt, mon R. Père, que désirant d'en connaitre l'Auteur, vous m'en fîtes avertir par un ami commun, avec qui je partis

sur le champ, pour avoir l'honneur de vous voir, charmé d'une occasion si favorable que me procurait, à mon tour, celui de vous connaître.[4]

Castel responded tersely, 'Il n'est pas question d'accueil que je fis à cet habile musicien, lorsque M.B. pour lui faire plaisir le mena chez moi la première fois, il y a environ quinze ans.'[5] Despite these equivocations, they both had a lot to gain from their acquaintance, and their intellectual partnership probably began before Rameau's *Traité de l'harmonie* appeared in print.

M.B. was probably a M. Borin, who published two anonymous works in the early 1720s: one on fencing, and one on music and dance, which was reprinted in 1746. Castel wrote favourable reviews for all of them, naming Borin as the author in his review of the second edition, published in 1746.[6] In his 1722 review of Borin's fencing book, Castel intimated that its author was someone who was shy, but whose upcoming works on dance and music would make him better known. Borin's *Musique théorique* appeared a year later, the same year as Rameau's *Traité de l'harmonie*, and makes numerous references to Rameau's work; Castel's review presented it as an introduction to Rameau's ideas. On Borin's work, Jacobi writes:

Considering that it was published at the latest in the autumn of 1722 – being mentioned by Castel's review of the *Traité* in November of that year – it is astonishing that in the short time since the publication of the *Traité*, the anonymous author could have read Rameau's massive work and recorded his views thereon in his own manuscript. This strongly suggests that he was in close

[4] 'Lettre de M. Rameau au R.P. Castel', *Journal de Trévoux* (July, 1736), 1691-1709 (pp. 1691-2).
[5] 'Remarques du P. Castel sur la lettre de M. Rameau', *Journal de Trévoux* (September, 1736), 1999-2026 (p. 1999). Jam speculates that Castel invited Rameau to move to Paris, and even arranged for his work and accommodation, though he gives no evidence and Castel and Rameau's own exchanges make no mention of it. Jean-Louis Jam, 'Castel et Rameau', in *Autour du père Castel et du clavecin oculaire,* eds Roland Mortier and Hervé Hasquin, *Études sur le XVIIIe siècle,* XXIII (Brussels: Éditions de l'Université de Bruxelles, 1995), pp. 59-67.
[6] Review of *L'Art de tirer des armes. Journal de Trévoux* (February, 1722), 275-297; review of *La Musique théorique, et pratique, Journal de Trévoux* (January, 1723), 43-51; review of *La Musique théorique et pratique, Journal de Trévoux* (March, 1747), 500-12.

touch with Rameau, who probably showed him either the manuscript or a proof of the *Traité* before publication.[7]

Christensen notes that Castel also probably read it in advance of publication, as his review was both comprehensive and almost immediate. He also speculates that Castel inspired Rameau to make last-minute revisions, as shortly before publication, Rameau added a seventeen-page supplement with a more rigorous mechanistic dimension than the *Traité* had before.[8]

Castel's review was glowing, which was good, as it was the only one the *Traité de l'harmonie* received.[9] Castel wrote that Rameau had made music a mathematical science, observing that as 'Lully n'était point mathématicien […] toute sa science est au bout de ses doigts; il peut enchanter mes sens, mais il ne peut éclairer mon esprit.'[10] Although previous thinkers had attempted to unite music and science, 'à peine en trouve-t-on deux qui ayant écrit un peu foncièrement et d'une manière solide sur l'art et sur la science de la musique; je parle de Zarlin et de Kircher' who nevertheless, 'n'ont pu prendre entre leurs mains cette forme de système qui réunit sous un seul principe simple et fécond la variété des phénomènes que la nature présente d'abord à nos sens dans l'objet de chaque Art et de chaque science.'[11]

Castel and Rameau collaborated and supported each other throughout the 1720s. Rameau had received a limited education at a Jesuit school, before he working as an organist and harpsichord teacher, so Castel was in an excellent position to bolster his knowledge of science and mathematics; in exchange, Rameau could help Castel understand music, a subject he found personally

[7] Rameau, *The Complete Theoretical Writings,* ed. Erwin R Jacobi, 6 vols (American Institute of Musicology, 1967), I, p. xxiv.
[8] Thomas Street Christensen, *Rameau and Musical Thought in the Enlightenment.* (Cambridge: Cambridge University Press, 2004), pp. 109-111.
[9] Review of Rameau, *Traité de l'harmonie*, *Journal de Trévoux* (October and November, 1722): 1713-1743; 1876-1910.
[10] Castel, review of *Traité,* pp. 1714-5.
[11] Ibid., p. 1716.

difficult.[12] Castel made favourable comments about Rameau in his articles, supposedly to help establish Rameau's reputation. When Rameau's *Nouveau système de musique théorique,* was published, two years passed before Castel reviewed it – Jacobi conjectures that Rameau hoped that someone else would write about it first, but no one did.[13] Sure enough, the end of Castel's review urges other journalists to read it for themselves:

Il faut espérer que de si beaux exemples réveilleront l'émulation de quelques savants, et que nos Mémoires ne seront pas les seuls, où l'on applaudira à des vues si utiles pour la perfection d'un si bel art, que des principes si simples et si féconds érigent désormais en science.[14]

Castel introduced Rameau to his favourite author, Kircher, the seventeenth-century Jesuit whom Castel credited with the 'seed of discovery' that led to the ocular harpsichord. Later on, when they were quarrelling, Castel claimed to have pointed out pages of Kircher's *Musurgia Universalis* as sources of inspiration for Rameau's compositions:

Et le chant des oiseaux noté dans Kircher, celui de la Poule qui rappelle les poussins, celui du rossignol qui module par toutes les inflexions dont son gosier est susceptible, M. Rameau ne s'en souvient-il plus, ni de tous les efforts que je faisais de concert avec ce vaste auteur pour ranimer sa verve, et lui donner des desseins des pièces qui imitent le vrai de la nature?[15]

[12] 'J'ai essayé de bien des sciences, et de celles qui passent pour les plus difficiles, géométrie, algèbre, analyse, physique, etc. Mais je puis dire qu'il n'y a pas de proportion entre le temps et le travail qu'il faut pour apprendre ces sciences profondes, je dis pour les apprendre même toutes assez à fond, et le long temps et le travail pénible et assidu qu'il faut pour se rendre médiocrement possesseur d'une chose aussi médiocre que l'est la routine de la musique et du simple chant.' Louis-Bertrand Castel, 'Méthode pour apprendre la musique en peu de temps', *Mercure de France* (May, 1732), 841-856 (p. 843). This article also bears Rameau's fingerprints; Castel mentions him twice.
[13] Rameau ed. Jacobi, II, p. xvii.
[14] Review of Rameau, *Nouveau système de musique théorique, Journal de Trévoux* (March, 1728), 472-481 (p. 481).
[15] 'Remarques du P. Castel sur la lettre de M. Rameau', pp. 2006-7.

Apparently unaware of this claim, Rameau's biographer, Cuthbert Girdlestone, also suggests that 'La Poule', which appeared in Rameau's second book of harpsichord pieces in 1727, was inspired by Kircher's *Musurgia*.[16]

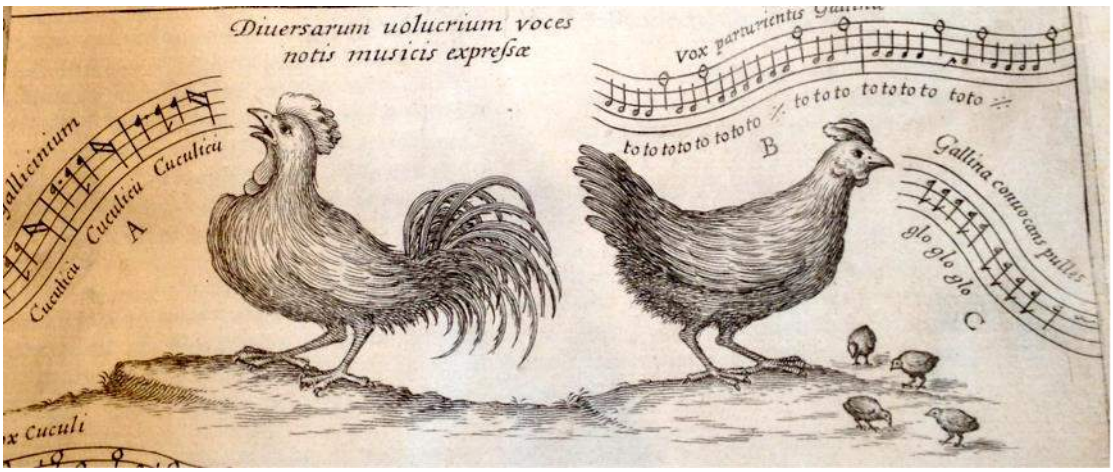

Illustration 6. Kircher's Hen

They also bonded over the ocular harpsichord, which they both saw as a direct extension of Rameau's theories. Castel claimed that Rameau was the first person who had heard about the instrument, and encouraged him to make it public.[17] Shortly after Castel had proposed it, Rameau also published comments on the idea:

> Je n'ai pas poussé plus loin mes découvertes dans la théorie de la musique, parce-qu'il ne m'en a pas fallu davantage pour m'instruire de ce qui regarde la pratique de cet Art. On peut voir cependant comment le R.P. Castel a saisi le principe proposé, et jusqu'où il prétend le porter, lorsqu'il s'en sert pour démontrer son clavecin oculaire, dans le Mercure du mois de Février 1726.[18]

[16] Cuthbert Girdlestone, *Jean Philippe Rameau.* (New York: Dover, 1969), p. 28.
[17] NE.II, p. 1640.
[18] Rameau, *Nouveau système de musique théorique* (Paris: Jean-Baptiste-Christophe Ballard, 1726), p. v.

Together, Rameau and Castel developed a shared scientific and musical vocabulary throughout the 1720s. In order to consider how this worked, we'll now explore one of Rameau's more mystifying concepts, and how Castel used it to develop colour music.

2. *Sous-entendu*, and Sensory Subtext

Rameau's music sprang from his concept of the fundamental bass, introduced in the *Traité de l'harmonie*. When Castel reviewed this work, he framed *la basse fondamentale* as a great discovery, and later used it to justify his own concept of a fundamental blue, 'la couleur tonique de la nature, et le fondement primitif de toutes les couleurs.'[19] Rameau's fundamental bass relied upon corollary theories: in his earlier works, he depended on the idea of *sous-entendre;* later on, this was replaced by the *corps sonore*.

Despite Rameau's lifelong insistence, and Castel's earlier agreement, the fundamental bass was not a discovery, but rather a synthesis of research on the physics of vibrating strings, the acoustics of harmonies, and conventional notational systems. Christensen writes,

> Rameau argued that all music is fundamentally harmonic in structure. Every harmony (or chord) is generated from a single fundamental (or what we call today a chord 'root') in some consistent way. In the *Traité*, this way was monochord (string) divisions, while in later writings it was the acoustical phenomenon of harmonic upper partials generated by many vibrating systems (the *corps sonore*). […] From this mechanistic basis, all other musical parameters – melody, counterpoint, mode, and even rhythm, could be seen as derivative. Thus both the vocabulary and grammar of tonal music appeared to stem from the same numerical acoustical source.[20]

Much of seventeenth-century acoustics had focussed on the vibrations of a single string (a monochord) and its division into geometrically precise (aliquot)

[19] NE.III, p. 1825.
[20] Christensen, p. 5.

subsections. In musical practice, thoroughbass (also known as figured bass, and closely related to 'basso continuo', a common form of accompaniment) was a notational system in which a single note indicated what chord the musician was to play. This note was the lowest in the chord, so musicians inferred the higher notes by memorizing which chords sprang from each bass. Rameau's work combined these traditions to form a theory in which every chord was physically derived from a fundamental bass, unifying musical theory and practice within a single principle.

In order to claim that his fundamental bass could generate all chords, Rameau had to argue that some chords sprang from bass notes that were not acoustically sounded in those chords. To account for this irregularity, his notion of *sous-entendre* held that all notes of a harmonic chord were understood or 'imagined' to be present, even if they were not heard. He wrote:

> Par le mot *sous-entendre* on doit être prévenu que les sons auxquels on l'applique, peuvent être entendus dans les accords ou il ne se trouvent point ; et même, à l'égard du son-fondamental, il faut s'imaginer qu'il devrait être pour lors *entendu au-dessous* des autres sons lorsqu'on dit qu'il est *sous-entendu*.[21]

Yet Rameau was not consistent, and sometimes claimed that he could actually hear these notes, having trained himself through practice. As a result, musicologists and intellectual historians continue to debate exactly what Rameau meant by *sous-entendre*, whether Rameau believed those notes to be 'imaginary', and whether it ought to be understood as an early theory of psychoacoustics.[22]

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[21] *Traité de l'harmonie,* p. xxi.

[22] For examples, see: Jairo Moreno, 'The Complicity of the Imagination: Representation, Subject, and System in Rameau', in *Musical Representations, Subjects, and Objects: The Construction of Musical Thought in Zarlino, Descartes, Rameau, and Weber* (Bloomington: Indiana University Press, 2004), pp. 85-127; David E. Cohen, 'The "Gift of Nature": Musical "Instinct" and Musical Cognition in Rameau', in *Music Theory and Natural Order from the Renaissance to the Early Twentieth Century*, eds Suzannah Clark and Alexander Rehding (Cambridge: Cambridge University Press, 2001), pp. 68-92.

Castel made his own interpretation of *sous-entendre* quite clear, and he made extensive use of it when developing his colour-music theory; despite the bitterness of their quarrel, Rameau did not speak out against Castel's appropriation of the *sous-entendre.* When their phrasing is compared, we have reason to believe that they were largely in agreement on this subject. Although my analysis of this concept is necessarily incomplete, I hope that it might point musicologists in a useful direction.

When Castel reviewed Rameau's *Traité*, he made a distinction between the judgements made by unchanging reason, and those made by the capricious ear:

> M. Rameau sut entrevoir que l'expérience n'est point ici un juge tout-à-fait infaillible, qu'à la vérité *l'on ne peut juger de la Musique que par le rapport de l'ouïe, et que la raison n'y a d'autorité qu'autant qu'elle s'accorde avec l'oreille* ; mais que la raison a aussi ses droits, que l'usage ne rassure point contre les revers de la mode et du caprice, puis qu'il détruit souvent en un temps ce qu'il établit en l'autre ; que la raison étant toujours la même, et toujours d'accord avec la vérité, c'est à elle de justifier l'usage.[23]

A couple of years later, when proposing the ocular harpsichord, Castel claimed that sensation could be infinitely refined and perfected, because aesthetic pleasure was an intellectual response to proportion, rather than a physical response to stimulus. Castel also believed that the ear hears different notes by subdividing the surface of the eardrum into many equal parts, each of which is susceptible to a particular vibration.[24] So when a given note sounds, the only part of the eardrum that vibrates is the subdivision that is tuned to that note; this is why, unlike colours, notes do not alter when they are combined. The beginnings of this theory are present in Castel's review of the *Traité*, at a point where he imagines the eardrum functioning in a manner similar to the divisions of a monochord:

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[23] Castel, review of *Traité*, p. 1718.
[24] For more discussion of these ideas, see Chapter V.4.

On sait que lorsqu'une corde ou que l'oreille tremble, elle s'allonge, et que par conséquent ses parties souffrent une division, non pas totale, mais partielle, et que l'âme est là comme aux écoutes pour tout sentir. Cette division doit sans doute se faire de la manière la plus naturelle; c'est la nature seule qui l'a fait; celle du nombre sénaire est la plus simple et la plus facile; elle se fait donc dès qu'un son frappe l'oreille; chaque division nous fait donc entendre le son qui lui est propre.

In the explanation of hearing that Castel offers here, all notes are already potentially present in the architecture of the eardrum, as sections that become defined when the eardrum vibrates, splitting into aliquot divisions. This means that when a note causes a section of the eardrum to vibrate, other corollary sections vibrate as well. Musicians, who perfect their sense of hearing and harmony through practice, should be especially susceptible to this phenomenon:

[Rameau] a remarqué qu'en fait de musique comme en fait de langage, on s'exprime quelquefois à demi mot, et que l'oreille a la propriété de *sous-entendre* souvent ce qu'elle n'entend pas: il fait voir les musiciens ont toujours à la bouche ces paroles, *un tel son, un tel accord est sous-entendu: de sorte*, dit-il*, que l'expression prévient souvent celui qui en connait le moins la force*; d'où il est aisé de conclure que lorsque nous entendons la quarte, nous sous-entendons la quinte avec laquelle la quarte forme l'octave complète'.[25]

Castel's simile between music and language is apt: even if a note is unuttered, due to the syntax of harmonic language, it is nonetheless communicated to the listener, who understands both sounded and unsounded notes together. The *sous-entendre* is thus a form of subtext, a species of harmonic ellipsis. As further evidence of this interpretation, Castel invokes Pardies' idea that a plucked string can vibrate at the frequency of two tones simultaneously, in unison at the interval of an octave:

Or ce qu'une corde peut faire, l'oreille peut le faire aussi ; lorsqu'elle est donc frappée de la quarte *sol, ut,* elle doit trembler aussi pour la quinte *ut, sol*, & l'âme

[25] Castel, review of *Traité*, pp. 1732-3.

toujours attentive à l'état présent du corps doit *sous-entendre*, c'est-à-dire, *entendre tout bas* cette quinte.[26]

This passage would seem to suggest that these extra notes are not in the ear itself, but in the mind, which perceives them through its close 'attentiveness' to the body. If the principle of *sous-entendre* is an early form of psychoacoustics, then these notes that are heard 'in whispers' would indeed be imaginary. However, it is clear from the next sentence of Castel's review that he, at least, does not think this is so. Rather than develop his explanation of *sous-entendus* through their grammatical or intellectual role in harmony, he brings up the subject of harmonic overtones:

On peut pousser encore plus loin cette idée, […] c'est un fait attesté par M. Saveur que lorsque la nuit on touche une grande corde, on entend la douzième *ut, ut, sol*, et même souvent la dix-septième *ut, ut, sol, ut, mi,* et que dans les trompettes on en entend encore davantage ; de sorte que dans la physique, la nature nous donne le même système que M. Rameau a découvert dans les nombres, et voilà ce concours précis de la raison et de l'oreille, à quoi cet auteur vise dans tout son ouvrage.[27]

This example argues for the empirical reality of *sous-entendus* within the ear, because like harmonic overtones, they can be better heard 'at night', when it is quieter. Of this passage, Christensen writes:

The phenomenon Castel makes reference to is of course that of the harmonic overture (or upper partial) series produced by many uniformly vibrating bodies. Rameau must have been astounded by this revelation. Had he known of this fact when writing the *Traité*, there is every reason to suspect he would have cited it to support his principle of harmony, as he indeed did after Castel's disclosure.[28]

Rameau needed precisely this kind of justification in order to defend the fundamental bass. In its absence, he'd disguised the extent to which his ideas on

[26] Ibid., p. 1733.
[27] Ibid., p. 1734.
[28] Christensen, p. 133.

unison and the octave differed from Zarlino's, by misrepresenting the earlier thinker's ideas, and misquoting him in the *Traité*.[29] Christensen writes that in addition to making Rameau aware of Saveur's research on harmonic overtones, Castel also introduced him to geometric progressions. Bouissou concurs, adding that this influence brought, 'une dimension physico-mathématique inédite à son discours théorique.'[30] So, in the preface of his next book, the *Nouveau système du musique théorique*, Rameau began with a discussion of geometrical progressions, and then moved on to harmonic overtones, introducing the subject by invoking a harmonic 'seed' that pre-exists within us:

> Il y a effectivement en nous un germe d'harmonie, dont apparemment on ne s'en point encore aperçu: Il est cependant facile de s'en apercevoir dans une corde, dans un tuyau, &c. dont la résonance fait entendre trois sons diffèrent à la fois;* [*Cette expérience est citée par différents Auteurs.] puisqu'en supposant ce même effet dans tous les corps sonores, on doit par conséquent le supposer dans un son de notre voix, quand même il n'y serait pas sensible; mais pour en être plus assuré, j'en ai fait moi-même l'expérience, et je l'ai proposé à plusieurs musiciens, qui, comme moi, ont distingué ces trois sons différents dans un son de leur voix; de sorte qu'après cela, j'e n'ai pas douté un moment que ce ne fut-là le véritable principe d'une *basse-fondamentale*, dont je ne vois encore la découverte qu'à la seule expérience.

For Castel, the notion of *sous-entendre* allowed him to support and advance the theory of sensation that he needed to defend his colour music. Castel located pleasure in 'esprit', and not in the body, arguing that the mind is not only affected by the senses, but affects them in its turn. In Castel's reasoning, the *sous-entendre* proves that all harmony is determined by a fixed, internal principle: 'Nous entendons toujours, ou si l'on veut, nous *sous-entendons* l'harmonie parfaite, et c'est à cette harmonie naturelle que nous comparons toutes celles que nous entendons'.[31] In which case, according to Castel, there is no reason to believe that

[29] See, Alan Gosman, 'Rameau and Zarlino: Polemics in the *Traité de l'harmonie', Music Theory Spectrum* 22, no. 1 (2000), 44-59.
[30] Sylvie Bouissou, *Jean-Philippe Rameau, Musicien des Lumières* (Fayard: Paris, 2014), p. 244.
[31] Castel, review of *Traité,* p. 1735.

there's a fundamental difference between visual harmony and musical harmony. It is thus possible to experience new sensations by mastering one's intellect and refining one's aesthetic sense:

> Si à l'occasion d'un son *ut*, on en croit entendre trois, si on en imagine trois, il est donc naturel d'imaginer ces deux *sol, mi* à l'occasion de ce troisième; ils ont donc avec lui un rapport naturel qui les fait *sous-entendre,* c'est-à-dire, qui excite dans l'oreille ou dans l'âme leur idée, leur sentiment, leur sensation. On les entend donc si on en a l'idée, le sentiment, la sensation présente et actuelle.[32]

There is a remarkable coherence between this passage, and the passage from Rameau quoted just above: the differences in vocabulary and phrasing are subtle (apercevoir/exciter; entendre/croire entendre, distinguer/imaginer), and can perhaps be put down to differences in the focus of each writer. It wasn't necessary for Rameau to discuss epistemological questions in depth in order to present his musicological principles; it was, however, necessary for Castel to do so, if he was to defend the ocular harpsichord against empiricist claims that the harmonies of colour and sound could not be collapsed into each other.

The most significant parallel between Rameau and Castel in these two passages concerns the relationship between sensation and expertise. It is important for Rameau to specify that he, like other musicians, can distinguish three sounds in the human voice, because it is only professional musicians who can claim to have cultivated the ability to perceive those extra notes through the 'rapport naturel qui les fait *sous-entendre'*. Although everyone has the potential to hear them, they must perfect their senses in order to do so.

Similarly, although Castel uses the word 'imaginary', the sounds he is describing as *sous-entendu* are not imagined, but actually heard in the ear. They are supplementary sensations created by the mind, which, amazingly, produces sounds that harmonise with the external note. So *sous-entendre* proves that sound, or any sensation for that matter, is always already intellectual, because

[32] NE.III, p. 1815.

the idea of a sensation and its correct harmonic placement precedes and determines its bodily experience. Accordingly, in Castel's epistemology, those who rely purely on physical sensation confine themselves to a clouded understanding and a necessarily confused mixture of feelings and ideas:

> Le sentiment est une intelligence enveloppé ou une confusion d'idées: la sensation est une confusion de sentiments. Le sentiment est une idée générale et vague, qui résulte de plusieurs idées, que l'esprit ne peut démêler facilement; mais qui ne laissent pas de l'assurer de leur existence, ou de celle de leur objet.[33]

These points were of vital importance to Castel's argument for an ocular harpsichord. Listeners who found colour music to be confusing and unpleasant, needed only to improve and perfect their senses intellectually until they could experience their sensations harmonising with one another.

3. Rameau's New Friends at the *Académie des sciences*

As we've seen, Rameau and Castel's collaboration consisted of filling in gaps in each other's knowledge, and creating a common vocabulary and mutually supportive systems. This latter element was a common and accepted form of scientific networking in the period, and a way of asserting the credibility of new ideas. The ability to cite the friendship or support of a thinker in a different field was a highly valued tool in the attempt to substantiate, legitimise, and publicise one's work.[34]

Together, Castel and Rameau shaped their early careers in this tradition, but by the early 1730s it was taking them in different directions – Castel and the Jesuits had advised Rameau not to compose for opera, and he was richly

[33] NE.IV, pp. 2342-3.
[34] For a very useful discussion of scientific networks in this period, and the need for a more nuanced understanding of them, see the preface of: Ellen McNiven Hine, *Jean-Jacques Dortous de Mairan and the Geneva connection: scientific networking in the eighteenth century, SVEC*, no. 340 (1996).

rewarded for ignoring them.[35] In addition, the intellectual climate of the 1730s was one of flux and change, and Rameau liked to be seen on the cutting edge of new ideas. Throughout his career, Rameau was to continue repackaging his theories, adapting to new conceptual paradigms as they became fashionable. At first with Castel, then with the *Académie des sciences* and Mairan, and later on with D'Alembert, Rameau cultivated friendships with thinkers who could feed him innovative scientific language and ideas.

In contrast, Castel was less interested in aligning himself with another thinker's complementary ideas, and more in promoting his own universal system. His combination of undisguised ambition, idiosyncratic ideas, and polemical approaches to competing thinkers had positioned him as an outsider. He had made rather a lot of enemies in the *Académie des sciences* by 1730.

Castel's series of quarrels with academicians need to be picked apart in greater detail than they can be given here, and by a scholar significantly better versed in mathematics, but the big picture is one of rapidly mounting hostility. Castel and Fontenelle both published treatises on mathematics in the late 1720s, which were each meant to be accessible to the general reading public. Fontenelle hoped for a favourable review and large excerpts in the *Journal de Trévoux*, Castel hoped for a favourable reception and general acknowledgement from the *Académie*.[36] However, Castel's work advocated a very different style of mathematics from the style preferred by the academicians: a simpler, heuristic

[35] Castel later wrote that Rameau, 'sentait que sa réputation était fait, et qu'il n'y manquait que l'éclat, le couronnement, et en quelque sorte le sceau du public. Nous ne le suivîmes pas dans le nouveau Théâtre, où contre notre avis, il jugea à propos de se donner en spectacle. Cependant, quoique ce genre de Musique théâtrale ne soit pas de notre compétence, comme nous n'avons pu ignorer le succès de M. Rameau, ni être tout-à-fait indifférents du côté scientifique que ce succès nous présente…' (Review of *Génération harmonique,* p. 2147.) The *Trévoux* considered 'spectacles' to be outside its purview, and at times, immoral. See Anne-Sophie Gallo, 'Théâtre et opéra dans le *Journal de Trévoux* (1701-1762): Scène héritée, scène rêvée', *Dix-huitième siècle*, no. 42 (2010): 513-531.

[36] See their correspondence in *Œuvres complètes de Fontenelle,* ed. Alain Niderst (Paris: Fayard, 1989), and a brief summary of the quarrel in: Alain Niderst, *Fontenelle* (Paris: Plon, 1991), pp. 313-316.

style favoured by the Jesuits, which was similar to the style of mathematics being practised in Britain after Newton.[37] In the course of this advocacy, Castel had been taking sides against the *Académie* in minor quarrels in the *Journal de Trévoux*, and leveraged his reputation as an anglophile to become a member of the Royal Society, the *Académie*'s British competitor.[38] After Castel's *Mathématique universelle* appeared, it was attacked by academicians in the *Mercure de France,* and the *Journal des savants*. Castel retaliated with a review of their 1725 *Mémoires*,[39] of which Shank writes, 'Read alongside the escalating mathematical provocations of his earlier writings and the wider polarities triggered by the priority dispute, this review constituted a direct challenge to the authority of academic mathematicians in France.'[40] The academicians furiously demanded Castel's removal from the *Journal de Trévoux*.[41] Castel and Fontenelle fell out, and Saurin ridiculed Castel in a blistering fifty-page pamphlet, published anonymously in 1730,[42] which was further circulated by a review and excerpts in the *Journal des savants.*[43] The *Journal de Trévoux* issued an apology for this review in May, but did not publicly acknowledge Castel as the author, or remove him from their editorial staff.[44] Castel's interactions with members of the *Académie des sciences* continued in this vein.

Meanwhile, Rameau made strides towards academic approval, following his sudden metamorphosis into a composer of opera with *Hippolyte et Aricie.* Rameau signalled his intent to overturn operatic conventions through the use of tragic narrative, which had typically been reserved for theatre, and by basing his musical style in his own theory, which valued complex harmonies over

[37] Greenberg, pp. 258-65.
[38] See Schier, pp. 9-22.
[39] *Journal de Trévoux* (January, 1730): 103-120.
[40] Shank, pp. 205-6.
[41] Shank, p. 207; he cites the *Procès verbaux de l'Académie royale des sciences* of 1 April 1730, in the Archives de l'Académie des sciences.
[42] *Lettre critique de M*** a M*** sur le Traité de Mathématique du P.C.* (Paris: Gabriel Martin, 1730)
[43] *Journal des savants* (October, 1730): 603-611.
[44] 'Apologie'. *Journal de Trévoux* (May, 1730): 893-4.

traditional melodies and eschewed the traditional recitative. The fundamental bass produced an unusually large number of notes, creating a dense and complex sound that struck some listeners as modern and provocative, and others as difficult and cacophonous. This revolutionary opera created a quarrel that divided audiences into camps: 'Ramistes', and 'Lullistes', who preferred the older, sparer style exemplified by Lulli.'[45] Rameau's name now circulated in salons, and the theoretical ideas that hitherto had received almost no attention could now be experienced first-hand in a divisive new performance.

Rameau began to cultivate a friendship with one of Castel's erstwhile targets at the *Académie*, Dortous de Mairan, who encouraged Rameau to move on from the *sous-entendre*, and towards his own concept of the *corps sonore.*[46] Mairan had proposed a corpuscular theory of acoustics in 1720, which, while largely consistent with Cartesian physics, was inspired by Newtonian optics and specifically by Newton's observations on the prism and the musical scale.[47] The *corps sonore* located harmonic overtones more specifically in sounding bodies, rather than relying on the experience of hearing. Of Rameau's *corps sonore*, Cynthia Verba writes,

> According to this principle, a resonating body will generate not only its fundamental or lowest sound, but also a series of harmonically related overtones through the successive divisions of the resonating body, producing the octave, the perfect twelfth, and the major seventeenth – or, when reduced within the octave, the intervals of the perfect fifth and major third. This marked a change to a more physical or experimental basis for his theory of harmony, since the overtones were actual sounds, generated simultaneously with the principal sound.[48]

Thus Rameau reframed his fundamental bass to fit the fashionable science of the mid-1730s, positioning himself as a proponent of experimental philosophy, and

[45] Girdlestone, p. 145.
[46] Christensen, p. 140. For Castel's history with Mairan, see Schier, pp. 166-70.
[47] See Hine, pp. 88-93.
[48] Cynthia Verba, *Music and the French Enlightenment* (Oxford: Clarendon Press, 1993), p. 58.

including celestial imagery in *Castor et Pollux* (1736) to allude to the fashionable Newtonian debates.[49] Christensen notes that this development was mostly for show:

First of all, not all musical pitches possess the uniform overtone content Rameau claimed. […] Secondly, Rameau made a number of faulty observations, particularly concerning the sympathetic resonance of lower-tuned strings. […] Rameau's gambit to open his *Génération harmonique* with thirty pages of propositions and experiments was a calculated emulation of the then-in-vogue 'experimental' science. His strategy would have been unmistakable recognized by all *Académie* members and educated lay persons as Newtonian in character[…].'[50]

Rameau acknowledged that he had adopted these ideas at the encouragement of Mairan, and another academician, Gamaches:

Il y a dix ou douze ans que M. de Mairan, dont le nom seul fait l'éloge, raisonnant avec moi sur mon système, me communiqua cette réflexion sur les particules de l'air, et qu'il m'expliqua son idée fort en détail, conformément à ce qui en a été rapporté dans les Mémoires de l'Académie des sciences de l'année 1720, pag.11. Mais n'ayant pas encore les vues tournées de ce côté-là, je ne sus pas en profiter, et je l'avais même oublié, lorsque M. de Gamaches me rappela ce que m'avait dit M. de Mairan; et par une bonté dont je ne puis trop lui témoigner ma reconnaissance, me fit si bien sentir le rapport de ce principe avec ceux sur lesquels j'avais déjà fondé mon système, que je me le suis enfin approprié.[51]

When Rameau's *Génération harmonique* was published, it was accompanied by a short appendix, an excerpt of the Academic registers of 12 January 1734, signed by Fontenelle. It stated that three members had been nominated to review Rameau's work: Réaumur, Mairan, and Gamaches. The excerpt declares that the *Académie* had approved Rameau's work as a direct extension of Mairan's Newtonian *corps sonore*, and as consistent with experimental methodology.

[49] Bouissou, pp. 440-1.
[50] Christensen, p. 145.
[51] *Génération harmonique* (Prault: Paris, 1737), pp. 3-4.

These new trends were a problem for Castel, who was preparing to publish his optical theory as an alternative to Newton's, and had depended heavily upon the concept of *sous-entendre*, and on Rameau's fundamental bass.

5. Castel, Newtonian Anti-Newtonian

Castel had been a very early proponent of Newtonian mathematics. When he was young, and borrowed a copy of the *Principia*, he was so stunned and desperate to keep studying it, that he copied it out by hand: 'Deux mois ne me suffisaient pas pour entendre Newton; mais ils me suffisaient pour l'écrire. Je l'écrivis donc à la hâte pour avoir droit de l'entendre à loisir. J'en ai gardé la copie.'[52] Yet Castel found Newton's physics highly suspicious. In particular, he thought that Newton's use of mathematics to deduce truths about the physical world, and the use of experiments to test those descriptions, was disastrously misguided and even 'occult'. He was not alone in receiving Newton this way, and it wasn't until the mid-1730s that 'Newtonianism' began to connote a coherent philosophy that did away with Cartesian hypotheses, and instead used observable phenomena, expressed in the language of mathematics, to predict (or, to use Newton's term, 'deduce') other observable phenomena.[53]

Long before this change took place, when reviewing Newton's *Optics*, Castel laced his critique of Newton's physics with praise for his skill as a rhetorician. In his opinion, Newton presented his conclusions in such a way that they became a kind of magic mirror for readers. He marvelled that Newton could convey so much plausibility using experiments that could literally be a trick of

[52] Castel, Louis-Bertrand, *Le Vrai système de physique générale de M. Isaac Newton exposé et analyse en parallèle avec celui de Descartes* (Paris: C-F Simon fils, 1743), pp. 14-5.
[53] See François de Gandt, 'Newtonianisme', in *Dictionnaire européen des lumières,* ed. Michel Delon (Presses Universitaires de France, 1997), pp. 775-8; Jean le Rond D'Alembert, 'Newtonianisme', in *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers, etc.,* eds Denis Diderot and Jean le Rond d'Alembert, in University of Chicago: ARTFL Encyclopédie Project (Spring 2016 Edition), eds Robert Morrissey and Glenn Roe, <http://encyclopedie.uchicago.edu/> XXII, II, p. 8.

the light, or a momentary impression; 'bells' and 'clouds' that people could infuse with whatever meaning they desired:

Tout contribue à cette espèce d'éblouissement; le sujet est tout brillant; mais la manière dont il est traité, ne l'est pas moins: l'Auteur, par la force et l'énergie de sa méthode vive et concise, y met partout le lecteur, comme en sa place, sur les voies mêmes de la recherche et de l'expérience; partout il l'intéresse, et le tient en suspens jusqu'à l'évènement qu'il lui laisse cependant entrevoir, de sorte qu'une expérience qui aurait pu paraitre l'effet d'une espèce de hasard, devient la suite préméditée d'un raisonnement profond et subtil: mais le grand art, et comme le coup de maître en ce genre, c'est de saisir, et de présenter les expériences du côté le plus favorable; car il faut le plus souvent aider un peu aux faits, afin qu'ils aident à leur tour au système: on sait assez que les expériences, surtout celles qui sont difficiles et recherchées, sont un peu comme les cloches, ou les nues, qui disent, ou qui représentent tout ce qu'on a dans l'esprit; un petit tour qu'on donne, une circonstance à quoi on s'attache, une autre qu'on néglige, une expression, un mot, un je ne sais quoi, sont souvent tout le nœud de ces systèmes d'expérience.[54]

When Castel invented the ocular harpsichord two years after this review, he claimed that the colour-sound analogy was proved in Newton's *Optics*. Then, ten years later, in the *Nouvelles expériences*, he claimed that his colour-music system was diametrically opposed to Newton's. Indeed, he wrote, if Newton was correct, then the ocular harpsichord was impossible, a chimera:

J'avoue donc en fin de bonne foi, à ma confusion, si l'on veut ; si le système de M. Newton a lieu, tout le mien est renversé de fond en comble, il n'y a ni musique, ni harmonie, ni clavecin de couleurs : et tout ce que j'en ai dit jusqu'ici n'est qu'une belle chimère comme bien des gens l'ont prétendu, et comme quelques-uns le voudraient peut-être bien encore.[55]

Publicising *L'Optique des couleurs* in 1739, Castel described his system as a practical optics drawn from heuristic observations, in contrast to the fashionable Newtonian system, which was useless and purely hypothetical, because it was drawn from the 'abstract and fantastic' colours of the prism:

[54] Review of *Traité d'optique, Journal de Trévoux* (August, 1723), 1428-1450 (pp. 1430-1)
[55] NE.IV, p. 2033.

L'Ouvrage dont on donne ici le projet, est exécuté et prêt à imprimer. Son titre porte que c'est une Optique fondée sur les observations, et toute relative à la pratique, aux Arts, à la peinture, à la teinture, aux manufactures, aux diverses fabriques de couleurs. C'est pour la distinguer de ces Optiques à la mode, Philosophiques ou Géométriques, qui se traitent mutuellement de romans, et dont celle qui passe pour la plus solide, n'a pourtant pour objet que des couleurs abstraites et fantastiques qui ne font d'aucun usage pour la perfection des arts et des vraies science; toute sa spéculation n'aboutissant qu'à des mesures d'angles, à des immatérialismes, à des qualités occultes, à des termes surannés.[56]

Two of the letters reprinted in *L'Optique des couleurs* are in response to a letter from a 'Mr D'. Schier writes, 'The second "réponse" is almost violent in tone and accuses Newton of bad faith, stupidity, and faulty observation, but adds nothing new to what we know either about Castel or about his scheme.'[57] To be more specific, Castel's second letter displays a dramatic, almost enraged hostility to the prism. In one extraordinary passage, Castel describes Newton's prismatic experiments as a shipwreck:

Je me défiais du prisme et de son spectre fantastique. Je le regardais comme un art enchanteur ; comme un miroir infidèle de la nature, plus propre par son brillant à donner l'essor à l'imagination, et à servir l'erreur, qu'à nourrir solidement l'esprit […] Je le regardais avec terreur, comme un écueil signalé par le naufrage d'un vaisseau fameux, suivi de mille vaisseaux, qui venaient à l'envi partager son désastre, en recueillant ses débris.[58]

Castel follows this passage with an extensive war metaphor, in which he takes up theoretical 'arms' against Newton, whose prism is simultaneously weapon and battlefield. Three years later, Castel published a vehemently anti-Newtonian work, *Le Vrai système de physique de M Isaac Newton exposé et analyse en parallèle avec celui de Descartes*. Some discussions of Castel's colour theory have used this as their text, and thus inaccurately present Castel and the ocular

[56] 'Projet d'une nouvelle optique des couleurs'. *Journal de Trévoux* (April, 1739), 804-820 (pp. 804-5).
[57] Schier, pp. 168-9.
[58] *Réponse*, 1739, pp. 2567-8; OdC, p. 377.

harpsichord as straightforwardly anti-Newtonian.[59] The climate in which Castel had introduced the ocular harpsichord was very different from that of 1743, at which point Newton was famous because, not in spite, of his physics. Castel strenuously resisted this reception, complaining that the great mathematician had been transformed into a sort of messiah for credulous hysterics:

> Pendant les dernières *vingt années* qui viennent de s'écouler, Newton s'est fort développé. Je dis *développé*, par le nombre des mains qui y ont travaillé, et par la célébrité et l'éclat qu'elles ont su donner à leur travaille. Ce travail a été pour et contre; mais plus souvent pour, que contre Newton. On a plutôt fait avec ce redoutable Géomètre, de lui rendre les armes, et de se déclarer son très-humble disciple. Cela fait honneur, donne un air de géométrie et de profondeur, et n'engage à rien; Newton, selon le nouveau style, ayant tout trouvé, et tout démontré, *pour ceux qui veulent bien le supposer*.[60]

This reversal of position meant that, whether one was for or against Newton, the ocular harpsichord offered an entertaining opportunity to discuss analogies between colour and sound, and to debate how far those analogies could extend. In short, the ocular harpsichord's fame was tied to debates about Newtonian optics, even as Castel started using it to present his own optical experiments as a alternatives to Newton's. The first stage of this transformation was his *Nouvelles expériences.*

6. Castel's New Experiments

In 1735, Castel published his first works on the ocular harpsichord in a decade: six long articles in the August, September, October, November and December issues of the *Journal de Trévoux*. These articles were styled as public letters to Montesquieu, whom Castel had befriended after tutoring his son. By addressing

[59] Blay, in one of the most widely quoted articles on Castel's optics, bases his entire analysis on *Le vrai physique*. Michael Blay, 'Castel critique de la théorie newtonienne des couleurs', in *Autour du père Castel,* eds Mortier and Hasquin, pp. 43-58.
[60] Emphasis Castel's. *Le vrai système,* p. 3.

his articles to Montesquieu, Castel publicly promoted the intimacy of their friendship, and he took the opportunity to thank the famous writer for encouraging him to put his new ideas before the public.

As the introductory articles were short pieces in the *Mercure de France*, this new series marked a change in the character of Castel's articles on the subject, and in his intended audience. Titling his series, *Nouvelles expériences d'optique et d'acoustique*, Castel presented his 'musique véritablement chromatique' as an ambitious new system, designed to appeal to a readership of sociable specialists and learned aristocracy.[61] In addition, they demonstrated a dramatic expansion of the scope Castel envisaged for the ocular harpsichord, which was now presented as not only fun and useful, but the symbol of a transformational synthesis of science and art. 'Car si c'est ici un art nouveau,' he wrote, 'je puis assurer que c'est aussi une science toute nouvelle et qui peut renouveler bien d'autres arts et d'autres sciences.'[62]

The expansive approach of these articles was reinforced by remarks and digressions on a variety of other fields and subjects, preserving the conversational tone and quasi-mathematical styling of his earlier works on his invention (which receive close analysis in Chapter V). However, over time, Castel's use of rhetorical structures and devices had become more varied and refined. Now, in addition to using rhetoric to strengthen his claims, he also used it to soften and disguise the most extreme arguments he was making about colour music, presenting them as hesitant, or incomplete, or charmingly frivolous. We should read these moments in his articles as evidence of a canny

[61] According to Sgard, the *Trévoux* distinguished itself from other (in its view) 'heretical' journals by explicitly defending religion, while appealing to a cultivated 'public d'hommes de lettres et d'érudits'. It sought to provide a space for public discourse among learned elites in which all subjects (except religion) were treated with neutrality: 'Attachés à souligner le rôle d'intermédiaire des *M. de T.* entre le public et les savants de l'Europe, comme entre ces savants eux-mêmes, les auteurs engagent les gens de lettres à recourir au journal pour proposer leurs difficultés sur des points de doctrine ou pour soumettre au jugement du public les projets de leurs ouvrages.' See, 'Mémoires de Trévoux 1 (1701-1767)' in Sgard, *Dictionnaire des journaux*.
[62] NE.I, p. 1446.

persuasive technique. As this series of articles progressed, Castel waded deeper and deeper into the most contentious intellectual debates of his moment, and by presenting his boldest claims as the most delightful and least relevant parts of his argument, he subtly encouraged readers to accept them without question or resistance.

By titling this work, *Nouvelles expériences*, Castel suggested that the ocular harpsichord formed part of the emerging field of experimental philosophy. The articles did introduce the public to Castel's own optical theory, formulated through experiments with paints and pigments, in contrast to Newton's experiments using the prism. However, ultimately, the *Nouvelles expériences* are anti-experimental, and increasingly discuss the senses as malleable and untrustworthy. After early sections establishing the correlation between a rainbow of carefully defined colours and the musical scale, the series culminates, beginning in section five, with a theory of pleasure presented as a Euclidean proof, which then in the sixth section transforms into an anti-empiricist epistemological theory:

> C'est une étrange méprise, que celle de plusieurs philosophes modernes, de concevoir l'âme comme une simple capacité inactive de penser et de vouloir, et comme un simple miroir capable de représenter superficiellement tous les objets, sans aucun fonds, sans aucune capacité véritable de retenir en dedans de sa substance l'image, l'idée de rien ; voulant que ce soit toujours une espèce de table rase, et que toutes ses connaissances, ses goûts, ses habitudes soient comme en dépôt ou même en propriété dans des traces corporelles.[63]

Castel used the ocular harpsichord as a persuasive rhetorical device within these articles. In the early sections of the series, he keeps direct references to the instrument itself to a minimum, and instead refers to the general idea of colour music. As the series progresses, and as Castel's arguments become more controversial and explicit, references to the ocular harpsichord

[63] NE.VI, pp. 2668.

increase in number and directness. The first three sections are largely concerned with 'experiments', explaining how Castel arrived at the correct correspondence between sound and colour, and the choice of blue as the fundamental colour. However, the experiments are related anecdotally, frequently as social interactions with collaborators. Beginning in the fourth section, the tone and subject matter shifts, and Castel begins advancing arguments against Newtonian optics and Lockean empiricism, culminating in his own extended theory of sensation – this sixth part alone is almost half the total length of the series. These latter arguments are intermingled with allusions to the ocular harpsichord's mechanics: Castel was using public interest in the physical instrument to attract a wide readership for his larger philosophical system.[64]

This restraint allows for the development of other persuasive techniques. For example, in the first article, Castel pauses in the middle of his *narratio* to digress into a *raisonnement du goût*. This 'digression' presents the methodology behind the new experiments as a light-hearted literary aside. He even suggests that it might have been better to remove it:

> Voici, Monsieur, un raisonnement de goût plutôt que de philosophie, et qui a peut-être besoin qu'on aide un peu à la lettre. Je pourrais le supprimer, mais vous aimerez peut-être mieux voir les raisons que le résultat de ma découverte : le public pourra s'en tenir au fait éprouvé.[65]

The *raisonnement du goût* justifies the creation of a colour-scale by claiming that the human senses have equal strength and potential, are equally cultivated, and equally understood by practitioners of their respective arts. There are a number of dubious assumptions behind this claim (how and on what grounds could one make such a comparison?), so Castel disguises its centrality to his argument by softening his repetition of 'même' with early additions of 'à peu près', and hesitant, apologetic interjections:

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[64] These allusions were compiled for Chapter II; for their locations see references to NE.
[65] NE.I, p. 1462.

M'imaginant, si l'on veut, que les facultés des hommes sont à peu près les mêmes dans des arts à peu près également cultivés, et que nos divers sens ont à peu près la même énergie, la même force, la même étendue et par conséquent les mêmes bornes, chacun par rapport a son propre objet ; je me suis persuadé que le coup d'oeil du peintre égalait l'intelligence, la sensibilité, le coup d'oreille, si je puis le dire, du musicien, et que cette oreille sonante étant bornée aux demi-tons du son, cet œil pittoresque était borné aux demi-tons de la couleur, c'est-à-dire, à des intervalles pareils et de pareille étendue, de pareille petitesse.

Delivering this crucial point as an apologetic, charming frivolity is a brilliant way of capturing a reader's attention and predisposing them to accept it. Ultimately, the *Nouvelles expériences* argue that the harmony each sense is capable of experiencing is the same regardless of the organ that is stimulated, and the nature of the stimulation. Castel thus proposed to identify the correct colour-scale by using 'analyse' to apply the architecture of music to colour, using a heuristic and intuitive process of mixing paints and putting nuances in order. This process of ordering is meant to refine and perfect one's understanding of nuance; to cultivate expertise. If this process of refinement continues, and combines more than one sense (through, for example, practice at an ocular harpsichord) eventually one's understanding of harmony will be perfect enough to make sensory distinctions irrelevant.

This is a bold claim, and Castel does not attempt to make it convincing on logical grounds, or *logos*. Instead, he appeals to *pathos*, the feelings of his reader: specifically embarrassment, fear, modesty, and surprise. He writes that in the course of these experiments with paint, Castel and an assistant both came to the conclusion that the 'tonic' colour is blue, and not violet, because of the number of semi-tones between blue and red:

Lorsque la personne qui faisait ces expériences, d'abord dans son particulier, eut observé ces défauts de correspondance, elle se trouva dans un grand embarras, craignant de m'embarrasser beaucoup moi-même, parce que, comme j'ai dit, je ne lui avais point communiqué mes soupçons contre ce violet tonique. Elle n'osa d'abord se fier à sa découverte, elle tourna la chose de tous les sens… Elle ne se

croyait pas si avancée lorsqu'elle me communiqua son embarras et le fruit de ses recherches. Elle fut donc agréablement surprise, de me voir moi-même tout aussi agréablement surpris, que sa pratique s'accordait si juste avec ma théorie, et de me trouver tout préparé d'avance pour souscrire à sa découverte.[66]

His unnamed assistant was probably an aristocratic friend or tutee, as she is one of Castel's and Montesquieu's 'communs amis'. It is easy to imagine that some of Castel's readers would have known exactly who she was, and that following publication of Castel's articles, her involvement would have been a topic of casual conversation. If readers had asked her if Castel's account of their experiments was true, she could have confirmed it on largely emotional grounds: she did help him with his work, she was embarrassed, she was concerned about disappointing him, they were indeed pleased and surprised. In which case, passages like these skilfully establish *ethos*, Castel's credibility and goodness of character, extending beyond the pages of the *Journal de Trévoux* and into the social lives of readers.

7. The Quarrel

The remarks that started Castel and Rameau's quarrel were in the second part of the *Nouvelles expériences*, which focused on establishing that colour and music were each reducible to three essentials, and one fundamental. This point was necessary to the ocular harpsichord because having demonstrated this, Castel argues that these fundamentals and essentials map onto each other precisely. He wrote:

On dirait que les musiciens se sont donnés le mot entre eux et avec les peintres, et les peintres avec les teinturiers, et les teinturiers avec les philosophes pour ne reconnaître les uns que trois sons et les autres trois couleurs. Qu'on lise Zarlin, Mersenne, Rameau, Kircher et jusqu'à l'Assilard et aux plus simples méthodes de

[66] NE.I, pp. 1464-6.

chant: qu'on lise d'un autre côté Felibien, Kircher, etc., il n'y a que trois sons, il n'y a que trois couleurs.[67]

Castel goes on to explain why there are three 'essential' colours rather than five (as 'teinturiers' claim) or one (as 'physiciens' claim). He then discusses the importance of threes to musicians, before claiming that the fundamental bass is distinct from the well-known forms of thoroughbass and 'basso continuo'. Although those forms of bass were necessary to musical practice, Castel claimed that they were secondary to the fundamental bass, which functioned on a deeper, structural level. Zarlino and Kircher had discussed this before, and Rameau's fundamental bass had followed and repeated them. This was a useful point for Castel to make, as if Rameau continued to relocate his fundamental bass to Newtonian, empiricist territory, Castel could retain control over crucial elements of the theory by claiming they derived from a Jesuit intellectual genealogy in which he claimed expertise:

Les habiles musiciens ne goutent point de musique sans basse, et lorsqu'ils ne l'entendent pas, ils la suppléent par une espèce d'harmonie spontanée ou de chant intérieur qui la leur fait *sous-entendre*, c'est leur expression. […] Cependant les basses que les musiciens pratiquent, et qu'ils doivent même pratiquer selon les règles de l'art, et pour une plus grande variété qui est ici la grande règle, ne sont basses ou basses qu'à demi. *Kircher* nous apprend qu'une vraie basse qu'il nomme *base*, ne devrait procéder que par quartes, quintes, et octaves. Et M. Rameau en suivant cette idée de Kircher qui pourrait bien être celle de Zarlin, nous dit et nous répète qu'il y a des basses fondamentales au-dessous des *basses* dites *continues* des musiciens. Ce que Kircher nous dit, ce que M. Rameau nous répète, sans trop le démontrer cependant ni l'un ni l'autre, je tâchai de l'établir dans ces mémoires, lorsque j'y rendis compte dans le tems, de cette découverte, que je croyais et plus neuve et plus étendue.[68]

As we've seen, Castel had previously given all the credit to Rameau, citing Kircher and Zarlino as thinkers who had been unable to uncover the unifying principle that was Rameau's claim to fame. Castel admitted that when he first

[67] NE.II, p. 1628.
[68] Ibid., pp. 1635-6.

discussed the fundamental bass, he had believed it to be more profound, but with greater study and reflection, he had realised that Rameau's theory did not offer the fixed fundamental that he had originally believed it did.

Castel claimed that colour music would work because both sound and colour had fixed and unmoveable fundaments: blue, and *ut*. Having established this, Castel argued that the three 'essential' colours (blue, red, and yellow) map precisely onto thirds in the diatonic scale (*ut*, *mi*, and *sol*). In order to explain all harmonies with the concept of the fundamental bass, Rameau had juggled his ratios using chordal inversions and modulation, and allowed for three possible fundamentals: *ut, sol*, and *fa*. Castel declared that this meant that Rameau's fundamental bass wasn't 'fundamental' at all:

> Cet auteur est toujours estimable d'avoir enchéri sur ses prédécesseurs en ébauchant au moins ce qu'ils n'avaient qu'indiquée. Mais en admettant deux et même trois fondamentales dans chaque ton, la tonique, la dominante, et même la sous-dominante, il perd de vue l'unité de la nature qui s'était d'abord laissée entrevoir à lui: […] N'est-ce pas là le propre caractère d'une basse et d'un fondement, d'être ferme et inébranlable? Y a-t-il d'autre partie à qui cette propriété convienne comme à celle-là? On voit bien que toutes les basses prétendues fondamentales de M. Rameau, ne sont moins que cela; elle sont toutes renversables, s'il est permis d'user de ce terme, toutes mobiles.[69]

The following July, the *Journal de Trévoux* printed Rameau's response, a letter addressed directly to Castel: ostensibly polite, while pointedly quoting Castel's words in private conversations over the years, and suggesting that Castel had misunderstood the basic principles of music. Rameau presented himself as a grateful recipient of Castel's former esteem, baffled at the mysterious and factually unfounded criticism he now found himself subjected to. He insisted that the fundamental bass was indeed his own discovery, and protested that Castel had originally been happy to attribute 'the glory' of the discovery entirely to him. He took issue with the attribution to Kircher, claimed that Kircher had only

[69] Ibid., pp. 1637-8.

copied Zarlino, that his bass had been very superficial, and wrote that in any case Castel had been reading Kircher for twenty years before they met, 'sans beaucoup de fruit': if he and other thinkers had sensed something vaguely similar before, but had been unable to articulate it, then that only proved the truth and novelty of Rameau's contribution. Castel's comments on the fatal lack of fixity in Rameau's fundamental bass were nothing but confusion over semantics:

> Au reste, le nom ne constitue pas les choses, ce n'est que l'application qu'on en fait qui y met le prix: ainsi les beaux noms de *basis*, de *vrai basse*, si vous voulez, de *fondement*, *de baβe, d'hipaton*, de *basse fondamentale*, ne sont que des mots, dont la force dépend de l'objet auquel on les applique.[70]

In his reply, Castel appealed to their history of friendship, subtly indicating that Rameau had derived a lot of his legitimacy from Castel's own ideas and public support. The strain of not making this claim explicit is evident in the manuscript drafts of Castel's response to Rameau. These drafts are overwhelmingly focussed on calibrating his account of their acquaintance and the beginning of their quarrel, to achieve a tone of modest and injured goodwill. The drafts offer an interesting insight into why this tone was so important, and also explain why Rameau's response was published in the *Journal de Trévoux*. The following is a very long quotation, but it is given here in its entirety because it provides not only an unvarnished glimpse into this quarrel, but a fascinating practical insight into how these kinds of quarrels were conducted in general. (We'll return to this subject, and this quotation, in the following chapter.) Castel is accounting for his change of heart in regard to the originality of Rameau's theories; in fact, he says, he'd always had his doubts, but had tried to be kind to Rameau:

[70] Ibid., p. 1703-4.

M. Rameau a senti le coup, d'autant plus vivement sans doute qu'il y était moins accoutumé de ma part: je n'en suis point surpris. Il me fit dit il y a 15 jours par une personne de mérite et fort connue dans la littérature qu'il ne voulait pas m'avoir pour ennemi. Je répondis que je ne l'avais jamais été, et que je ne voulais ni pouvais l'être, mais que la vérité était au-dessus de tout. On m'ajouta qu'il voulait se rapprocher, c'était, je crois, le meilleur parti qu'il y avait à prendre. Ma bonne volonté étant au fond toujours la même pour lui, encore aurions-nous pu de vive voix éclaircir au moins les malentendus et écarter les difficultés étrangères qui le glissent toujours de part ou d'autre dans toutes sortes de discussions. M. Rameau en a jugé autrement: il a fais une lettre qu'il m'adresse; mais j'en ai été instruit le dernier. Il l'a fait courir ou lu dans Paris et j'en ai appris le contenu par la voix publique. Enfin il l'a livrée à l'impression, on me l'a communiqué et j'ai consenti de bon cœur qu'on l'imprimât, parce qu'elle me donne lieu de revenir un peu en arrière sur mes premiers démarches pour les porter plus en avant au profit comme je l'espère de la science et de l'art de la musique, et à la satisfaction de messieurs les musiciens qui ont eu à se plaindre de ce que réellement pleine d'estime pour plusieurs d'entre eux je ne prodiguais cependant mon admiration qu'à M. Rameau.[71]

In the final version Castel published in September, this account is drastically truncated, and embellished with phrases like 'au premier coup d'œil' to make it look as if it hasn't been carefully composed. Castel addressed his article to the public, pointing out that he had been forced to do so by Rameau's refusal to address him personally – a reference to the multi-stage publication history outlined above. Castel's response is styled as a juridical defence, with twenty-nine numbered points of contention, wherein he presents himself as the humble and unfairly vilified victim of Rameau's arrogance and mathematical error, who is prepared to stand his ground and not 'blush' in the face of Rameau's accusations. He writes that Rameau had asked to meet him and not the other way around, and having made this point, he adopts a magnanimous and wounded posture:

Le public ne prend aucun intérêt à ces personnalités qui ne sont bonnes qu'à repaître l'amour propre des personnes intéressées. Voulant me rappeler aux engagements qu'il suppose que j'ai pris à perpétuité envers lui, M. Rameau aurait pu citer uniquement mes extraits, assez flatteurs en ce genre, et les seules pièces

[71] *Remarques du P. Castel sur la lettre de M. Rameau,* Brussels, Bibliothèque royale de Belgique (KBR), Ms. 20758, fols 41^{r}-75^{v} (fol. 65^{v}).

juridiques après tout de ce nouveau procès. Je puis désavouer, je désavoue même des discours familiers, oubliés de droit après quinze ans, et moins conformes à ma manière générale de penser, qu'au but présent auquel on les ajuste avec trop d'art.[72]

On the subject of Kircher, Castel has many objections. He writes that Kircher had only provided 'une semence de découverte' which Rameau had greatly improved upon, reminds Rameau of conversations in which they read Kircher together, claims that he had only recently studied the *Musurgia* in depth, and that he had initially suppressed other references to Kircher in order to build Rameau's reputation. Castel writes that the dispute has now forced him to be blunt: he had indeed changed his mind about the soundness of Rameau's theories, which he now found to be inconsistent, forming a 'vicious circle'. He pointedly remarked that Rameau knew very well that Castel could have been even blunter about how much he owed him, and the objections Castel had always had to holes in his theory: 'J'en avais assez dit dans mes *Nouvelles expériences d'optique*, pour faire *sous-entendre* à ce savant musicien que j'en supprimais encore plus.'[73] Employing a peculiar metaphor, he describes his experience upon re-examining his old reviews of Rameau's books:

Je recourus à mes oracles. Je relus mes extraits. Ils promettaient des merveilles; mais ce n'étaient que des commentaires d'oracles. Je consultai le texte, le *Traité de l'Harmonie*. Les Oracles de la Sybille étaient écrits sur des feuilles de chêne: les vents les confondaient et les emportaient à leur gré. Je ne retrouvai plus ce que j'avais crû voir.[74]

Castel's odd invocation of oracles in this passage would have had a special connotation for contemporary readers. Oracles were a common operatic convention, used to mediate between the human and divine worlds, and to drive

[72] 'Remarques du p. Castel sur la lettre de M. Rameau', p. 2000.
[73] Ibid., p. 2002. Castel's emphasis.
[74] Ibid., p. 2013.

the plot along.[75] However, this passage is a concerted jab at Rameau's style of music, and the practical problems it was causing in production of his operas.

For the second act of *Hippolyte et Aricie,* Rameau had composed an ambitious oracular trio, a demonstration of the complex style and composition that made his music controversial. Although it was successfully performed in a private rehearsal, most likely at the Hotel de Soissons (the home of his patron, the Prince de Carignan)[76] it proved too difficult for the singers at the Opéra, and had to be rewritten, to Rameau's deep regret.[77]

In addition to being compositionally ambitious, the second 'trio des parques' was intended to create a visceral emotional effect in listeners, using enharmonic progressions to overwhelm and alarm audiences, and so push them into a realm of raw auditory experience. As Downing writes, 'With the trio, Rameau sought to present the transmission of an oracular message along with the physical effects it entailed. […] For Rameau, the enharmonic genre constituted a temporarily horrifying, and corporeal, experience of limits.'[78] Castel used this disappointing episode to humiliate Rameau for making empty promises. Rameau's score had promised auditory marvels that did not materialise because his trio could not be sung; similarly, his theories made claims that were not borne out, because they led to a vicious circle.

Rameau did not respond, and the quarrel fell silent. Probably Rameau felt that Castel had, for the time being, got the better of him. Castel was a much better writer than Rameau, and his rhetorical mastery gave him a subtlety and skill against which the composer was ill-equipped to defend himself: this did not stop

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[75] See, Geoffrey Burgess, 'Enlightening Harmonies: Rameau's "corps sonore" and the Representation of the Divine in "tragédie en musique"', *Journal of the American Musicological Society* 65, no. 2 (2012), 383-462.
[76] Graham Sadler, 'Patrons and pasquinades: Rameau in the 1730s', *Journal of the Royal Musical Association*, no. 113 (1989), 314-337 (p. 323).
[77] Girdlestone, p. 151. See also, Spire Pitou, 'Hippolyte et Aricie', in *The Paris Opéra: An Encyclopedia of Operas, Ballets, Composers, and Performers,* 3 vols (Connecticut and London: Greenwood Press, 1985), I, pp. 271-4.
[78] Thomas A Downing, *Aesthetics of Opera in the Ancién Régime (1647-1785)* (Cambridge: Cambridge University Press, 2002), pp. 166-7.

Rameau from trying, but in comparison to Castel, and when angry, his style is childish and clumsy. Rameau had acknowledged as much in his first letter of the quarrel, writing, 'je sens bien que cela serait infiniment mieux entre vos mains, je ne sais que dire les choses, vous savez les peindre à l'esprit'.[79] As we'll see in the following chapter, this unequal dynamic was one of the elements that soon prompted Voltaire to intervene with the *Lettre à Rameau.*

When the *Génération harmonique* was published in early 1737, Rameau managed its reception very carefully. On 4 May 1737, Mairan delivered a paper at the *Académie*,[80] which is entirely devoted to systematically refuting any and all physical correspondence between sound and colour. Mairan's paper doesn't mention Castel once, but it was clearly received as a response to him. Twenty years later, Le Cat recalled it as a decisive blow against the ocular harpsichord: 'M. de Mairan, qui éclaircit et embellit tout ce qu'il touché, en appréciant cette analogie à sa juste valeur, a bien rabattu de l'enthousiasme que l'on avait conçu pour elle.'[81] Mairan and Rameau's collaboration now caused a new quarrel in the *Observations sur les écrits modernes*, where they were accused of conspiring to fabricate similarities between their theories in order to improve their standing.[82]

In December, the *Journal de Trévoux* published a review of *Génération harmonique,* written as 'nous' rather than from Castel's own voice – a far cry from the legalistic defence of his previous reply.[83] It contains significant praise for Rameau, and it is also very condescending. It maintains and repeats Castel's points on Rameau's fundamental bass, while emphasizing that the *Journal de Trévoux* had earlier been his champion and therefore shared in his operatic success.

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[79] 'Lettre de M. Rameau au R.P. Castel', p. 1698.
[80] 'Discours sur la propagation du son dans les différents tons qui le modifient', *Histoire de l'Académie royale des sciences*, *1737* (1739), 1-59.
[81] Le Cat, *Éloge*, p. 238.
[82] 'Lettre de M*** à M. l'abbé D.F. sur le nouveau livre de M. Rameau', *Observations sur les écrits modernes* X, no. 138 (August, 1737), 68-72. See also issue 139 of the same journal, and Mairan's response in issue 150.
[83] Review of *Génération harmonique, Journal de Trévoux* (1737): 2142-2157.

At the end of December, Rameau's music student, Thérèse Deshayes, (also the mistress and future wife of Rameau's patron at the time, La Poupelinière) reviewed *Génération harmonique* very favourably in *Le Pour et Contre*. Deshayes was not in the habit of publishing reviews in journals, and it is difficult to imagine that Rameau was not somehow involved in this review. 'On voudrait tout savoir, on aime à s'instruire, mais on craint de se donner la peine de penser,' she began, 'M. Rameau nous indique un riche pays qu'il a nouvellement découvert. Si l'on veut le parcourir, il faut consentir à le suivre, à marcher comme lui dans les routes qu'il a tracées le premier.'[84] Deshayes' review framed Rameau as a *mondain* musician-philosopher, and his work as both accessible and exciting: 'A la suite de ces observations qui sont à portée de tout le monde, nous voyons le musicien suivre le philosophe, et passer à la pratique'.[85] Rameau's new experimental style was alluded to, with empiricist echoes:

> De tout ce que je viens d'extraire, je crois qu'on jugera l'ouvrage de M. Rameau, moins comme un système, que comme une démonstration sensible et palpable de la musique prise dans son origine, et suivie dans tous ses effets; puisque le principe sur lequel il se fonde nous est donné, comme nous l'avons dit, par la nature, et que tout en est produit harmoniquement, arithmétiquement, et géométriquement.[86]

Rameau's response to the *Journal de Trévoux's* review appeared in *Le Pour et contre* in January. It overflows with sarcasm and contempt for Castel. Rameau mocks Castel for attempting to style himself as a polymath, disdainfully listing off titles before referring to him, in the rest of the review, as 'le journaliste' and 'l'auteur': 'Pourquoi ce célèbre mathématicien, tout à la fois, géomètre, physicien, métaphysicien, physico-mathématicien n'a t'il employé ses connaissances que pour donner des erreurs dont on ne le soupçonnerait point, si la démonstration

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[84] 'Extrait du livre de M. Rameau, intitulé *Génération harmonique'. Le Pour et contre*, no. XIII (December, 1737): 31-48 (p. 34). See also Chapter IV, n. 48.
[85] Ibid., p. 42.
[86] Ibid., p. 47.

ne suivait de près?'[87] The 'remarks' are mostly taken up by quotations by Castel, interwoven with Rameau's corrections and ripostes. Rameau's furious reaction to Castel's comment on oracles, seemingly unabated in the year since Castel had made it, is a good example of what his ripostes look like:

> P. 2161&62, 'M Rameau persiste dans cet ouvrage à regarder l'accord de la grande sixte comme fondamentale. Le Mémoire déjà cité etc. a suffisamment éclairci cet article. Le double emploi est un terme bien imaginé pour sauver à demi les débris du système simple de deux accords fondamentaux, que nous avions par erreur attribué à l'auteur, etc.' C'est-à-dire que le Mémoire où l'on renvoie, détruit tout ce que je démontre sur ce sujet: sont-ce là les 'oracles de la Sybille?' Qu'on les consulte donc ces Oracles, puisqu'on le veut: c'est là qu'à bon droit 'ils sont écrits sur des feuilles de chêne qu'emportent les vents'.[88]

Later on, Rameau bitterly invokes the oracles again: 'Si ce que l'Auteur cherchait dans ses Oracles n'y était point dicté, pouvaient-ils mieux s'expliquer à son égard qu'en lui paraissant "écrits sur des feuilles de chêne que les vents confondaient et emportaient à leur gré"?'[89] It seems that Castel had, essentially, won. If not, it is difficult to understand why Rameau was moved to be so vicious in this last article, and why Castel was apparently content to let the quarrel end there.

8. The Aftermath

Although the trajectory of their careers and subsequent quarrel took them in different directions, Castel and Rameau's ideas remained entwined. This became increasingly apparent the further they got from debates in the 1730s on Newton and experimental philosophy. After reading Diderot's *Lettre sur les sourds et muets,* which discusses Castel and the ocular harpsichord at length, Rameau transformed the *corps sonore* into an intersensory phenomenon capable of

[87] 'Remarques de M. Rameau sur l'extrait qu'on a donné de son livre intitulé: *Génération harmonique, dans le Journal de Trévoux,* Décembre 1737', *Le Pour et Contre* XIV, no. cxcvi (January, 1738), 74-96 (pp. 74-5).
[88] Ibid., pp. 91-2.
[89] Ibid., p. 94.

affecting vision, touch, and sound. They publicly reconciled during the course of the *querelle des bouffons*, when Castel took it upon himself to attack Rousseau in a series of anonymous pamphlets, which must have been a help to Rameau, who continued to be unable to respond elegantly to articulate attack. Rameau still relied on the blunt device of quoting a critic in an attempt to turn his words against him, only now it was Rousseau and the *encyclopédistes* whom he accused of semantic games and a disgusting use of rhetoric, instead of Castel:

> On dit dans l'avertissement, 'le peu de sensation que la critique nous paraît avoir fait dans le public.' Le dégoût causé par l'extrême amplification de choses inutiles, dans ces articles où l'on ne cherche qu'à s'instruire, aura bien pu rejaillir sur une critique déjà faite. Il n'y a, d'ailleurs, de vrais curieux dans les arts que les artistes et les amateurs. Je demande si les articles de géométrie ont du faite une grande 'sensation dans le public'?[90]

Reporting on the progression of the *querelle des bouffons*, and quoting Rameau's ripostes, Fréron agreed with this assessment,

> Admirez, Monsieur, avec quelle justesse et quelle rapidité notre fameux Artiste, sans se donner pour écrivain (Messieurs les Encyclopédistes ont la politesse d'insinuer dans leur Avertissement qu'il ne l'est pas) déduit les preuves contre de pareille imputations; la Rhétorique de ces Messieurs ne leur fournit pas une véhémence si naturelle, parce qu'elle a sa source dans le génie et dans la vérité.[91]

This comment of Fréron's introduces a passage in which Rameau distances himself from the ocular harpsichord. Tellingly, Rameau does not distance himself from Castel's ocular harpsichord, but from a specific interpretation of it that had developed in recent years among the *encyclopédistes*. Diderot's references to the ocular harpsichord recast it to evoke the subjugation of physical realities, like pleasure, to the over-rationalisation of geometry. In a similar use, D'Alembert's

[90] *Réponse de M. Rameau à MM. les éditeurs de l'encyclopédie sur leur dernier avertissement.* (Paris: Sebastian Jorry, 1757), pp. 13-4, n. a.
[91] 'Réponse de M. Rameau', *Année Littéraire* I, no. XIII (March 4, 1757), 303-311.

avertissement for the sixth volume of the *Encyclopédie* addressed Rameau's quarrel with Rousseau in these terms:

> Enfin les opinions plus que singulières qu'on soutient dans cet écrit, et qui ne préviennent pas en sa faveur, entre autres, que la Géométrie est fondée sur la Musique; qu'on doit comparer à l'harmonie quelque science que ce soit; qu'un clavecin oculaire dans lequel on se bornerait à représenter l'analogie de l'harmonie avec les couleurs, mériterait l'approbation générale, et ainsi du reste (*b*). Si ce sont-là les vérités qu'on nous accuse d'ignorer, de négliger, ou de dissimuler, c'est un reproche que nous aurons le malheur de mériter longtemps.[92]

'Que veut dire, par exemple, ce Clavecin oculaire que vous m'attribuez?' Rameau asked, 'C'est votre ouvrage; je vous l'abandonne.'[93]

[92] D'Alembert, 'Avertissement', *Encyclopédie,* VI, pp. i-ii.
[93] *Réponse de M. Rameau à MM. les éditeurs de l'Encyclopédie sur leur dernier Avertissement* (London: Sébastien Jorry, 1756), p. 22.

IV

Pegasus: Voltaire and Poetic License

Voltaire's references to Castel span four decades, and they began in 1736 during the first stage of Castel's quarrel with Rameau. At the time, Voltaire was attempting to collaborate with Rameau, and he followed their exchanges with interest and amusement. Then, in a high-profile article in the *Journal de Trévoux*, Castel accused Voltaire of being a new and dangerous kind of philosophical dilettante: an Optimist. Voltaire was outraged, but he proceeded to attempt to pacify Castel. He wrote to him asking about the ocular harpsichord, and wrote a chapter on it for his book about Newtonian philosophy. As we saw in the previous chapter, when Castel and Rameau's quarrel sputtered into life again, Castel appears to have had the advantage. Seizing an opportunity to kill two birds with one stone, Voltaire intervened with the anonymous *Lettre à Rameau*: a merciless polemic that ridiculed Castel's ideas and style, and dubbed him the 'Don Quixote of Mathematics'.

Since the eighteenth century, this nickname has effectively become the defining characterisation of Castel. However, in the course of my research, I have been unable to find a single contemporary repetition of this nickname, or any eighteenth-century discussion of the *Lettre à Rameau.* This suggests that the *Lettre* didn't resonate with its contemporary readers. We cannot attribute its apparent irrelevance to the public's lack of interest in Castel: his star was rising, as the ocular harpsichord became a subject of discussion across Europe. We also cannot speculate that contemporary readers didn't care what Voltaire thought about the ocular harpsichord, as even after Voltaire's chapter on the instrument in the *Éléments de la philosophie de Newton* was removed from subsequent editions, his commentary there was quoted and repeated. Nor can we claim the *Lettre* was irrelevant because it was not read: though it was previously thought to have had a limited distribution, I have found that it was published at least four times in four years. So we may reasonably suppose that if no one discussed the

Lettre or adopted its pithy nickname, it was probably because its readers didn't find it very apt or funny.

This supposition is supported by the larger history of Voltaire's feud with Castel in the late 1730s, which was longer and trickier than critics have thought. This is both because Voltaire misrepresented its extent and outcome, and because it never quite became an open quarrel. Voltaire and Castel were engaged in a protracted struggle to embarrass one another publicly between 1737 and 1739. The *Lettre à Rameau* represents the climax of this struggle: Voltaire's attempt to expose Castel as a vindictive fraud, and goad him into open war. In the short term, and to Voltaire's evident irritation, he failed. This is how he described the situation in a 1738 letter to Maupertuis:

> Autre anecdote. Il y a un an qu'ayant des doutes que j'ai encore sur l'exactitude des rapports des couleurs et des tons de la musique, et ayant ouï-dire qu'un père Castel travaillait sur cette matière, et imaginant que ce Castel était newtonien, je lui écrivis, je lui demandais des éclaircissements que je n'eus point. Nous fûmes quelque temps en commerce, il me parla de son clavecin des couleurs. J'en dis un mot dans mes éléments d'optique, je lui envoyais même le morceau. Vous serez peut-être surpris que dans la quinzaine ce bonhomme imprima contre moi dans le Mercure de Trévoux les choses les plus insultantes et les plus cruelles. Cependant les libraires de Hollande sans que je le susse ont imprimé mon ouvrage et ses louanges, et ce misérable fou se trouve loué par moi après m'avoir insulté. Quand on est loin, qu'on imprime en Hollande, et qu'on a affaire à Paris, il n'en peut résulter que des contretemps. J'ai su depuis que ce fou de la géométrie est votre ennemi déclaré.[1]

This passage is frequently given as an unvarnished account of what it was like to deal with a supposedly unhinged Castel, but as we'll see, it is mostly varnish. Voltaire wrote this letter following an especially skilful sally from Castel, which he was trying to deflect by reordering the sequence of events that had led up to it. By the time Voltaire read the 'cruel', 'insulting' things he mentions, he was already well underway with his plan to circulate the anonymous *Lettre à Rameau*

[1] *Correspondence and related documents*, OCV, vols 85-135 (1968-77), 15 June 1738, D1519. Unless otherwise indicated, all references to correspondence are to this edition.

in Paris. Voltaire could see that Castel was riding the ocular harpsichord to glory, and he thought that he was just the man to bring him down to earth.

1. The Publication History of the *Lettre à Rameau*

As the account given here is complex and largely new, it will be useful to summarise the *Lettre's* publication history, before we go into the details. Historically, Voltaire's *Lettre à Rameau* was mistaken for a piece of private correspondence. This began with Kehl edition,[2] and continued into the current *Œuvres complètes*, where Besterman comments that although Voltaire wrote it to be printed as a pamphlet, 'it has so often been printed with the correspondence that it will be convenient to include it here', and reproduces the pamphlet in facsimile.[3] The OCV's critical edition, edited by Stenger, takes this four-page pamphlet as its base text. In the course of my research, I have identified some hitherto unattributed and misattributed references in the correspondence that make it clear that Voltaire wanted the *Lettre* to be widely read. I have also found that in addition to the pamphlet, it was published three times in journals. Comparison of these four publications with the tale that emerges in the correspondence shows that there were two slightly different versions circulated at different moments in Voltaire's attempts to publicise it.

As we saw in the previous chapter, Castel and Rameau's quarrel began with a letter from Rameau, which although addressed to Castel, was never sent to him directly. Instead, it eventually reached him in the second of three stages of circulation. First, Rameau wrote a manuscript version, which circulated in Paris. Then, it was printed as a pamphlet, and circulated again, supposedly reaching a wider readership, as it is at this point that Castel claims to have seen it. The

[2] 'Lettre IX à M. Rameau sur le père Castel et son clavecin oculaire', *Œuvres complètes de Voltaire*, Kehl Edition, 53, pp. 21-5.
[3] 'Lettre à Monsieur Rameau', ed. Gerhardt Stenger, OCV 18C, 3-23 (pp. 18-9). Unless otherwise noted, subsequent references refer to this edition.

pamphlet was then reprinted in a journal: in the case of Rameau's letter, the *Journal de Trévoux* chose to publish it, so that Castel could respond within their pages, too.

The *Lettre à Rameau* underwent a similar three-stage circulation. Voltaire wrote it in March 1738, and quickly sent it to his old friend and trusted agent Thiriot in Paris, for circulation as a manuscript.[4] In May, Thiriot sent it to the *Nouveaux Amusements du Cœur*, where it was accepted for the September 1738 issue.[5] Voltaire was very irritated when he learned about this, because the *Nouveaux Amusements* was new and poorly circulated, and he wanted the *Lettre à Rameau* to be read immediately in Paris: by Rameau, mathematicians and scientists, and Castel himself.[6] So, a pamphlet was also arranged, with slight revisions, and published a month later, dated 21 June 1738.[7]

This pamphlet somehow made its way to Amsterdam to the offices of the publisher Du Sauzet, who put it in his journal, the *Bibliothèque française*.[8] The *Nouveaux Amusements* struggled in its early years, and eventually folded. A few years later, when it relaunched to great success, the first few issues were reprinted, so the earlier version of the *Lettre* was published again in 1741, now bearing a date: May 1738.[9]

I have not found categorical proof that Castel read the *Lettre à Rameau*, and previous critics have concluded that he didn't know of its existence.

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[4] 10 April 1738, D1480.

[5] 'Lettre à Monsieur Rameau', *Nouveaux Amusements du cœur et de l'esprit* II, no. 6 (September, 1738), 113-119.

[6] 1 May 1738, D1489.

[7] These changes are all very minor, the main ones are: in the fourth paragraph, 'tandis que vous avez affaire' is changed to 'mais vous avez affaire'; in the fifth paragraph, 'avec quelle bonté, avec quelle condescendence' is changed to 'avec quelle bonté, quelle condescendence; the final line is changed from 'ne lui répondez point' to 'ne lui répondez pas'. So, the manuscript copies (MS1, K84, K85, and K12) were taken from the first version that was sent to the *Amusements*, and the pamphlet and *Bibliothèque française* represent the final version.

[8] 'Lettre à Mr. Rameau, sur le P. Castel, jésuite', *Bibliothèque Française* XXVII, no. 1 (1738), 105-110.

[9] 'Lettre à Monsieur Rameau', *Les Amusements du cœur et de l'esprit* II (1741), 265-271.

However, as we'll see, he probably did read it. The *Nouveaux Amusements* that published the *Lettre à Rameau*, first in 1738 and then again in 1741, also opened with a long piece by Castel: the *Dissertation philosophique et littéraire.*[10] However new or poorly circulated the *Amusements* was in this period, it was significant enough that the *Journal des savants* reviewed its publication of Castel's *Dissertation* the following spring.[11] If Castel ever wanted to see what was published alongside his work, he would have found the *Lettre* there.

This chapter gives the history of Voltaire's dealings with Castel and the ocular harpsichord in the period leading up to and immediately after the *Lettre à Rameau*, roughly 1735-1740. To do this effectively, I'll begin by discussing Voltaire's doomed attempts to work with Rameau—the context of Voltaire's first encounter with Castel, and the man to whom the *Lettre* is addressed.

2. Voltaire and Rameau

Voltaire followed Rameau's career from the moment the composer shot to fame with the production of his first opera, *Hippolyte et Aricie*. When he attended the premier on 1 October 1733, he didn't think much of it, writing to Cideville that, 'La musique est d'un nommé Rameau, homme qui a le malheur de savoir plus de musique que Lully. C'est un pédant en musique. Il est exact, et ennuyeux.'[12] However, Voltaire soon changed his mind, and by November, he had begun to work on a libretto for Rameau, *Samson*.[13] They collaborated on this project on and off for the next three years, troubled by creative differences and

[10] The full reference, with its long explanatory title: Castel, Louis-Bertrand, 'Dissertation philosophique et littéraire, où par les vrais principes de la physique et de la géométrie on recherche si les règles des Arts, soit mécaniques, soit libéraux, sont fixes ou arbitraires; et si le bon goût est unique et immuable, ou susceptible de variété et de changement', *Nouveaux Amusements du cœur et de l'esprit* II, no. 6 (September, 1738), 1-67.

[11] Review of Castel, *Dissertation philosophique et littéraire*, *Journal des Savants* (May, 1739), 890-902.

[12] 2 October 1733, D661.

[13] 15 December 1733, D689.

disapproving censors who objected to the biblical subject.[14] Meanwhile, Voltaire became embroiled in scandal over the *Lettres philosophiques*, and fled Paris to live secretly with his mistress, Madame du Châtelet, at her husband's ramshackle chateau at Cirey.

In Voltaire's absence, Rameau gradually lost interest in the project, and in 1736 he recycled some of its music for *Castor et Pollux*.[15] Voltaire deeply regretted 'l'enfant mort né de Samson',[16] and struggled to regain Rameau's attention; they ultimately made a second attempt at collaboration, *Pandore,* in 1740.[17] In short, throughout the period that he was sparring with Castel, Voltaire was actively looking for opportunities to approach Rameau.

Voltaire was reading the *Journal de Trévoux* in late 1735, while it was publishing Castel's *Nouvelles experiences*. We do not know if he read them at the time, but he was considering related issues, commenting that Castel's colleague Tournemine, 'dispute bien mal contre Mr. Locke, et parle de Newton comme un aveugle des couleurs.'[18] If the ocular harpsichord was not on Voltaire's radar, it is an odd coincidence that he used the aphorism of the blind judging colours to ridicule Tournemine, whose article was in the same issue in which Castel suggested that the blind could do just that:

> Or je le demande à quiconque n'est pas aveugle et bientôt aux aveugles mêmes qui ne sont peut-être pas aussi peu juges de couleurs qu'on le dit populairement, je demande si le rouge n'est pas en tout sens la couleur dominante de la nature?[19]

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[14] For the history of *Samson*, see Russell Goulbourne's introduction to the critical edition in OCV 18C; R.S. Ridgway, 'Voltaire's Operas', *SVEC*, no. 189 (1980), 119-51; Madeleine Fields, 'Voltaire and Rameau', *The Journal of Aesthetics and Art Criticism* 21, no. 4 (1963), 457-65; and Cuthbert Girdlestone, 'Voltaire, Rameau, et *Samson*', *Recherches sur la musique française classique* 6 (1966), 133-143.
[15] Cuthbert Girdlestone, *Jean Philippe Rameau* (New York: Dover, 1969), pp. 194-6.
[16] 23 April 1739, D1990.
[17] This project also fell apart, but was patched together for a performance by none other than Rousseau, who had just arrived in Paris. See introduction to *Pandore* in OCV, 18C.
[18] 30 November 1735, D950.
[19] NE.III, pp. 1827-8.

Voltaire was later to return to this idea with the short conte, *les Aveugles juges des couleurs.*

There is another circumstance that suggests that Voltaire may have been considering the ocular harpsichord in late 1735. That autumn, the Italian writer Algarotti visited the couple at Cirey, while all three of them were working on books about Newton. Algarotti's dialogues, *Il Neutonianismo per le dame,*[20] pair a gallant Newtonian with a curious Marquise, believed to have been modelled on Madame du Châtelet. In the style of Fontenelle's *Entretiens*, they wander through gardens, looking at the stars, and talking of the physics of the Universe. When the Newtonian brings up Castel's ocular harpsichord, the Marquise finds it so absurd that she thinks he's making fun of her. They come up with whimsical ways of using such an instrument, speculating that women could use it to match the colours of their outfits, and that doctors could use it to cure sick painters. They also laughingly propose to use it for dinners, by performing musical sauces—a suggestion that echoes similar jokes about the ocular harpsichord, published in *Le Pour et Contre* in August 1735.[21] In April 1736, Emilie du Châtelet wrote to Algarotti asking what he thought of Castel's 'musique', and if he would to send her a copy.[22] In summary, Algarotti's passage suggests that the ocular harpsichord may have been the subject of some hilarity during his stay at Cirey. Algarotti's passage led to a discussion in the press over whether these jokes were appropriate or funny; evidence that it was controversial to ridicule the ocular harpsichord in the late 1730s.[23]

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[20] Published in Italian in 1737, and French in 1738. Francesco Algarotti, *Il Neutonianismo per le dame,* 2 vols (Napoli: n.p., 1737); Francesco Algarotti, *Le Newtonianisme pour les dames,* trans. Perron de Castera (Paris: chez Montalant, 1738). For a history of their friendship and the publication of Algarotti's *Newtonianisme*, see: Haydn Trevor Mason, 'Algarotti and Voltaire', In *Mélanges à la mémoire de Franco Simone*, 4 vols (Geneva: Slatkine, 1981) II, pp. 467-480.

[21] Antoine François Prévost, 'Musique des couleurs, clavecin oculaire', *Le Pour et Contre* VI, no. XVI (August, 1735), 11-20 (p. 15).

[22] 20 April 1736, D1065.

[23] See Annex II, nos 13-17.

In any case, the first reference we have to Castel in Voltaire's letters is from November 1736, when he began to take an interest in the quarrel with Rameau. When Voltaire wanted updates on the quarrel, he wrote to correspondents who would have seen Rameau in person on a regular basis. On 10 November,' he wrote to Berger, secretary to Rameau's patron, the Prince de Carignan: 'Comment pourrait on faire pour avoir par écrit le procès de Castel & de Rameau? Vous êtes un correspondant à qui on peut demander de tout. Envoyez moi ce procès. Ecrivez moi souvent.'[24] A week later, Voltaire wrote to Thiriot for news. Thiriot was living at the home of the wealthy patron la Pouplinière, who afterwards became Rameau's protector, and whose mistress, Thérèse Deshayes, was taking music lessons from Rameau. (As we saw in the previous chapter, Deshayes also reviewed Rameau's *Génération harmonique* for *Le Pour et Contre*.) Voltaire framed his request in terms that would have pleased Rameau: 'vous devriez bien vous égayer à m'envoyer la dispute d'Orphée Rameau avec Euclide Castel. On dit qu'Orphée a battu Euclide. Je crois en effet notre musicien bien fort sur son terrain.'[25]

Rameau had withdrawn from Voltaire, so getting Thiriot to pass on flattering messages in person was the surest way to reach him. Madame du Châtelet evidently had the same expectation, as she also wrote to Thiriot to plead for *Samson* and advise Rameau on his quarrel with Castel. She thought Rameau had better points to make, but that he sounded smug:

> J'ai bien regret à Samson, mais n'y a-t-il plus d'espérance? Rameau a travaillé jusqu'à présent sur de si mauvaises paroles, qu'il n'est pas étonnant qu'il ait échoué aux scènes. Je lui fais mon compliment de Castor et Pollux, j'ai lu ses lettres au p. Castel, j'en suis très contente, mais j'y voudrais moins d'amour propre. Je suis accoutumée à voir le plus grand mérite et la plus grande modestie jointe ensemble, et je trouve que cela est très bien assorti.[26]

[24] 10 November 1736, D1197.
[25] 18 November 1736, D1202.
[26] 16 January 1737, D1260.

Throughout this period, Voltaire relied upon Thiriot's presence in Paris, as a series of scandals had made it difficult for him to be there to take care of things himself. He had visited the capital the previous summer, once the controversy over the *Lettres philosophiques* had died down, but while he was there, and while in the carriage on his way back to Cirey, he wrote a new work, *Le Mondain*.[27] This satirical poem on luxury was intended for private circulation among friends, but it could not be controlled once copies got to Paris in November, and it triggered a fresh outrage. *Le Mondain* celebrated libertine philosophy, denigrated Jansenist frugality, and, in a jokey passage that describes Adam's dirty fingernails, implied that the state of innocence had not been pure and pleasant, but barbaric and impoverished.[28] While it is not exactly polemical in nature, *Le Mondain* found itself in the hands of readers who had been primed by other scandals to view Voltaire as a deist, and it was humorously combed for confirmation of its author's amorality. *Le Mondain*'s structure also echoed Pope's *Essay on Man*, which encouraged readers to see it as a continuation of the praise Voltaire had expressed for Pope in the *Lettres philosophiques*.[29] By late December, it had caused such a scandal that Voltaire fled France for Holland.[30]

3. Optimism

In January, February, March, and June 1737, the *Journal de Trévoux* published a four-part review of Leibniz's *Theodicy.*[31] The editors of the *Trévoux* evidently wanted to draw attention to it, as three of its four parts headed the issues in which they appeared. They also assigned one of their leading writers to the

[27] 'Le Mondain', ed. by H.T. Mason, OCV 16, pp. 269-313 (pp. 273-4).
[28] André Morize, *L'apologie du luxe au XVIIIième siècle et 'le Mondain' de Voltaire* (Geneva: Slatkine Reprints, 1970), pp. 35-45.
[29] See Nicholas Cronk, 'The Epicurean Spirit: Champagne and the Defence of Poetry in Voltaire's "Le Mondain",' *SVEC*, no. 371 (1999), 53-80.
[30] See '"Le Mondain": Composition, Publication' in Morize.
[31] Review of Leibniz, *Essais de théodicée, nouvelle édition par M.L. de Neufville. Journal de Trévoux* (1737), I, 5-36; II, 197-241; III, 444-471; IV, 953-991.

project, and one who had written about Leibniz before—Castel. The review is not signed (standard practice at the *Trévoux*) but Castel's authorship is not in doubt. He also included publicity for one of his recent books, and his distinctive style would probably have been identifiable to regular readers.[32]

Castel spent the first part of his review summarising Leibniz's biography, and accusing the editor of the new edition, Neufville (a pseudonymous Jaucourt) of plagiarising his own June 1721 article on Leibniz. Having dispatched these preliminary matters and established his authority, Castel began his second article by acknowledging that the *Theodicy* was probably unknown to most readers. This, he wrote, was why the *Trévoux* had decided to give this serious and worthwhile work its due, and carefully explain the full significance of Leibnizian philosophy.

Castel wrote that although Leibniz was not maliciously or deliberately irreligious, his desire to reconcile disparate philosophies, added to his mania for system-building, had led him into error. As a result, Castel found that Leibniz' philosophy of the 'optimum' was morally and philosophically corrupt. Despite Leibniz' admirable desire to see goodness as the motor of the world, the system he had made was too simplistic, and its consequences were suspicious and surprisingly far-reaching. To sum up this system and the troubling modern attitude which it had made possible, Castel created a new word, 'Optimism': 'En termes de l'art, il l'appelle *la raison du meilleur* ou plus savamment encore, et théologiquement autant que géométriquement, le système de *l'Optimum*, ou *l'Optimisme*.'[33] Yet although Leibniz had given 'optimism' a credibility it didn't

[32] Ibid., p. 31. The work Castel publicises is his preliminary discourse to: Edmund Stone, *Analyse des infiniments petits, comprenant le calcul intégral dans toute son étendue, etc. traduit par M Rondet* (Paris: Gaudoin et Giffard, 1735).
[33] Emphasis Castel's. Ibid., p. 207. Both the *Oxford English Dictionary* and the *Trésor de la langue française* cite this as the first use of optimism in any language. See also, Laurent Loty, 'Optimisme, Pessimisme', in *Dictionnaire européen des lumières,* ed. Michel Delon (Paris: Presses universitaires de la France, 1997), pp. 794-797.

have before, Castel did not hold him responsible for inventing it, or for its dire implications:

Il n'est ni le seul ni le premier auteur de cette pensée. Des théologiens réputés catholiques, parce qu'ils croyaient et qu'ils voulaient l'être de bonne foi, ont été optimistes. […] Ne taxons point les personnes, et n'attribuons point à leur cœur ce qui n'était souvent qu'un préjugé de leur esprit. On ne prévoit pas toujours toutes les conséquences, de tout ce qu'on pense avec le plus de réflexion.[34]

Although optimistic ways of thinking had ensnared other, highly pious minds, until Leibniz, it had not taken hold in less devoted thinkers. The fact that now it had was alarming, because 'Optimism' is a materialist vision of an amoral world, disguised by professed faith in goodness:

L'Optimisme, celui du moins de M. Leibnitz, n'est qu'un matérialisme déguisé, un spinosisme spirituel dont toute la théorie de cet auteur est par vingt autres endroits plus que suspecte. Son harmonie préétablie en rendant la marche de nos esprits, invariablement parallèle à celle de nos corps et de tous les corps de l'univers, assujettit les opérations des uns et des autres aux mêmes lois de mécanisme aveugle et purement corporel.

Optimism turns God into an automaton,[35] because it is the result of a broken modern science, which is too mechanistic to be compatible with the concept of free will, whether human or divine.[36] If people are taught to believe in a broken physics, it is not surprising that their understanding of metaphysics will be broken as well:

Une mauvaise physique rend, à coup sûr, les gens mauvais théologiens. Ils voient que Dieu ayant tiré le bien du mal par un second ordre de Providence, la plupart de nos biens, de nos plaisirs, de nos joies naissent du sein de la misère, de la douleur, de la tristesse; et ils s'imaginent que ce qui est, doit être, et qu'absolument il faut avoir du mal, pour avoir du bien.[37]

[34] Review of *Théodicée* II, p. 208.
[35] Ibid., p. 210.
[36] Ibid., p. 215.
[37] Ibid., p. 217.

In this way, Leibniz had inadvertently opened the floodgates to a new form of popular philosophy: 'M. Leibniz, avec un génie véritablement inventif, a ouvert une carrière toute nouvelle, et introduit une nouvelle mode de philosophie bel esprit. ... Quoiqu'il en soit, la plupart des beaux esprits ont suivi cette veine, et la suivent aujourd'hui.'[38] Castel's readers must have been surprised to learn that the majority of their *beaux esprits* subscribed to a vision of the world that was at once godless, absurd, and previously unknown to them, and wondered who exactly he could mean. Castel now arrived at the crux of his argument for 'optimism' as an alarming modern trend. The attitude that everything eventually works itself out because evil is the necessary cause of good can seem moderate in the hands of an intelligent and subtle man like Leibniz. However, once in the hands of outrageous *beaux esprits* like Pope and Voltaire, optimism becomes a dangerous weapon:

> Voilà ce qui donna lieu, dans le siècle passé, ou au commencement de celui-ci, à la secte des beaux esprits dont nous parlons. Ils ne critiquent point la Providence, mais ils ne l'anéantissent que mieux, en faisant semblant de lui applaudir. Tout est bien, tout est mieux, tout est très-bien. Le mal n'est pas un mal, puisqu'il est la cause nécessaire du bien, nécessaire à dieu même, qui non seulement sait tirer le bien du mal, mais ne le sait, ou ne le peut tirer que de là; non seulement encore malgré sa sagesse, mais précisément à cause même de sa sagesse. M. Leibnitz, homme modéré, homme intelligent et précautionné, n'a glissé tout cela que par la voie du raisonnement, de la persuasion, de l'insinuation. Les esprits outrés de notre siècle qui n'en manquent pas, ont éventé la mine et brusqué le raisonnement. Un P*** en Angleterre, un V*** en France, comme s'ils avaient une mission spéciale pour cela, et avec une espèce d'enthousiasme, ne cessent de nous prêcher en prose et en vers, qu'il n'y a pas de mal, que la nature est bien, que le système régnant est celui de la belle nature, qu'elle est telle qu'elle a dû être, qu'elle ne pouvait être autrement, que l'homme a commencé par là, que l'état d'innocence n'est qu'une chimère.[39]

While Pope had adopted a decidedly Leibnizian stance, Voltaire had not, and Castel's choice to paint them both as fanatic Optimists is unfair. Yet Castel leaves

[38] Ibid., p. 219.
[39] Ibid., pp. 221-2.

aside his reference to Pope, whose *Essay on Man* had just been translated into French. Instead, he writes that despite the principle of poetic license, one cannot help remarking that a poet's personal enthusiasm for disfiguring and making a travesty of religion must be great indeed, if that poet goes so far as to prefer the pagan age of iron to the Christian age of gold. This transition introduces a quotation from *Le Mondain*:

> Regrettera qui veut le bon vieux temps
> Et l'âge d'or et le siècle astrée, […]
> Oh le bon temps que le siècle de fer![40]

Nicholas Cronk has made a compelling case for reading *Le Mondain* 'as a further stage in Voltaire's dialogue with the English poet, a response to this shocked discovery that their thinking was running in parallel.'[41] Castel's review supports this reading, showing that parallels between Pope and Voltaire were observed by contemporary readers and taken as proof of Voltaire's animus for Christianity. However, Castel does not pursue the issue further, writing that his point is not to critique poetic lines in depth, but to show his readership how influential and insidious this Optimism is. Concluding that he intends to discuss Leibniz 'sans parler des conséquences affreuses qu'en tirent les prétendus beaux esprits dont nous venons de parler',[42] Castel abruptly moves on to summarize *Theodicy's* preface.

Close reading of Castel's review puts it beyond doubt that he invented *optimisme* to vilify figures like Pope and Voltaire. His review is long, carefully researched, devoid of overt hostility for Leibniz, and his use of the term is limited to a short self-contained section that culminates with criticism of *Le Mondain*, and the very end of the review. Throughout the rest of the series, he instead

[40] This is a slight misquotation, though a convenient one for the point Castel is making. The lines ought to read, 'Regrettera qui veut le bon vieux temps/ et l'âge d'or et le règne d'Astrée/ …. Ah le bon temps que ce siècle de fer!' OCV 16, pp. 295-6, lines 1, 2 and 21.
[41] Cronk, p. 62.
[42] Review of *Théodicée* II, p. 224.

refers to the 'philosophie du mieux' or 'le système de l'optimum'. It is also clear that Castel didn't want his readers to forget his new word, or that its intended target was not Leibniz himself, as his last use of *optimisme* is in the concluding line of the fourth and final part of his review. The *Théodicée*,

> Mérite l'attention des théologiens: et ils y trouveront à profiter soit pour adopter beaucoup de bonnes choses […] soit pour la réfutation de ce fonds d'optimisme spinosiste qui y est peut-être mieux exposé qu'on ne le trouve partout ailleurs.[43]

On the first of March, Voltaire wrote to Jaucourt, who, as the editor and translator of the *Theodicée* Castel had reviewed, had been accused of plagiarism. Voltaire said that he had heard of this 'revolting review' by the 'so-called tyrants of the republic of letters', though he claimed not to have read it himself, and made no mention of the comments aimed at *Le Mondain*. Who, he wondered, did the *Trevoux*'s Jesuits think they were? As far as he could tell, they were pathetically embittered by their lack of real power, and their mediocrity:

> On dit que les jésuites dans leur journal de *Trévoux* ont fait un extrait bien révoltant de la *Théodicée*. Je n'ai point vu ce journal mais je sais qu'en général ces prétendus tyrans de la république des lettres réussissent fort mal auprès de ceux à qui ils veulent imposer des lois, et qu'on regarde leur journal, comme des édits que le roi Stanislas donnerait en Pologne ou le prétendant à Londres. Vouloir dominer sur les esprits, et n'avoir pas la force, c'est à dire la raison de son côté, est une grande misère.[44]

Jaucourt apparently made no reply to this provocation, as a month later Voltaire prodded him again: what did he make of Castel's bizarre combination of absurdity and insolence? In his opinion, it was just like a *Trévoux* Jesuit to overreach his limitations in such an impoverished, incompetent way:

> Avez-vous vu l'étrange extrait qu'un certain jésuite a donné dans ce malheureux journal de *Trévoux*, de la *Théodicée*? C'est un chef d'œuvre d'absurdité et

[43] Ibid., p. 901.
[44] 1 March 1737, D1292.

d'insolence, mais qui ne doit point surprendre, ces gens-là veulent être tyrans de la république des lettres. Mais il n'y a rien de si pauvre que des tyrans sans pouvoir et sans raison.[45]

However vile Voltaire found this review and the *Journal de Trévoux* in general, he clearly didn't think they were without power, as his other letters demonstrate attempts to get his situation with Castel under control. He wrote to Castel himself and by mid-March he was waiting for Moussinot to forward his reply.[46] And if we are to believe his letter to Maupertuis, it was around this time that he wrote his flattering chapter about the ocular harpsichord.

4. Voltaire Attempting to Placate Castel

In the fourteenth chapter of the 1738 *Éléments de la philosophie de Newton*, 'du rapport des sept couleurs primitives avec les sept tons de la musique', Voltaire characterised Castel as an ingenious philosopher who deserved the public's gratitude. Without naming Castel outright, the chapter thanks him for his industry and imagination:

Un philosophe ingénieux a voulu pousser ce rapport des sens et de la lumière peut-être plus loin qu'il ne semble permis aux hommes d'aller. Il a imaginé un clavecin oculaire, qui doit faire paraître successivement des couleurs harmoniques, comme nos clavecins nous font entendre des sons: il y a travaillé de ses mains, il prétend enfin qu'on jouerait des airs aux yeux. On ne peut que remercier un homme qui cherche à donner aux autres de nouveaux arts et de nouveaux plaisirs.[47]

Even if it was possible to experience colour music, and such a thing was not beyond the limitations of the senses, Voltaire was not convinced that it would be nice to look at. Colour music might be too abrupt and dazzling to have any effect

[45] 29 March 1737, D1305.
[46] 18 March 1737, D1299.
[47] Voltaire, *Éléments de la philosophie de Newton*, OCV 15, pp. 393-4.

upon the eyes, apart from exhausting them. Yet Voltaire hedges comments on the instrument with praise for its inventor:

> Il y a eu des pays, où le public l'aurait récompensé. Il est à souhaiter sans doute, que cette invention ne soit pas, comme tant d'autres, un effort ingénieux et inutile: ce passage rapide de plusieurs couleurs devant les yeux semble peut-être devoir étonner, éblouir, et fatiguer la vue; nos yeux veulent peut-être du repos, pour jouir de l'agrément des couleurs. Ce n'est pas assez de nous proposer un plaisir, il faut que la nature nous ait rendus capables de recevoir ce plaisir: c'est à l'expérience seule à justifier cette invention.[48]

Noting that the ocular harpsichord has not been produced, he acknowledges that even if the effort is in vain, the ambition to increase the scope of art and nature is worthy of admiration: 'En attendant, il me paraît que tout esprit équitable ne peut que louer l'effort et le génie de quiconque cherche à agrandir la carrière des arts et de la nature.'[49] So however interesting it was as a concept, Voltaire would not accept the ocular harpsichord as a legitimate idea, until it existed as a thing that could be heard and seen.

We don't know how Castel responded to these overtures, as we do not have their letters to each other. However, it seems that Voltaire's efforts fell flat. In June, the *Journal de Trévoux* published the fourth and final part of the *Theodicy* review, with Castel's concluding line about the 'fond d'optimisme spinosiste' being best identified 'elsewhere'. At the end of that month, Voltaire wrote to d'Argens with a list of things to ridicule in the *Mémoires secretes*, including the 'absurd impertinence' of the *Trévoux* Jesuits for painting Pope as diabolical, and Castel's idiocy in an early work, the *Mathématique universelle*:

> Le goût que vous avez pour le bon et pour le vrai ne vous permettra pas de passer sous silence […] l'impertinence absurde des jésuites qui dans leur misérable journal viennent d'assurer que les Essais de Pope sur l'homme sont un ouvrage diabolique contre la religion chrétienne; pareilles impertinences dans le père Castel, qui dans un livre de mathématiques, pour faire comprendre que le

[48] Ibid., p. 393.
[49] Ibid., p. 394.

cercle est un composé d'un infini de lignes droites, introduit un ouvrier faisant un talon de souliers, qui dit, qu'un cône n'est qu'un pain de sucre, &c, et que ces notions suffisent pour être bon mathématicien.[50]

Voltaire, still hoping to collaborate with Rameau, continued sending encouraging remarks to Thiriot. He began appending Castel's former nickname 'Euclid' to Rameau's, making him 'l'Euclide-Orphée',[51] and rechristened Castel 'Zoïle', an ancient critic famous for his blistering attacks on Homer. By early 1738, the quarrel between Castel and Rameau had started up again, and Voltaire again requested news.[52]

5. Letters to Thiriot About a Letter to Rameau

In March 1738, Voltaire lost control over the publication of the *Éléments*. He had left a copy of his unfinished manuscript with the publisher Ledet on a recent trip to Amsterdam, and then had trouble obtaining permission to print and sell it in Paris. Meanwhile, Ledet had invested quite a lot of money laying out the pages that were finished and commissioning engravings for its many diagrams and illustrations. After a while, he decided that he was not willing to wait any longer and risk losing his investment, so he got a mathematician to complete Voltaire's unfinished chapters, and published an unauthorised edition. Hoping to sell as many copies as he could, he tacked on an inviting subtitle: 'Mis à la portée de tout le monde.'

Voltaire was angry about errors in the unauthorised edition, but he was especially embarrassed by the subtitle, which suggested that his work was a popularisation intended to simplify Newton for a general audience, rather than a

[50] 22 Jun 1737, D1342.
[51] 3 November 1737, D1383. In this letter, Voltaire discusses Thérèse Deshayes' review of the *Génération harmonique*, which evidently circulated in some other form before Prévost printed it, as Voltaire had read it two months before it appeared in *Le Pour et Contre*.
[52] 22 March 1738, D1471.

serious engagement with the new philosophy underlying and suggested by Newton's physics.[53] The subtitle implied that Voltaire was trying to do with Newton exactly what Castel had accused him of doing with Leibniz the year before: develop a career in what Castel had dubbed 'une nouvelle mode de philosophie *bel esprit*'.

Voltaire had recently learned of Ledet's decision to print the *Éléments* when he wrote to Thiriot on 28 March, mentioning that 'someone' had 'shown' him an amusing letter to Rameau about Castel. Voltaire thought that Rameau ought to publish a reply, but he was worried to send the letter on, lest it be attributed to him. If Thiriot would promise not to let that happen, then he was happy to share it:

> On m'a fait cent chicanes, cent tracasseries pour mes éléments de Newton. Ma foi je les laisse là. Je ne veux pas perdre mon repos pour Newton même. Je me contente d'avoir raison pour moi. Je n'aurai pas l'honneur d'être apôtre, je ne serais que croyant. On m'a fait voir une lettre à Rameau sur le Révérend père Castel qui m'a paru plaisante, et qui vaut bien une réplique sérieuse, mais je n'ose même l'envoyer de peur qu'une tracasserie me passe par les mains. Si vous étiez homme à promettre *jure jurando* secret profond et inviolable, je pourrais vous envoyer cela. Car si promettez tiendrez.[54]

Shortly thereafter, the situation became more urgent, as the unauthorized edition of the *Éléments* arrived in Paris. The same day that Voltaire received this news, he sent Thiriot the *Lettre à Rameau*: 'Vous verrez ci-jointe la lettre d'une bonne âme à Orphée Rameau sur Zoïle Castel. *Secretum petimus que Damus que vicissim.* Ce Castel là est un chien enragé, c'est le fou des mathématiques, et le tracassier de la société.[55]

The decision to send the *Lettre* may have been impulsive, and perhaps Voltaire regretted it. The drafts of his letters testify to a considerable amount of anxiety as he went back and forth on how hard to push Thiriot, writing passages

[53] See Walters and Barber's introduction to the *Éléments* in OCV 15, specifically pp. 70-4.
[54] 28 March 1738, D1474.
[55] 10 Apr 1738, D1480.

about the *Lettre* that he then crossed out. Voltaire seems to have been less worried that it would fall into the wrong hands than he was that it would fail to fall into the right hands, as he evidently wanted the *Lettre* to be read by certain people, and wanted to know how they reacted to it, without putting the proof of his authorship in writing. Two weeks on, Thiriot had not acknowledged or sent news about the *Lettre à Rameau*, so in a postscript on 23 April, Voltaire wrote:

Vous deviez bien accuser au moins la réception de la lettre à Rameau; et nous informer quel usage vous en faites. Recevoir paquets et n'en pas avertir son monde c'est le mettre en inquiétude. Je vous embrasse de tout mon cœur.[56]

Then he had second thoughts, and crossed this section out:

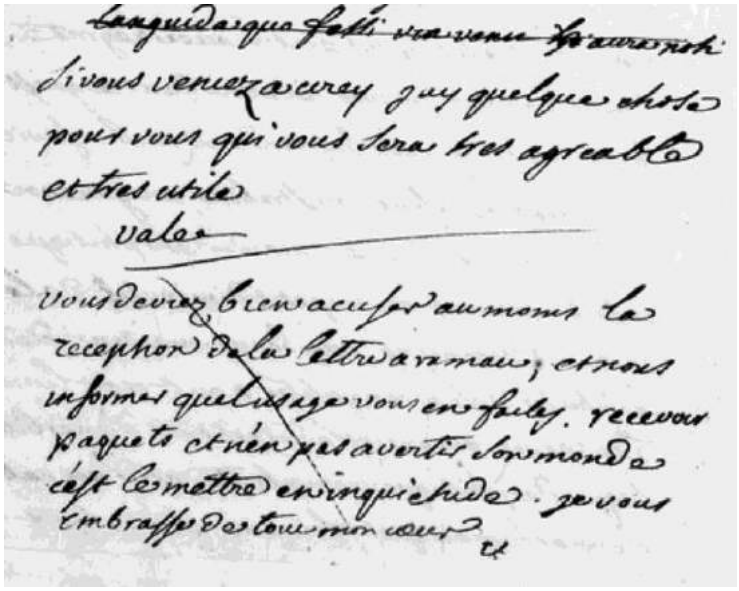

Illustration 7. Voltaire's Cross-Out

He didn't have to wait much longer: it seems that in the week that followed, Thiriot informed him that the *Lettre* was going to be published in the *Nouveaux Amusements*. On 1 May, Voltaire began a letter with angry complaints about Thiriot's terrible mishandling of a certain piece of writing:

[56] 23 April 1738, D1483.

Vous faites fort mal mon cher ami d'envoyer l'écrit en question à ce misérable journal très mal fait, presque inconnu, qui ne se débite que tous les trois mois, qui ne sera dans Paris que dans un an, et dont il vient tout au plus une vingtaine d'exemplaires. Vous avez cent autres débouchés. On peut obtenir des permissions, on peut se servir des brochures hebdomadaires, vous devriez même consulter le R. père sur l'ouvrage, en lui faisant tenir une copie. Je suis sûr que la lecture lui fera impression. Il faudrait consulter de la même façon les mathématiciens qui ont examiné les mêmes problèmes. J'abandonne le tout à votre prudhomie.[57]

In notes to this letter, Besterman speculates that 'l'écrit en question' was an early memorandum on the *Éléments*, and disagrees with Charrot, who identifies the 'R père' as Castel, on the grounds that Voltaire, 'had recently produced a public criticism of Castel, and it is therefore out of the question that he should have referred a Newtonian problem to him so soon after.' Yet the 'public criticism' Besterman mentions is the *Lettre à Rameau*, which in its previously known pamphlet form, did not appear until June. My discovery that the *Lettre à Rameau* was published in the *Nouveaux Amusements du Cœur*, and later dated 'May', upon reprinting, makes it much more likely that this passage discusses when and where the *Lettre* should be published. It is unlikely that Voltaire would have described the *Bibliothèque française* as miserable, poorly made, or unknown: it was trimestrial, but it had been running since 1723, published lots of his other works and letters, and its editor, Du Sauzet, was effectively functioning as his Amsterdam agent.[58] In contrast, the *Amusements* had been launched less than a year before, closed not long afterwards, and in its reprint, misspelled the title as the *Letre à Rameau*—in short, it fits Voltaire's description.[59] These comments

[57] 1 May 1738, D1489.

[58] Du Sauzet also handled the early version of *Micromégas*, another work from the same period that mocks Castel. On this and Voltaire's general relationship with Du Sauzet, see: Edwin Van Meerkerk and Theodore E.D Braun, 'From the *Voyage du baron de Gangan* to *Micromégas*: new documentary evidence linking Voltaire's space odysseys', *SVEC*, no. 6 (2002), 371-384.

[59] On the two journals' histories, see Jean Sgard, *Dictionnaire des journaux 1600-1789,* (Oxford: Voltaire Foundation, 1991) <http://dictionnaire-journaux.gazettes18e.fr>; See also the entry on Du Sauzet in: Jean Sgard, *Dictionnaire des journalistes 1600-1789*, (Oxford: Voltaire foundation, 1999) <http://dictionnaire-journalistes.gazettes18e.fr>.

must be about the *Lettre* itself: Thiriot had sent it to the *Amusements*, and Voltaire was angry because he wanted it to circulate in Paris as widely and as soon as possible.

Yet here again, Voltaire had second thoughts, and decided not to send this paragraph. Perhaps he was not sure that he could trust Thiriot, or perhaps he simply realized that he could get the *Lettre* published somewhere else, himself. In any case, Voltaire evidently found this exercise of self-control frustrating. In contrast to the airy lines he typically used for editing his letters, this passage is crossed out with an angry, forceful scribble.

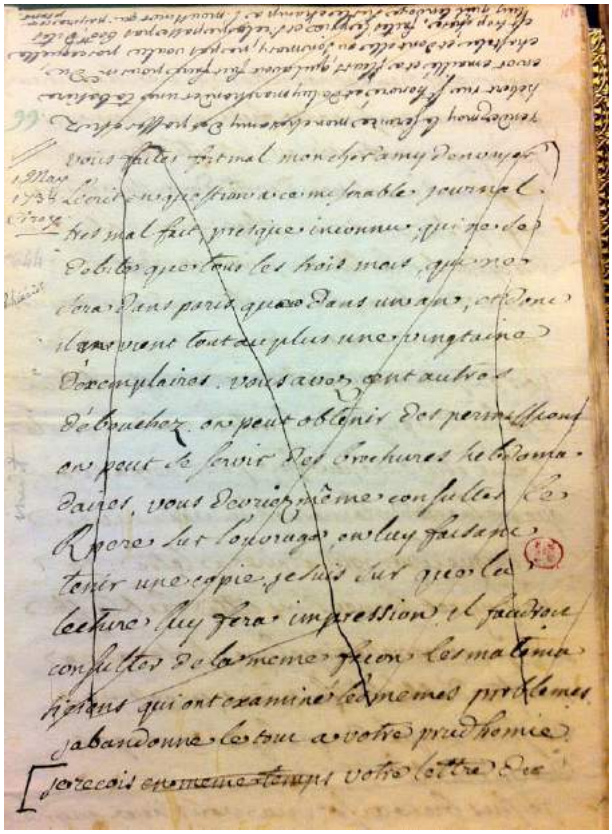

Illustration 8. Voltaire's Scribble

6. Chimera or Pegasus?

The extended history of the *Lettre*'s composition and publication speaks to a significant amount of deliberation and care, and Voltaire had done a lot of research on Castel by the time he wrote it: the *Lettre* touches upon almost every

major publication and quarrel that Castel had been involved in since his arrival in Paris. As a result, the contents of the *Lettre* are too rich to be exhausted by this chapter, which explores Voltaire's dynamic with Castel in order to give context to the ocular harpsichord. Instead, we'll focus on contrasting the *Lettre*'s well-known 'Don Quixote' nickname with another epithet, 'Bellerophon', and on comparing the *Lettre'*s comments to those made in the *Éléments.*

Voltaire's *Lettre à Rameau* should be read as a frustrated attempt to undermine Castel's persona as the celebrated inventor of the ocular harpsichord, and focus attention on Castel as a vindictive madman. The intention to casually destroy an otherwise positive reputation is evidenced by the *Lettre*'s phrasing, and its conspicuous errors.

For instance, Voltaire prefaces his ridicule of Castel's 1724 *Pésanteur universelle* by acknowledging that nobody discusses it when talking of Castel: 'Pour apprendre à connaître votre maitre, sachez encore ce que vous avez ignoré jusqu'ici avec le public nonchalant, qu'il a fait un nouveau système de physique, qui assurément ne ressemble à rien, et qui est unique comme lui.'[60] Having introduced it, he evades the impression of having combed Castel's early works in search of things to ridicule by invoking an 'intrepid man' who'd already read it, and showed him the silliest pages:

> Ce système est en deux gros tomes. Je connais un homme intrépide qui a osé approcher de ces terribles mystères. Ce qu'il m'en a fait voir est incroyable; il m'a montré, livre 5, chapitres 3, 4, et 5, que ce sont les hommes qui entretiennent le mouvement dans l'univers, et tout le mécanisme de la nature, et que s'il n'y avait point d'hommes toute la machine se déconcerterait; il m'a fait voir de petits tourbillons de roues engrenées les unes dans les autres, ce qui fait un effet charmant, et en quoi consiste tout le jeu des ressorts du monde. Quelle a été mon admiration! quand j'ai vu page 309, second partie ce beau titre, 'Dieu a créé la nature et la nature a créé le monde'.

[60] 'Lettre à Rameau', pp. 18-9.

Perhaps some intrepid man did show Castel's book to Voltaire, but Voltaire had also ordered a copy for himself,[61] and took accurate notes on what he read there. Then, he ended up misquoting it: page 309 reads 'Dieu ayant créé la Nature, la Nature a produit le monde.'[62] These changes may be minor, but they do make Castel's phrasing seem considerably more stupid. Considered closely and in context, errors like these look like studied, needling shows of nonchalance.

Voltaire opens the *Lettre* by congratulating Rameau on the rare honour of being attacked by 'quelque vilain pédant ennuyeux' within his own lifetime, and concludes by advising Rameau not to bother responding to Castel's attacks, which are motivated by a quixotic delusion of grandeur:

> Il est encore tout glorieux des combats qu'il a rendus contre les Newton, les Leibniz, les Réaumur, les Maupertuis: c'est le Don Quixote des mathématiques, à cela près, que Don Quixote croyait toujours attaquer des géants, et que le révérend père se croit un géant lui-même.[63]

It is possible that critics looking to summarise the attitude of the *Lettre à Rameau* have selected this particular quotation because it is one of the only parts that is straightforwardly critical. The *Lettre* is deeply sarcastic, so it is difficult to quote it out of context. In any case, apart from the fact that the nickname apparently didn't catch on until much later, when its primary appeal was that it was Voltaire who had invented it, there are a number of reasons that we cannot take it at face value.[64] First of all, this passage is also full of conspicuous inaccuracies. Castel

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[61] 30 Nov 1736, D1213.

[62] *Traité de physique sur la pesanteur universelle des corps,* 2 vols (Paris: André Cailleau, 1724) II, p. 309. Among Voltaire's notes on Castel in the Leningrad notebooks, OCV 81, p. 324: 'Dieu ayant créé la nature, la nature a produit le monde. Castel 309.2.'

[63] 'Lettre à Rameau', p. 22.

[64] See, for example, these introductory comments to an 1868 biography of Castel: 'Le P. Castel appartient à cette classe d'esprits pénétrants et inhabiles, lumineux et confus. Il ne faut pas lui demander une doctrine suivie et un système exact; ses théories sont mal définies, ses idées sur la musique sont incomplètes; son invention du clavecin oculaire ne se réalisa jamais, et Voltaire avait raison de l'appeler le *Don Quichotte des mathématiques*.' M Bertrand, 'Un rêve de savant au XVIIIe siècle: le père Castel', *Le Correspondant* 75, no. 39 (1868).

had indeed had a nasty quarrel with Réaumur, but it is inaccurate to describe him as having had 'combats' against Newton, Leibniz, or Maupertuis.

In the passage that mentions the ocular harpsichord, Voltaire repeats the argument used in the *Éléments de la philosophie de Newton*, pointing out that twelve years after its 'invention', the instrument has still not been completed. However, in the *Lettre à Rameau*, this critique of non-existence is made to reinforce another point, whose subtlety has since struck critics as so mysterious that some have chosen to correct it.

In the *Éléments,* Voltaire calls for the public to thank Castel for attempting to enrich their lives with the ocular harpsichord, even if the limitations of the senses means it is impossible or doomed to be unpleasant. In contrast, the *Lettre à Rameau*'s sole reference to the ocular harpsichord presents it as evidence of the personal absurdity that makes Castel impossible to argue with. Voltaire brings it up to sympathise with Rameau for working within limitations that don't apply to Castel. Where Rameau is limited to 'calculating' music for the ears, his rival is a man who makes music for the eyes, which means that instead of sticking to established principles and moving step by step, Castel does something else:

> Vous pouvez disputer contre nous, Monsieur, qui avons la pauvre habitude de ne reconnaître que des principes évidents, et de nous traîner de conséquence en conséquence; mais comment avez-vous pu disputer contre le révérend père Castel ? En vérité, c'est combattre contre Bellérophon. Songez, Monsieur, à votre téméraire entreprise; vous vous êtes bornés à calculer des sons, et à nous donner d'excellente musique pour nos oreilles; mais vous avez affaire à un homme qui fait de la musique pour les yeux. Il peint de menuets, de belles sarabandes. Tous les sourds de Paris sont invités au concert qu'il leur annonce depuis douze ans; et il n'y a point de teinturier qui ne se promette un plaisir inexprimable à l'opéra des couleurs que doit représenter le révérend physicien avec son clavecin oculaire. Les aveugles mêmes y sont invités; il les croit d'assez bons juges des couleurs, il doit le penser, car ils en jugent à peu près comme lui de votre musique.[65]

[65] 'Lettre à Rameau', pp. 16-17.

Leaving aside the reference to the blind judging colours, which we've already seen at the beginning of this chapter, the key to this passage lies in Voltaire's reference to Bellerophon, the mythological prince who killed the chimera by riding on the back of the flying horse, Pegasus. Some criticism of the ocular harpsichord had indeed described it as a chimera, as Castel himself acknowledged. However, if Voltaire intended his reference to Bellerophon to call the chimera to mind, then his framing of Castel as its vanquisher looks like a mistake: if the ocular harpsichord is a chimera, then Rameau should be Bellerophon, instead. Following this logic, the Kehl *Œuvres* corrected the passage to read 'combattre comme Bellérophon'.[66] The Oxford *Œuvres* faithfully changes it back again, but Stengher comments in a footnote that the reference, 'est diamétralement opposée à l'idée que Voltaire veut exprimer réellement.'[67]

If this was a mistake, then it was a startlingly clumsy one, as it appears in the middle of a carefully worded passage where Voltaire uses a light touch to persuade Rameau to give up hope of reasoning with Castel. The discovery that the *Lettre à Rameau* was reprinted three additional times makes it all the more conspicuous, as no one at those journals caught or changed it, either. So if it was not a mistake, then 'Bellerophon' must have had another connotation in the late 1730s.

As we have seen, when Castel reviewed the *Theodicy*, he attacked Voltaire for being an amoral vulgariser of Leibniz' dangerously broken philosophy, alongside another poet, Pope, whose *Essay on Man* was being read as an attack upon religion in France.[68] If readers of that issue of the *Journal de Trévoux* wanted an example of the sort of thinking Castel was warning them against, they could conveniently find one three pages later in a review of the *Essay on Criticism*, in which Pope uses Pegasus as a metaphor for poetic license:

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[66] *Œuvres de Voltaire*, ed. Beaumarchais, 53, pp. 21-5.
[67] 'Lettre à Rameau', p. 17, n. 5.
[68] See Robert W Rogers, 'Critiques of the Essay on Man in France and Germany 1736-1755', *ELH* 15, no. 3 (1948), 176-193.

If, where the rules not far enough extend,
(since rules were made but to promote their End)
some lucky licence answers to the full
th'intent propos'd, that license is a rule.
Thus Pegasus a nearer way to take,
may boldly deviate from the common track.
Great wits sometimes may gloriously offend,
And rise to faults true critics dare not mend;
From vulgar bounds with brave disorder part,
And snatch a grace beyond the reach of art,
Which, without passing thro' the judgment, gains
The heart, and all its End at once attains.[69]

The *Journal de Trévoux*, reviewing Silhouette's prose translation, quoted this passage thus:

Il est des licences qu'on peut prendre. 'Pégase, peut, pour prendre un chemin plus court, s'écarter de la route battue, un génie peut quelquefois violer la règle avec gloire et succès, et s'élever à des fautes que les vraies Critiques n'osent corriger; s'éloigner des limites vulgaires avec un beau désordre, et saisir une grâce au delà de la portée de l'art, qui en s'affranchissant du jugement gagne le cœur, et d'un seul coup remplit toutes les fins.'[70]

If 'combattre contre Bellérophon' implies that Castel's ocular harpsichord is a Pegasus, rather than a chimera, then Voltaire's reference makes perfect sense: fighting with Castel is like fighting with Bellerophon because they're both afforded a 'lucky license' that allows them to move in whatever direction they choose. It is impossible to counter or refute Castel logically, because he is above all a stylist, exploiting the ocular harpsichord as a rhetorical device. Although Rameau may think he is equally matched to Castel because of his expertise in music, Voltaire assures him that he's not. Castel's music is imaginary, even twelve years after he invented it, so his arguments do not need to appertain to physical reality in order to persuade. He thus has an unfair advantage that allows

[69] Alexander Pope, *Essay on Criticism* (London: W. Lewis, 1711), p. 11.
[70] Review of *Essai sur la critique*, *par M. Pope, ouvrage traduit de l'Anglais en Français, par M. de S***, Journal de Trévoux* (February, 1737), 244-270 (p. 255).

him to escape the rules that apply to poor Rameau, who in comparison to Castel, rides into battle on an ordinary horse, bound by gravity and the limits of logical argument.

Read this way, Voltaire's comments on the instrument in the *Éléments* and in the *Lettre* become consistent, despite their differences in tone: the ocular harpsichord is a marvellous analogy, practically impossible because of the limitations of the senses, but equally impossible to counter in an argument, because its imaginative charm is so persuasive.

7. The Cruellest and the Most Insulting Things

The unauthorised edition of the *Éléments de la philosophie de Newton* had been circulating for several months when, in mid-June, Voltaire wrote to Maupertuis complaining that Castel had mistreated him in the *Journal de Trévoux.* Voltaire claimed to have been very nice and good to Castel, but in spite of his generosity, 'vous serez peut être surpris,' he wrote, 'que dans la quinzaine ce bonhomme imprima contre moi dans le Mercure de Trévoux les choses les plus insultantes et les plus cruelles.' It should be clear by now that Voltaire's account in this passage (quoted fully in this chapter's introduction) misrepresents his interactions with Castel. To begin with, it was not true that Voltaire had first become aware of Castel in the course of his Newtonian research, and its unlikely that Voltaire had ever thought Castel was a Newtonian, as the *Nouvelles experiences* had made it clear that he was not. It is true that Voltaire had written to Castel a little over a year before, but as we've seen, that was only after Castel smeared him as an optimist in the *Journal de Trévoux*. It is unclear why Voltaire claimed that Castel was Maupertuis' declared enemy, as they seem to have moved in similar circles, and some evidence suggests that they were cordial, if not friendly: Castel later recalled some professional advice given to him by Maupertuis in a personal letter to La Condamine, and was also on an exclusive

list to receive a complimentary copy of Maupertuis' *Essai de cosmologie* in 1750.[71]

Critics have not agreed on what Voltaire meant by 'les choses les plus insultantes et les plus cruelles'. Besterman notes, 'I have not found the reference of which Voltaire complains under Castel's name, but Castel was one of the principal contributors of the *Mémoires,* and only a few of his articles were signed.'[72] Hellegouarc'h writes that Voltaire was referring to Castel's review of the *Theodicée*,[73] but Voltaire's letter makes it clear that the insults in question were printed in the previous fortnight, and not the year before.

Identifying the remarks Voltaire found offensive has been difficult because Castel put them somewhere very unexpected, and skilfully disguised them, turning his mockery into a private joke for readers who understood the context. Like the sarcasm of Voltaire's *Lettre à Rameau*, Castel's insults would have been highly entertaining for readers who knew what they were reading, and also, cannily, impossible for Voltaire to publicly refute. This may be why he chose to present a different narrative to Maupertuis, who was experiencing a uniquely powerful moment of fame and Newtonian credibility following his Lapland expedition, and was ideally situated to spread this alternative narrative around.

The comments Voltaire refers to are in a description of a hydraulic machine published in the *Journal de Trévoux*'s June issue. This review was also anonymous, but, again, Castel's authorship is not in doubt, and as we'll see he soon claimed responsibility for writing it. Castel's elegant and entertaining style and his extensive use of rhetoric would probably have made his authorship evident to readers—for example, his article begins with a long and flowery

[71] Mary Terrall, *The Man Who Flattened the Earth: Maupertuis and the Sciences in the Enlightenment* (Chicago: University of Chicago Press, 2002), pp. 5 and 281.
[72] 15 June 1738, D1519, ed. note 3.
[73] Jacqueline Hellegouarc'h, '"Les Aveugles juges des couleurs": interprétation et essai de datation', *SVEC*, no. 215 (1982), 91-97, n. 5.

exordium. Even in the rhetorically ornate *Journal de Trévoux*, this was not common, and certainly not in technical articles: when they published a description of a different hydraulic machine the following year, that article's author launched straightforwardly into his subject matter without any preamble at all:

Cette machine est l'invention du sieur Pinson architecte et Entrepreneur des bâtiments. Elle élèvera facilement cent vingt-cinq mille muids d'Eau, à cent soixante pieds au dessus des plus basses eaux de la rivière, elle peut même en élever une plus grande quantité et plus haut s'il en est besoin.'[74]

Castel's article begins quite differently:

Il est heureux pour le siècle où nous vivons, et glorieux pour le règne pacifique, sous le ministère duquel nous cultivons les sciences et les arts, de voir éclore avec une sorte de profusion, un nombre de découvertes et de nouvelles inventions, que le siècle précèdent pourrait envier à celui-ci. Soyons équitables et ne passons jamais les bornes de l'Histoire, dans l'éloge même.[75]

The unexpected grandeur of these opening lines would have alerted readers that this article was headed in a peculiar direction. Castel moves on to reflect on the history of the arts and sciences in France in the seventeenth and eighteenth centuries, using one of his favourite commonplaces: the development of flowers into fruit. In this metaphor, flowers, like the literature, poetry, and *beaux arts* that embellished the reign of Louis XIV, are exquisite, but they have no permanence or solidity, and are merely momentary steps towards the practical sciences of mathematics and mechanics:

Les belles lettres, les beaux arts, toutes les affaires d'esprit, de goût, de sentiment, d'imagination, ont dû par cette première impulsion, recevoir tout d'un

[74] 'Description et avantages d'une machine hydraulique pour fournir d'eau les habitants de la ville de Paris', *Journal de Trévoux* (April, 1739): 892-909 (p. 892).
[75] 'Description critique d'une nouvelle machine hydraulique, pour l'élévation des eaux, de l'invention de M. Dupuy, maître des requêtes', *Journal de Trévoux* (June, 1738), 1307-1339 (p. 1307).

coup ou assez vite leur perfection. Ce sont-là des fleurs, qui précèdent régulièrement les fruits, les Sciences profondes, les Arts solides, les Inventions étendues. Les fleurs sont passagères. L'idée d'un printemps éternel n'est qu'une idée. Les littérateurs de nos jours, car chaque saison a aussi ses fleuristes et leurs fleurs, se plaignent eux-mêmes de la rapidité avec laquelle leur règne, le règne du bon goût, du bon style est passée. [76]

Castel's language here is reminiscent of the passage he had quoted from Voltaire's *Mondain,* comparing the ages of iron and gold, and it quickly becomes clear that he once again has Voltaire, the poet and would-be *philosophe* in mind. The spirit of the sciences has killed off poetry, he writes. Not only do writers of literature complain that their reign has ended, but even voices that could dominate the world of *bel esprit* prefer, instead, to play a minor role in science:

L'esprit de la Philosophie et de la Géométrie, pourquoi le dissimuler? a un peu étouffé celui de la Poésie. Nous parlons Histoire et Histoire vivante. Tel qui sur le Théâtre pourrait briller à côté de Racine et de Corneille, au-dessus de ses contemporains, préfère à la suite de Descartes ou de Newton, le second rang de la science, au premier rang du bel esprit.[77]

Just over a month after the unauthorized *Éléments de la philosophie de Newton* had unexpectedly appeared in Paris, it would have been obvious to readers that this appeal to 'living history' was directed at Voltaire. Having set his stage, Castel sprinkles his bombastic discussion of hydraulics and Dupuy's machine with other coded jabs at Voltaire's Newtonian project.

Castel writes that this machine is so magnificent that it is not really a pump at all, but a fresh discovery, a brand new principle the likes of which no one has ever seen. He emphasizes this point with an extensive *accumulatio* of all the things one cannot find in Dupuy's machine, whose absences prove it is not a pump. This curious choice becomes confusing, and then comic, as Castel begins

[76] Ibid., p. 1309.
[77] Ibid., p. 1310.

interspersing Newtonian buzzwords among his list of things that one can actually expect from a pump:

> Il n'y a rien de ce qui caractérise une pompe, ni dans la cause, ni dans l'effet, ni dans aucune circonstance essentielle ou accidentelle. Il n'y a ni piston, ni aspiration, ni refoulement, ni attraction, ni suspension, ni horreur du vide, ni pression d'air, ni principe d'équilibre, ni frottements, ni dureté d'exécution, ni importunité de radoubage, ni grands frais d'établissement et d'entretien. Nous le disons, parce que nous le pensons, parce que nous le savons, parce que nous l'avons vu, parce que nous l'avons étudié, médité, approfondi. Car aux chicaneurs les vérités les plus palpables ne se laissent point apercevoir: mais aux amateurs de bonne foi, les vérités les plus secrètes se manifestent, comme au grand jour.[78]

Perhaps the contemporary urgency of such matters has been lost in the sands of time, but it seems unlikely that Dupuy really was overwhelmed by vicious 'chicaneurs' attempting to insist that his hydraulic machine was nothing but a lowly pump. So as the article progresses, moments like these turn Castel's defense of Dupuy and his machine into a proxy defense of Castel and his ocular harpsichord against Voltaire, and against the *Lettre*'s portrayal of him as an unbalanced charlatan. At one point, he compares the intoxicated ignorance of a 'bacchic poet' to the cautious simplicity of a 'geometer-mechanic and philosopher', a clear reference to himself:

> De tous les besoins de la vie, le croirait-on! celui de l'eau est peut-être le plus important, après l'air, qui n'a besoin que de notre propre machine, pour nous faire vivre et respirer. Un poète bachique peut ignorer cette vérité simple, dans la double ivresse que le transporte. Un Mécanicien Géomètre et Philosophe en est averti à chaque pas.[79]

Is this article Castel's response to Voltaire's insults in the *Lettre*? We cannot confirm with certainty, but there are numerous passages that suggest it is. Castel bemoans the difficult life of an inventor, who is forced to watch his critics doubt the truth of his inventions, only to copy his ideas later on:

[78] Ibid., pp. 1316-7.
[79] Ibid., p. 1311.

Voilà à quoi un inventeur, c'est-à-dire, un bienfaiteur de l'humanité, de sa patrie, de ses citoyens est réduit. Il a toutes sortes d'objections, de contradictions, d'imaginations à combattre, de tours mêmes, de retours et de souplesses à redouter. Tel qui le critiquera, après l'avoir vu, le copiera, après l'avoir compris.[80]

If this article is indeed Castel's response to the *Lettre*, then this lamentation appears to complain about the contrast between Voltaire's comments in the *Lettre* and the *Éléments*. It also makes the same accusation of two-facedness that Voltaire then tried to turn upon Castel when he complained about this article to Maupertuis: 'ce misérable fou se trouve loué par moi après m'avoir insulté.' Later on, Castel uses a labyrinthine transition from a technical passage to return to the metaphor of fruits and flowers he opened with, so that he can ask Voltaire to shut up. Subtextually, Castel commiserates with Voltaire; of course the poet is intimidated, because he is a recent arrival in the world of mathematics, and is 'frightened' of Castel's 'excessive superiority'. Voltaire ('l'esprit') lacks the long experience that would otherwise have taught him to treat the ocular harpsichord ('une nouveauté'), with more respect:

C'est tout dire, les bornes de leur principe d'attraction joint aux frottements du refoulement qui renforcent ceux de l'aspiration, produisent cette énormité de différence qui réalise d'une manière sensible, ce que nous disions au commencement, que les Arts et les Sciences du siècle précédent n'étaient que la fleur et l'enveloppe des sciences et des arts, que notre siècle fait éclore de toutes parts sous nos yeux. Nous avons beau dire; l'imagination est pourtant effrayée d'une supériorité si excessive, et l'esprit entre en défiance contre une nouveauté qui n'a pas une longue expérience pour la cautionner. Mais l'imagination est priée ici de se taire, et l'esprit aussi; parce qu'on doit remarquer que nous n'entreprenons pas de porter la démonstration au-delà du simple témoignage des yeux.[81]

Publishing a response in this manner would have allowed Castel to denounce the *Lettre à Rameau* without acknowledging its existence or attracting the attention

[80] Ibid., pp. 1319-20.
[81] Ibid., 1326-7.

of those who had not read it. It would also have enabled him to expose Voltaire's authorship in a way that could not be publicly denied, because he doesn't mention Voltaire's name or any of his works, but is clearly alluding to him. Put together, such a reply would have demonstrated not only defiance, but precisely the restraint and subtlety the *Lettre à Rameau* had accused Castel of lacking. Finally, by rebuking Voltaire in the course of explaining the technicalities of a practical machine, Castel demonstrated a grounded understanding of physics, mathematics, and infrastructure in total contrast to the purposeless delusion implied by 'the Don Quixote of Mathematics'.

The pamphlet version of the *Lettre à Rameau* is dated six days after Voltaire wrote to Maupertuis about Castel's insults and cruelty, on 21 June. The same day, Voltaire wrote to Thiriot to say that the *Lettre à Rameau* had arrived at Cirey, and to deny the 'cruelly mortifying' rumour that he had authored it. He predicted that the *Journal de Trévoux* would attribute it to him, and that they would be furious.

> Madame du Châtelet et moi nous serions cruellement mortifiez qu'on imputât à Cirey la lettre que vous nous avez envoyée sur le père Castel, et à laquelle nous n'avons d'autre part que de l'avoir lue. Il serait bien cruel qu'on pût avoir sur cela le moindre soupçon. Vous savez mon cher ami ce que vous nous avez mandé, et votre probité et votre amitié sont mes garants. Je suis bien sûr que si les jésuites m'imputent cet ouvrage, vous ferez ce qu'il faudra pour leur faire sentir combien je suis sensible à cette calomnie.[82]

A few weeks later, Voltaire wrote to Thiriot again, asking how the *Lettre à Rameau* was being received in Paris: 'J'ai reçu le gros paquet du prince accompagné de votre aimable lettre. Je trouve celle qu'on a écrite à Rameau assez plaisante. Je vous prie de me mander à qui on l'attribue.'[83]

[82] 21 June 1738, D1527.
[83] 12 July 1738, D1551.

8. From the Frivolous to the Solid: Castel on the *Éléments*

Two months later, when the *Journal de Trévoux* published the first of Castel's two-part review of Voltaire's *Éléments de la philosophie de Newton*, Castel took the opportunity to clear up any remaining ambiguity around the authorship of his hydraulic machine piece, and who it was intended to take aim at. His opening lines remind readers of the fruit-to-flower commonplace he had used to skewer Voltaire for abandoning first-rate verse in favour of second-rate science:

> Voici un ouvrage bien propre à justifier la remarque que nous faisions dans un de nos dernier Mémoires, à la gloire de notre siècle, que c'était le siècle des sciences profondes, des arts solides et des découvertes utiles, en comparaison du siècle précèdent, que nous appelions le siècle des beaux arts et de la belle littérature. Dans cette remarque, nous avions surtout en vue M. de Voltaire, et l'ouvrage que nous annonçons, avec un nombre d'auteurs et de génies brillants et profonds, que la force et l'élévation de leurs pensées a rappelés et rappelle tous les jours de la carrière du bel esprit au goût dominant du siècle pour la philosophie, la géométrie, et les autres sciences de raisonnement.[84]

Castel's strategy had an appreciative audience in Desfontaines, who was in the midst of his own worsening feud with Voltaire, and pointed it out to another anti-Voltairean, Jean-Baptiste Rousseau: 'Tous les philosophes et géomètres tombent naturellement sur le corps du pauvre géni Newtoniste,' he cackled, 'le P. Castel dans le J. de Trévoux s'est moqué de lui fort joliment ces jours ci.'[85]

Ultimately, the *Journal de Trévoux*'s treatment of the *Éléments de la philosophie de Newton* was fairly even-handed, and they even published Voltaire's explanatory *Eclaircissements,* which eventually prefaced the official French edition.[86] Castel's review was largely positive, but of course, he'd also begun by directing readers' attention to the hydraulic machine article. In

[84] Review of Voltaire, *Éléments de la philosophie de Newton, Mémoires de Trévoux*, no. Aug, Sept (1738), I, 1669-1709; II, 1846-1867 (pp. 1669-1670).
[85] 12 Aug 1738, D1586.
[86] 'Eclaircissements nécessaires donnez par m. de Voltaire le 20 mai 1738, sur les *Éléments de la philosophie de Newton', Journal de Trévoux* (July, 1738), 1448-1470.

combination, this means that Castel's fair-minded tone is also very condescending. Because he casts his review as a magnanimous apology on Voltaire's behalf, Castel is able point out the silly subtitle and emphasise that the *Éléments* is full of mistakes without sounding mean, because he is ostensibly asking readers to overlook those flaws. Castel writes that critics had been treating Voltaire as an interloper in the world of philosophy because he was a poet:

> Les critiques de profession surtout sont injustes, et toujours déterminés à mettre les choses au pis. A peine a-t-on parlé de M. Voltaire Philosophe, que les rivaux de M. de Voltaire Poète ou Ecrivain, se sont flattés de le trouver à leur avantage, pour le punir de les avoir peut-être plus d'une fois effacé. M. de Voltaire Philosophe, a été pour eux un phénomène. Ils ont cru pouvoir l'observer, et y découvrir des tâches, des malentendus, des erreurs. Y en eut-il? Il y en a partout, et dans un noble projet, on tombe noblement.[87]

Of course, as we have seen, Castel had made these accusations himself. Here, however, he positioned himself as Voltaire's generous defender, asking readers to indulge and encourage this celebrity, so clearly well-meaning, and out of his depth:

> Ceux qui seraient le plus capables de découvrir peut-être quelque petit faible dans l'exécution d'un projet si noblement hardi, les vrais savants seront plus indulgents. Ils applaudiront au dessein, ils feront valoir l'exemple, ils aideront à une nouvelle exécution, ils encourageront tout le monde, ils remercieront de bonne foi l'Auteur, d'avoir prêté (car voilà le vrai point de vue) la célébrité de son nom à des matières, qui de soi n'ont ni célébrité, ni éclat, ni attrait sensible.[88]

Despite its condescension, and its portrayal of Voltaire as a dilettante, Castel's review praises Voltaire's genius, and takes the *Éléments* and the questions it raised seriously. Unsurprisingly, the chapter that he found most worthy was the

[87] Castel, review of *Éléments*, p. 1675.
[88] Ibid., p. 1676.

one that discussed the ocular harpsichord, even if it too was full of errors, which Castel helpfully corrected in his review:

Chapitre XIV. Du rapport des sept couleurs primitives avec les sept tons de la musique. C'est ici de tout ce livre l'endroit, auquel, si nous ne consultions que l'intérêt, l'intérêt même le plus honnête de la reconnaissance, nous applaudirions le plus volontiers. Mais il ne convient ni à M. de Voltaire de recevoir, ni à nous de donner des Eloges, qui puissent paraître mandiez.[89]

Comparing Castel's review with Voltaire's chapter on the ocular harpsichord, it is striking that both of them used the same technique to condescend to one another. In Voltaire's chapter on the harpsichord, a 'philosophe' intervenes in the world of art and pleasure. Though the overall success of his intervention is in doubt, the reader is encouraged to be fair: 'tout esprit équitable ne peut que louer l'effort et le génie'. In his review of the *Elements*, Castel sought the same effect, going in the opposite direction. Here, a poet intervenes in the world of philosophy, with scientifically dubious but rhetorically marvellous results:

Outre la célébrité de son nom, M. de Voltaire prête à M. Newton tout le brillant de son génie, et n'annonce le nouveau système, que sous les noms les plus pompeux de merveilles, de découvertes, de démonstrations; traitant tout ce qui n'est pas Newton, d'hypothèses, de chimères, de romans. Cela aide bien, qu'on ne s'y trompe pas.[90]

At several points like this one, Castel's review reproached Voltaire for having taken Newton's 'hypotheses' too seriously; a term that Castel used frequently in the course of trying to distinguish between Newton's mathematics, which he supported, and Newton's physics, which he did not: 'Le système de M. Newton est mathématiquement, géométriquement, hypothétiquement admirable, il perd toute sa force, dès qu'on le prend physiquement, littéralement et historiquement.'[91] This position was to lead Castel to become a polemical anti-

[89] Ibid., pp. 1705-6.
[90] Ibid., p. 1693-4.
[91] Ibid., p. 1858.

Newtonian in the years to come, as 'Newtonianism' came to connote precisely the fusion of mathematics and natural philosophy that Castel wanted to resist. For the moment, Castel seems to have been content to diminish Voltaire just enough to secure his own authority as a 'mécanicien, géomètre, et philosophe', who alone had the experience and knowledge to read Newton impartially, and see his contributions in perspective.

Voltaire apparently found Castel's review extremely irritating. He didn't care what the Castels of the world had to say, he wrote to Thiriot, as ultimately, he was sure that he had reason on his side:

> Le père Castel a peu de méthode dans l'esprit, c'est le rebours de l'esprit de ce siècle. On ne peut guère faire un extrait plus confus, et moins instructif. […] il n'y a point comme vous dites *d'opinions nouvelles* dans Newton, il y a des expériences, et des calculs et avec le temps il faudra que tout le monde se soumette. Les Renauds et les Castels n'empêcheront pas à la longue le triomphe de la raison.[92]

Of course, Voltaire was right—but the intensity of his annoyance was no doubt due to the fact that Castel was yet again skillfully portraying him as a frivolous poet peddling ideas he could not understand. Perhaps Voltaire was hoping for a cease-fire when he wrote to Castel's colleague at Louis-le-Grand, the abbé d'Olivet, at the end of October, complaining that Castel had no idea what he was talking about if he thought that science was more difficult than poetry:

> Je trouve même fort mauvais que le père Castel ait dit dans un extrait des *Éléments de Newton* que je passais du frivole au solide. S'il savait ce que c'est que le travail d'une tragédie et d'un poème épique, *si sciret donum dei*, il n'aurait pas lâché cette parole. La *Henriade* m'a coûté dix ans, les *Éléments de Newton* m'ont coûté six mois et ce qu'il y a de pis, c'est que la *Henriade* n'est pas encore faite. J'y travaille encore quand le dieu qui me l'a fait faire, m'ordonne de la corriger, car, comme vous savez *est deus in nobis agitante calescimus illo.*[93]

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[92] 7 August 1738, D1578.
[93] 20 October 1738, D1631. First quotation adapted from *John* iv.10, second Ovid, *Fasti*, vi.5.

However, this spirit of reconciliation didn't last very long, if that is indeed what it was. In late December, Voltaire wrote to Berger to ask a peculiar favour:

> Je vous prie, mon cher Berger, de vouloir bien me faire le plaisir, 1. de lire l'incluse; 2. de la porter secrètement au père Castel, jésuite; de ne point lui dire que vous l'avez lue; mais de le prier de la lire avec vous, et, lecture faite, de lui demander la permission de la rendre publique. Votre prudence et votre amitié se tireront très bien de cette négociation.[94]

Perhaps this enclosed document was the *Lettre à Rameau*; what else would have warranted this request for a farcical caper through the halls of Louis-le-Grand, apparently without being seen? Why ask Castel's permission to make this document public, if not because it was about him? Why would Berger need to manipulate him in order to obtain this permission, if not because it was offensive? Perhaps Voltaire hoped that Berger could gauge Castel's personal and unalloyed reaction to it, by catching him off-guard.

On the other hand, the *Lettre à Rameau* had been public for six months already. Perhaps the enclosed document was a new work: Voltaire wrote several short pieces in this period that satirise Castel and his ideas, which have since come to be known as the *contes philosophiques*. One, the *Aveugles juges des couleurs*, makes no reference to Castel, but satirizes the cross-sensory inference that the ocular harpsichord was meant to express. The tale that eventually became *Micromégas* was also drafted in the same period (the now lost *Baron de Gangan*) and contains a direct reference to Castel that mocks his analogical reasoning, eloquence, and contrarian resistance to empirical evidence.[95] Then again, it could be something else entirely, and we do not know the outcome of Berger's secret mission.

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[94] 22 Dec 1738, D1702.

[95] 'Ils virent deux lunes qui servent à cette planète, qui ont échappé aux regards de nos astronomes. Je sais bien que le Père Castel écrira même assez plaisamment contre l'existence de ces deux lunes, mais je m'en rapporte à ceux qui raisonnent par analogie.' *Micromégas,* eds Nicholas Cronk and J.B. Shank, OCV 20C, pp. 1-112.

After this, Voltaire seems to have abandoned his campaign against Castel, possibly because he soon became embroiled in a much more urgent drama. Four days after his letter to Berger, both Voltaire and Madame du Châtelet received copies of Desfontaines' *Voltairomanie*, an attack on Voltaire's ruthlessness and ego that was so menacing that they both spent the next week attempting to keep it a secret from each other. A general atmosphere of paranoia took hold at Cirey, as Madame du Châtelet struggled to keep Voltaire and their guests in check, locking up his papers, spying on Madame de Graffigny's letters, and angrily accusing her of sending out a copy of *La Pucelle*.[96] Under the circumstances, the project of picking a fight with the inventor of the ocular harpsichord had probably lost its appeal.

Further, if Voltaire had hoped that the *Lettre à Rameau* might persuade him to collaborate again, then his bridge to the composer was now in flames. Thiriot was in the middle of the fight with Desfontaines, and Châtelet was accusing him of having handed over Voltaire's work. Voltaire's reluctant sensitivity to this precarious situation is evident in a letter that he wrote to Thiriot in January. His first draft hypocritically reproached Thiriot for provoking Madame du Châtelet's suspicion, by making her think that Voltaire had authored the *Préservatif* and the *Lettre à Rameau*. But once again, he changed his mind, and crossed this section out:

~~Ne sentez vous pas que vous lui faites entendre que je suis l'auteur du préservatif au quel je n'ay d'autre part que la lettre au sujet de des Fontaines?~~ Comment lui dites vous que vous haïssez les libelles autant que vous aimez la critique, après lui avoir envoyé ~~la lettre imprimée contre Castel~~, la lettre manuscrite contre Montcrif, les vers contre Bernard, contre la Sallé? Que voulez vous qu'elle pense?[97]

[96] English Showalter, 'Sensibility at Cirey: Mme Du Châtelet, Mme De Graffigny, and the Voltairomanie', *SVEC,* no. 135 (1975), 181-192. On the feud with Desfontaines, see Moureau's introduction to *Le Préservatif,* OCV 20C, pp. 307-49.
[97] 7 January 1739, D1748.

This seems to have been the end of Voltaire's attempts to undermine Castel in published works; until, that is, after Castel's death, when he took up Castel's weapon and became the Enlightenment's great crusader against Optimism. In the 1741 edition of the *Éléments*, Voltaire shortened the fourteenth chapter, making it much less flattering to Castel. In 1748, he removed it entirely. In the short term, it appears that Voltaire, like Rameau, had lost his battle with Castel, who was still atop his Pegasus, and slashing away at the Newtonian chimera.

9. Castel's *L'Optique des Couleurs*

In 1739, Castel published a series of articles and letters, drumming up publicity for his upcoming book, *L'Optique des couleurs*, which followed in 1740.[98] This work reprinted some of these letters, appended to an account of his experiments with dye and paint. This work was an attempt to direct public interest in the ocular harpsichord towards Castel's more general theories about colour.[99] The only discussion of the instrument in this book is in an appended text, the French translation of Telemann's pamphlet on the instrument.

The five years between Castel's *Nouvelles expériences* and *L'Optique des couleurs* marked the ocular harpsichord's high point, in terms of Castel's productivity, the instrument's fame, and its topical relevance. By 1740, Castel's ideas on colour music had crystallised, and the French debates on Newton had resulted in acceptance of his methods and conclusions. This was an unfortunate

[98] 'Projet d'une nouvelle optique des couleurs', *Mémoires de Trévoux* (April, 1739), 804-820; 'Lettre […] sur un feu d'artifice où les couleurs bien diversifiés feraient un vrai clavecin oculaire', *Mémoires de Trévoux* (August, 1739), 1675-1678; 'Réponse du P. Castel jésuite à la lettre de M. D***', *Mémoires de Trévoux* (December, 1739), 2563-2592; *L'Optique des couleurs* (Paris: Briasson, 1740).

[99] For an interesting discussion of these theories from the perspective of aesthetics, see Corinna Gepner, *Le Père Castel et le clavecin oculaire: Carrefour de l'esthétique et des savoirs dans la première moitié du XVIIIe siècle* (Paris: Honoré Champion, 2014); especially Ch. 3, 'Vers une science des couleurs'.

result for Castel, who had staked the ocular harpsichord on his own optics, in contrast to Newton's. Voltaire read *L'Optique des couleurs,* and, in a letter to Formont, we see that his grim assessment of Castel remained unchanged:

> Vous avez donc lu ce fatras inutile sur la teinture, que monsieur le père Castel appelle son optique? Il est assez plaisant qu'il s'avise de dire que Newton s'est trompé, sans en donner la plus légère preuve, sans avoir fait la moindre expérience sur les couleurs primitives. C'est à présent la physique qui se met à être plaisante depuis que la comédie ne l'est plus.[100]

This passage shows Voltaire appropriating Castel's weapons in order to use them against him, foreshadowing *Candide* and its attack on optimism. His comment on 'physics' becoming entertaining, in an era where comedy is not, reverses Castel's claim that Voltaire had used poetry to weaponise philosophy that did not, itself, attack religion.

This brings us to the heart of Voltaire and Castel's rivalry, and the role that the ocular harpsichord played within it. While they disagreed with each other's arguments about Newton and the meaning of his work, their quarrel was driven by a need to establish who had the authority to use poetic license to make those arguments convincing. From Castel's perspective, Voltaire's status as a poet (and a 'bacchic' one at that) precluded him from being able to consider philosophy and physics in perspective, without getting carried away by fantasies and optical illusions. From where Voltaire was sitting, this was unbelievable hypocrisy, coming from a man who had built his reputation on the back of an extraordinary fantasy, the ocular harpsichord—an optical illusion so illusory that nobody had ever seen it. The problem with Castel's 'Pegasus' was not that it carried a deluded Don Quixote, but that it gave him great persuasive power, because his readers wanted to believe it could exist.

[100] 2 April 1740, D2195.

V

Castel's Rhetoric and Style:
Early Texts on the Ocular Harpsichord

We have seen that Castel was a skilled writer, and that he was conscious of the ocular harpsichord's value as a literary device, and emblem of his persona. We've seen that his interest in producing it was inconstant, at best. We've seen that he was at an advantage when it came to literary conflicts with less committed writers, like Rameau, and that he was equal to even the most dedicated polemical efforts of literary specialists like Voltaire. This chapter focuses on the mechanics of Castel's style, as demonstrated in his first four articles about the ocular harpsichord, and including Castel's exchange with the ocular harpsichord's first serious critic, an anonymous 'philosophe gascon'. As one would expect, Castel's writing evolved over the course of his career, but these early articles are representative of how he wrote about the instrument throughout his life, and of the style that made his voice unique and recognisable.

Castel's style can seem incoherent and repetitive to modern readers, which causes much of the critical ambivalence around his persona and the ocular harpsichord. Gepner writes,

> Ses écrits se caractérisent par leur côté répétitif, obsessionnel, par leurs incohérences, leurs affirmations sommaires, leurs échappées fantasques, sans oublier leur mauvaise foi polémique. Il ne faut pas y chercher, quoi qu'il en dise lui-même, une réflexion cohérente, aux fondements indiscutables, à la rationalité éprouvée.[1]

Critics frequently attribute their own experience of confusion to Castel's incoherent state of mind, and collapse his writing style into his personality, as does Chouillet-Roche when writing, 'il faut dire que la suite de son discours est très caractéristique

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[1] Corinna Gepner, *Le Père Castel et le clavecin oculaire* (Paris: Honoré Champion, 2014), p. 12. This declaration is somewhat confusing, as Gepner also discusses rhetoric and oratory (see pp. 101) and uses the term 'rhetoric' metaphorically and literally throughout the book.

de sa manière d'être'.[2] Yet considering Castel's extraordinarily prolific career, it must surely be remiss to interpret his style as the naturalistic expression of a disorganized personality, rather than a cultivated literary voice.

Modern readers do not possess the rhetorical training that formed the foundation of eighteenth-century education, and especially that of the Jesuits, but Castel's contemporaries read his work with these contexts in mind. There are many examples of Castel's contemporaries discussing his style, and they demonstrate that the imaginative naïveté of Castel's voice was precisely what his readers found compelling. In his posthumous biography of Castel, Paulian mused:

> On nous y fait d'abord remarquer que cet esprit naturellement facile, fécond, et inventeur, avait une imagination dont il était tantôt maître et tantôt esclave. Dans le premier cas il ne donnait dans les plus grands écarts, et il avançait les choses du monde les plus inconcevables, et dans le style le plus singulier.[3]

Ladvocat's biography (published, we should note, the same year that the Jesuits were expelled from France) notes that Castel 'cultiva les belles-lettres dans sa jeunesse, et il les enseigna selon la coutume des jésuites'.[4] A little later on, Ladvocat comments:

> Son imagination vive et quelquefois excessive, le jetait assez souvent dans des écarts, dans des saillies, et dans des singularités qui ont quelque chose d'original et même de comique; mais quand il avait assez de sang-froid pour retenir son imagination sous les lois de la raison, son style était attrayant et convenable, il parlait, il écrivait bien.

Yet another posthumous biographer, Lacombe de Prezel, began his article on Castel by writing:

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[2] Anne-Marie Chouillet, 'Le père Castel et son clavecin oculaire,' in *Autour du père Castel et du clavecin oculaire,* eds Roland Mortier and Hervé Hasquin, *Études sur le XVIIIe Siècle*, XXIII (Brussels: Éditions de l'Université de Bruxelles, 1995), pp. 9-12 (p. 11).
[3] Aimé-Henri Paulian, *Dictionnaire de physique,* 3 vols (Avignon: L. Chambeau, 1761), p. 316.
[4] Jean-Baptiste Ladvocat, *Dictionnaire historique-portatif,* 3 vols (Paris: Veuve Didot, 1764), I, p. 257.

En général le style du père Castel est vif, franc, naturel, naïf même, jamais tourné, jamais arrangé; il s'élance du premier transport du cœur, il conserve toute l'énergie du sentiment.[5]

Even critics who were hostile to Castel agreed that his style was attractive. The *Journal des savants* reviewed La Porte's compilation of Castel's work with a great deal of suspicion, when it came to accepting his claim that Castel's style had been both 'convenable': 'Pour attrayant, le style du P. Castel l'est presque toujours; pour convenable, l'Editeur a raison de faire sentir qu'il ne l'est que par moments. Quoi, par exemple, de moins convenable que ce style?'[6] This is followed by a quotation of Castel's that discusses Adam and Eve, and then by another that describes the advantages of civilized society as leading one by hand to paradise. 'Sous la plume d'un autre écrivain que le P. Castel, ce dernier trait n'aurait-il pas l'air d'une ironie indécente et irréligieuse?'

Tellingly, these commentaries all appeared after his death, but had Castel been able to respond to them, he would have claimed that his voice was entirely appropriate for the theories he presented to the public. His inventiveness and naïveté was intended to be appealing and easily understood by readers:

Comptez que mes termes sont faits pour mon style, que mon style est fait pour mes expressions, et qu'après tout on ne parle, on ne s'exprime que pour être entendu. Mon expression est communément physique et de fait, j'exprime la nature naïvement comme je la conçois, comme elle est.[7]

This project of accessibility was not limited to Castel's literary aesthetic. Beginning with his 1728 pedagogical work, *Mathématique universelle*,[8] Castel cultivated a 'méthode riante', which was intended to improve the teaching of mathematics by using forms readily available in nature, and avoiding abstract geometry.[9] Castel's

[5] Honoré Lacombe de Prezel, *Dictionnaire des portraits historiques, anecdotes, et traits remarquables des hommes illustres,* 3 vols (Paris: Lacombe, 1768), I, p. 231.
[6] Review of *Esprit, saillies et singularités du P. Castel*, *Journal des savants* (July, 1763), 462-5.
[7] *Journal*, fol. 52[r].
[8] Louis-Bertrand Castel, *Mathématique universelle,* (Paris: Pierre Simon, 1728).
[9] See Greenberg for discussion of the *Académie*'s reaction to this work, which he uses to portray the academicians as exclusive and hostile to change. Castel thought that mathematics should be taught intuitively, using realia readily available in nature, rather than using dry and

ideas on pedagogy and imagination were informed by and consistent with his Jesuit training,[10] but Castel's Jesuit credentials are perhaps most clearly evident in his use of rhetoric.

1. Jesuit Rhetoric

Castel joined the Society of Jesus in 1703, at the age of 15. Between 1711 and 1716 he taught rhetoric, humanities, and catechism at Toulouse, Clermont, Aubelas, Pamiers, and Cahors. We learn from one of Castel's obituaries that, 'les Jésuites de Toulouse, où il faisait ses études, se hâtèrent de l'engager dans la Société, au sortir de sa rhétorique'.[11] His education may even have included an unusual focus on the subject, as between 1692-1704 the Jesuits experimented with inserting an extra year of rhetoric in between the two years of *noviciat* and the three-year philosophy course all future teachers were required to take.[12] All of which suggests that Castel's rhetorical skill was manifested early on, and cultivated by the Jesuits.

Castel was remarkable for his range of expertise, and he may have deliberately modelled his career on seventeenth-century Jesuits by cultivating knowledge in a variety of fields. In his study of eighteenth-century Jesuit teaching in the sciences, Dainville writes:

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rigid geometry: 'Someone interested in trying to do new work in mathematics at the time would have done well to read Castel and follow the advice implied in what he said. Castel's counsel was the sort that a technician lost in his calculations, like Varignon, say, could never have given.' John Greenberg, *The Problem of the Earth's Shape from Newton to Clairaut,* (Cambridge: Cambridge University Press, 1995), p. 265.

[10]Although not focussed on Castel's era, Charmot's study of Jesuit pedagogy emphasises the importance of repetition to Jesuit teaching, and the value of images: F Charmot, *La Pédagogie des Jésuites,* (Paris: Edition Spes, 1943). A recent volume on eighteenth-century Jesuits and imagery includes several works about Castel and the ocular harpsichord in the bibliography, but only mentions it in passing as 'l'entreprise étonnante' without further comment. *La Chair et le verbe: Les Jésuites de France au XVIIIe siècle et l'image,* ed. by Edith Flamarion (Paris: Presses Sorbonne, 2008), p. 25.

[11] Claude Le Cat, 'Éloge du P. Castel, jésuite', in *Précis analytique des Travaux de l'Académie Royale de Rouen, 1761-1770* (Rouen: P. Periaux, 1817), 236-240.

[12] Gustave Dupont-Ferrier, *Du Collège de Clermont au lycée Louis-le-Grand (1563-1920),* 3 vols (Paris: E. de Boccart, 1921), I, p. 54.

Auprès des professeurs, il faut ranger des préfets de pensionnaires, qui ont été des maîtres de mathématiques parfois plus réputés que leurs collègues en titre, tel le fameux P. Castel à Louis-le-Grand. Le 'mathématicien' n'est pas seulement un professeur, dont nous aurons à caractériser l'enseignement, souvent il est aussi un savant ou un praticien. Il est parfois astronome. Plus rarement qu'au siècle précédent, car le temps n'est plus où son habilité ingénieuse suffisait à l'outiller ; les instruments se sont perfectionnés et coûtent cher, juste au moment où les ressources des collèges sont devenue précaires.[13]

Dainville's observation on the high cost of eighteenth-century scientific instruments is an important detail. Castel's polymathic knowledge and talents, and the tools needed to practice and develop them, were at odds with the recently straitened circumstances at his college. In his history of Louis-le-Grand, Dupont-Ferrier lists the school's teachers according to the fields in which they taught. He writes,

Nous venons de rappeler, à deux ou trois reprises, quelques-uns de ces noms : n'en soyons pas surpris. Parmi ces Pères, plus d'un réussissait à se faire connaître sans se spécialiser trop étroitement … Mais l'examen de ces noms nous révèle autre chose : sauf le P. de la Maugeraye, né en 1660, et le P. Castel, né en 1688, tous les Pères appartiennent a ces incomparables générations qui ont donné leur mesure entre 1620 et 1680.[14]

These types of comments suggest that Castel's range of skill and knowledge harked back to an older Jesuit archetype, which had become uncommon in the eighteenth century.[15] Perhaps this is why the order felt a need to control him, and to limit his ability to focus on his work. Castel was unusual in that he, unlike his colleagues at the *Journal de Trévoux*, was never promoted to the *scriptorium librorum*—Louis-le-

[13] François de Dainville, 'L'Enseignement scientifique dans les collèges des jésuites', in *L'Enseignement et diffusion des sciences en France au XVIIIe siècle,* ed. René Taton (Paris: Hermann, 1964), pp. 27-65 (p. 32.)
[14] Dupont-Ferrier, p. 185.
[15] For substantive insight on this point, see Richard; his thesis shows that Castel's ideas and theories were meant to fit together into a coherent 'Castelian' philosophical system of the universe. This goal was typical of seventeenth-century natural philosophers. Jean-Olivier Richard, 'The Art of Making Rain and Fair Weather: The Life and World System of Louis-Bertrand Castel, sj (1688-1757)', (unpublished doctoral thesis, Johns Hopkins University, 2015).

Grand's elite, who were relieved of their teaching duties in order to focus on their own projects.[16]

Expertise in rhetoric had made the Jesuits famous as educators, writers, and orators, and their reputation was entwined with its use, and particularly the Ciceronian style that sought to combine the best tendencies of strict 'atticism' and ornamental 'asianism'.[17] Rhetoric was one of the primary threads running through the Jesuits' political influence, presence in the press, and educational system, and hostility to the rhetorical tradition coincided with growing hostility against the Jesuits. In 1751, in the *Discours préliminaire* of the *Encyclopédie*, d'Alembert wrote:

> A l'égard de ces puérilités pédantesques qu'on a honorées du nom de rhétorique, ou plutôt qui n'ont servi qu'à rendre ce nom ridicule, et qui sont à l'art oratoire ce que la Scholastique est à la vraie Philosophie, elles ne sont propres qu'à donner de l'éloquence l'idée la plus fausse et la plus barbare. Cependant quoiqu'on commence assez universellement à en reconnaître l'abus, la possession où elles font depuis longtemps de former une branche distinguée de la connaissance humaine, ne permet pas encore de les en bannir: pour l'honneur de notre discernement, le temps en viendra peut-être un jour.[18]

In 1757, the same year Castel died, rumours began circulating that the Jesuits had been sowing political chaos, and had conspired to assassinate the kings of Portugal and France. Over the next decade, they were expelled and stripped of their influence and assets across Europe; finally, in 1773, Pope Clement XIV suppressed the entire order.

In many ways, the history of Castel's ocular harpsichord tells the tale of Jesuit rhetoric in microcosm. It made him famous, allowed him to consolidate his influence,

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[16] On the *scriptores librorum*, see Dupont-Ferrier, p. 62. He notes that his list is not exhaustive, as thirty-two years of Jesuit catalogues had been lost when he was writing. However, his list of *scriptores* does include the names of other Jesuits who worked alongside Castel at the *Journal de Trévoux* (PP. Lallement, Brumoy, Charlevoix, la Rue, Daniel, le Jay, Souciet, Honguant, and Berthier).

[17] See Fumaroli; his study of the history of rhetoric leading up to the beginning of the Enlightenment is largely focused on Jesuit texts. Marc Fumaroli, *L'Âge de l'éloquence,* (Geneva: Droz, 2009).

[18] *Encyclopédie*, I, p. x.

and enabled him to write at length on a wide variety of subjects. As we have seen in his letter to the comtesse de Maillebois, Castel then used his fame and persuasive skill to support bids for public infrastructure projects, and he saw these interventions as a means of securing funds. As the century progressed, the political climate changed around Castel, becoming openly hostile to this type of Jesuit influence and enterprise. Meanwhile, as the philosophical and scientific climate changed as well, figures like Voltaire began reacting to Castel's use of the ocular harpsichord to persuade readers of ideas he saw as illegitimate. As the Enlightenment developed, the idea of an ocular harpsichord came to mean something quite different from what Castel wanted to use it to say. Castel did not seriously engage with empiricist critiques of the ocular harpsichord, and instead dismissed them out of hand, or recast them as forms that he could easily respond to. The weakest parts of his arguments frequently occur in sections that make heavy use of rhetorical ornamentation, and this suggests that he used style to prop up arguments that he knew were unpersuasive on their own.

Despite its logical holes, Castel's writing appealed to readers, because he was able to make contradictory or outrageous arguments feel convincing through the use of emphatic and amplifying rhetorical devices. In using these literary tools, Castel demonstrated not only a mastery of the rules that governed rhetoric, but an ability and willingness to subvert them in order to persuade and surprise. Readers who were well disposed towards Castel could justify this use by arguing that the ocular harpsichord was still a work in progress, that it would take time to discover all the details of colour-music theory, and that in the meantime they were being entertained. For those who were suspicious of him, rhetoric served as evidence of Castel's manipulative insincerity. Consider, for example, Boureau-Deslandes' disdainful review of Castel's *L'Optique des couleurs*: 'Ne trouvez-vous pas que l'Auteur de *L'Optique* badine, quand il dit que *le noir est l'assemblage des couleurs sombres, et le*

blanc l'assemblage des couleurs vives. C'est-là une vraie antithèse, une espèce de figure de rhétorique, non une explication.'[19]

Aristotle defines the three arts of rhetoric as logical reasoning, or *logos*, appeal to the listener's emotion, or *pathos*, and expression of the speaker's character and goodness, *ethos*. In *De Oratore,* Cicero calls for orators to construct successful speeches by seeking to *docere* (inform), *delectare* (delight), and *movere* (move). Following Cicero, Quintilian wrote that well-structured oratory ought to include an *exordium* (introductory remarks designed to dispose an audience favourably to the speaker), a *narratio* (to lay out the facts), a *confirmatio* (to prove and develop the argument), a *confutatio* (to respond to criticisms and counterarguments), and finally, a *peroratio* (a conclusion that sums up the full strength of the argument).[20]

Quintilian's structure was designed for judicial speeches, and so might seem inappropriate for *belles lettres* meant to entertain a cultivated readership. Nonetheless, Castel's articles on the ocular harpsichord follow this structure. There are a couple of possible reasons for this. Rhetoric was so deeply ingrained in Jesuit curriculum that it was used to teach a variety of other subjects. For many years, the Jesuits had no dedicated history lessons—students were expected to absorb all necessary knowledge of history through their rhetorical training, and specifically through an exercise known as the *prélection*.[21] In addition, the Jesuits used mock trials as a pedagogical tool. These forced their students to refine their oratorical skills in public speeches, and also provided an opportunity to award prizes, which the Jesuits were fond of doing. If a student produced a particularly good example of judicial oratory, it was not unusual for his work to be further distinguished by publication in a journal, for instance, the *Mercure de France*. It is likely that an adversarial tone came

[19] 'Lettre de M. .... sur le livre intitulé: *L'Optique des Couleurs'*, *Observations sur les écrits modernes* 24 (1741), 10-22 (p. 15).
[20] For general definitions of rhetorical terminology as well as their history, see James A. Herrick, *The History and Theory of Rhetoric,* 4 ed (Boston: Allyn and Bacon, 2008)
[21] Paul Bailly, 'Collèges,' in *Les Établissements des jésuites en France depuis quatre siècles, 1540-1940,* ed. Pierre Delattre, 5 vols (Enghien: De Meester frères, 1957), I, p. 1424. On the *prélection*, see André Collinot and Francine Mazière, *L'Exercise de la Parole: fragments d'une rhétorique jésuite* (Paris: Éditions des cendres, 1987), pp. 66-70.

naturally to Castel, as he would have needed to excel at it, to be selected for the order.[22]

However, Castel's articles demonstrate a number of different techniques for softening the judicial tone of Quintilian's structure. One technique subverts that structure's narrative arc, in order to surprise, or to make a point more subtly than would be possible if he explicitly signalled his intention. A good example of this is Castel's hydraulic machine article, whose focal point is its *exordium* commencing a sub-textual attack upon Voltaire, rather than the description it is ostensibly used to introduce. Castel also makes heavy use of digressions, imagery (often startling and vivid), and rhetorical devices that use repetition to build emphasis. A further method uses rhetoric in articles styled as genres where its use is unexpected; a personal letter to or from a friendly correspondent (as is the case with his first piece on the ocular harpsichord), a mathematical proof (as is the case with the second), or a numbered list of reasoned objections and responses (as is the case with the third). Rhetorical techniques like these subverted and played upon readers' expectations, allowing Castel to advance arguments whose aim, tone and thrust differed from his stated objectives.

2. Castel's 'Correspondents'

Many of the texts on the ocular harpsichord were styled as responses or letters to and from a number of public correspondents. Some of these, like Montesquieu, were clearly real, and their personal relationships are evidenced by private correspondence and third-party accounts. Some other correspondents' reality and dynamics with Castel are not so obvious.

[22] On the Jesuit educational system's combination of eloquence and 'competitive struggle at every level', see Dena Goodman, *The Republic of Letters: A Cultural History of the French Enlightenment* (Ithaca: Cornell University Press, 1994), pp. 92-4.

Castel's first text on the ocular harpsichord, *Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pieces de musique*, was subtitled, 'Lettre écrite de Paris le 20 Fevrier 1725 par le R.P. Castel, Jésuite, à M. Decourt, à Amiens'. The letter styles Decourt as an ongoing correspondent and friendly acquaintance, and ends with Castel's hope that Decourt's work on fossils is progressing nicely. Castel opens with an apology for having taken so long to respond to Decourt's queries on 'ce que vous voulez bien appeler mes découvertes'.[23] This is followed by an attestation of Castel's modest willingness to put these discoveries before the public, 'l'unique creuset dont l'épreuve puisse nous en faire connaître la solidité ou le faible.' Castel puts the fate of his discovery in Decourt's hands: if he judges the idea to be worthy of publication, Castel will make no objection. Castel writes that he first got the idea for the instrument while reading Kircher, who is referred to as Decourt's 'bon ami'. Castel's 'letter' follows Quintilian's structure, with occasional references to its recipient that leaven its judicial tone.

I've looked for other evidence of this correspondent, and there is a 1782 text on the history of Amiens that gives a biographical account of a Jean-Joseph Decourt, who was descended from a prominent Amiens family, held an administrative position in local government, and was interested in fossils.[24] This text notes that Castel addressed his letter on the ocular harpsichord to Decourt, but gives Decourt's date of death as 14 December 1723, over a year before Castel supposedly wrote it. Aside from suggesting that Castel's best wishes for Decourt's 'pétrifications' may have been of a rather more personal nature, this discrepancy of dates casts doubt upon this letter's credibility as real correspondence. Added to which, as we've seen, Castel later wrote that Rameau was the first person he told about the idea.

From a stylistic perspective, framing this letter as a piece of personal correspondence has several benefits. It allows Castel to adopt a familiar tone, which

[23] 'Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pièces de musique', *Mercure de France* (November, 1725), 2552-2577 (p. 2552).
[24] Louis-François Daire, *Histoire littéraire de la ville d'Amiens* (Paris: P.F. Didot, 1782), p. 308.

accommodates the article's multiple conversational asides and digressions. It also authorises Castel to make assumptions about what his reader already knows, allowing him to gloss over and omit the serious science that he says supports his concept—a form of flattery that would be insincere and cloying if addressed to a general readership. We never hear back from Decourt, and I have found no other references to him in Castel's own work.

Castel's second correspondent in these early articles is Rondet, whose letter is discussed in depth in the chapter on the instrument's material history. Rondet reappeared at irregular and fortuitous intervals throughout Castel's career. On the subject of Rondet's letter, Schier writes,

> It is at this juncture that we make the acquaintance of a man who became Castel's collaborator, and an ardent supporter of the ocular harpsichord project. In spite of, or perhaps because of his association with Castel, he remained a very obscure figure. […] It was Rondet who translated into French Edmund Stone's book on fluxions for which Castel wrote a preface, and Rondet is said to have assisted in the actual construction of the ocular harpsichord. In addition he came to Castel's defense on at least one other occasion before his death in 1765.[25]

Schier doesn't explain why Rondet's connection with Castel should have rendered him obscure, and indeed, the opposite seems to be the case: Rondet apparently emerged from his profound obscurity for the sole purpose of defending and praising Castel, who in spite of this life-long and steadfast friendship, barely ever mentioned him.[26] It is true that 'Rondet, Maître de Mathématique' is given as the translator of Edmund Stone's work, for which Castel wrote the preface. But Stone's work was itself supposedly a translation of a French text by l'Hopital, and Castel's 'preliminary discourse' is, at a hundred pages, nearly half the book, so it is unclear exactly what Rondet translated. Without going into detail, Shank writes that this translation, 'only makes sense once one understands the cultural and mathematical translation that was

[25] Donald S Schier, *Louis-Bertrand Castel, Anti-Newtonian Scientist* (Cedar Rapids: The Torch Press, 1941), p. 155.
[26] In the translated letter from Castel to the author of the *Explanation*, Castel writes that Rondet was present when the second prototype was declared to be finished (p. 12).

involved as well'.[27] This may well be true, but Rondet's mathematical expertise, which he later attributed to Castel,[28] is a peculiar detail given that it seems his only other publications were three letters defending and admiring Castel in the *Mercure de France*, and two of those are about the ocular harpsichord. Without quoting Castel once, Rondet's first letter adopts Castel's language and style to heap praise upon his marvelous idea:

> L'Analogie que vous faites des sons avec les couleurs, a quelque chose de si convaincant, qu'on n'a qu'à la suivre pas à pas, pour être persuadé de la possibilité de ce brillant clavecin: aussi est-ce elle qui me frappa le plus; me faisant sentir une réalité, que la nature me donnait, sans en pénétrer les justes causes.[29]

If Rondet really authored the publications under his name, then he was a very convenient friend for Castel to make, as he not only possessed the mechanical knowledge that Castel claimed to lack, but claimed to have spent years as an assistant to an ocular surgeon. His letter provides a number of surprising ophthalmological case studies that support Castel's ideas about the senses. In short, the substance and circumstances of Rondet's limited œuvre suggest that he was actually a mouthpiece for ideas that Castel did not want to publish under his own name.

3. *Clavecin pour les yeux* (1725)

In his first text on the ocular harpsichord, Castel claimed that the ocular harpsichord was a product of analogical reasoning, supported by geometry and experiments in Newton's *Optics*. However, this reasoning is largely stylistic. The article is composed of

[27] John Bennett Shank, *The Newton Wars and the Beginning of the French Enlightenment* (Chicago: University of Chicago Press, 2008), p. 197.
[28] In an article announcing the new edition of Castel's *Mathématique universelle,* Rondet wrote that it was the 'livre auquel je dois mon propre état de géomètre'. 'Avis au public touchant la nouvelle édition de la Mathématique universelle du P.C.J de la société royale d'Angleterre etc par M. Ro[ndet]', *Mercure de France* (1754), 137-141 (p. 141).
[29] 'Lettre écrite de Paris le 17 Février 1726 par M. Rondet au R.P. Castel, jésuite, en réponse au clavecin oculaire', *Mercure de France* (1726), 650-660.

a series of conjectural observations on the nature of colour, sound, and the pleasures created by each. Castel's argument that the instrument is the product of mathematical work is ultimately circular, which he disguises using emphatic devices that rely on repetition.

Castel's introductory remarks, his *exordium*, respond to Decourt's expressions of praise and personal esteem. This allows Castel to invoke *eunoia* and *arete*, the components of *ethos* that predispose an audience to receptivity to the speech and faith in the speaker's excellence of character. Following this, Castel launches into his *narratio*:

> Je ne crains pas d'en dire trop, lorsque je donne le nom de belle, ou du moins de jolie chose au clavecin en question. Car que peut-on en fait d'art imaginer de plus curieux que de rendre visible le son, et de faire les yeux confidents de tous les plaisirs que la musique peut donner aux oreilles?[30]

Castel wonders what Brebeuf would make of his instrument, as Brebeuf, a seventeenth-century Jesuit, described 'la simple écriture' as 'l'art ingénieux de peindre la parole et de parler aux yeux.' This quotation of Brebeuf's paraphrase of Lucan is a commonplace, a topic that an audience can be expected to recognise, and which is used to build confidence and ease transitions.[31] This particular commonplace derives from the tradition of *ekphrasis*, in which description that makes strong use of imagery is described as a *peinture parlante*. In the previous century, in a work on sacred paintings, the Jesuit rhetorician Richeome had described different types of 'figures', the first being images imbued with allegorical and symbolic meaning, and the second being description in the style of Philostrates, whose language is sufficiently vivid to create a visual experience for readers, 'comme ayant la peinture devant les yeux.'[32] Castel supports his colour music by suggesting that it builds on this tradition. Unlike

[30] 'Clavecin pour les yeux', p. 2553.
[31] On the history of these, see Herrick, pp. 98-99.
[32] Louis Richeome, *Tableaux sacrés des figures mystiques* (Paris: Laurens Sonnius, 1601), p. 4. For discussion of Richeome, see Fumaroli, pp. 258-63.

ekphrasis, colour music would not require the abstraction of language, and it would also go in both directions, translating music into tapestries or paintings. What would Brebeuf say, he wonders, of,

> L'art non de réveiller simplement l'idée de la parole, et du son par des caractères abstraites et inanimées, tels que sont les lettres de l'Alphabet, ou les notes de la musique; mais de peindre ce son et toute la musique dont il est capable; de le peindre, dis-je, réellement, ce qui s'appelle peindre, avec des couleurs, et avec leurs propres couleurs; en un mot, de les rendre sensibles et présents aux yeux, comme ils le sont aux oreilles, de manière qu'un sourd puisse jouir et juger de la beauté d'une musique, aussi bien que celui qui l'entend, et que réciproquement, malgré le proverbe, un aveugle puisse juger par les oreilles de la beauté des couleurs.[33]

In the same way that ekphrastic description 'presents' images to readers as vividly as actual sight, colour music could produce a painting through the use of musical notes. This new form of communication would thus be more direct than language, as it would not be a description: music that is 'painted' by colours will be a 'real' and 'present' expression, doing away with the 'arbitrary' letters of the alphabet to achieve an aesthetic experience unmediated by the 'idea of speech'.

Castel acknowledges that this concept may seem 'comme des paradoxes d'une spéculation outrée'. He assures Decourt that this is not the case, and promises to provide 'des raisons de fait et de géométrie', and that, following the 'stile de Socrate', his analysis and 'démonstration' will precede the 'proposition et la construction de la chose'. He proposes to do this through the use of analogy,

> Car vous êtes trop géomètre pour ignorer que toute la géométrie est analogique dans sa marche, et que jamais dans aucune science on ne peut découvrir une vérité quelconque qui ne soit le quatrième ou troisième terme d'une analogie, par laquelle on compare entre elles des choses connues pour découvrir cette vérité inconnue.[34]

Analogy is thus a type of reasoning that, like geometry, begins with known truths to calculate an unknown truth; Castel claims that three or more stages of analogy can be

[33] 'Clavecin pour les yeux', p. 2553.
[34] Ibid., p. 2555.

employed in order to make a new discovery. Castel demonstrates this technique with a numbered list, which is intended to turn observations on the similarities between the waves of sound and light into a case for building a harpsichord for the eyes: 'Il faut donc remarquer 1. Que le son se répand tout autour comme la lumière en lignes droites. 2. Qu'à la rencontre des corps impénétrables il se réfléchit, et se réfléchit 3. à angles égaux comme la lumière.'[35]

However, this list is not an analogical argument, and at no point does he explicitly make the claim that an ocular harpsichord depends on: that the similarities between colour and sound are such that colour music, properly tuned, would have the same harmonic effect upon the eye as music has upon the ear. Castel begins interrupting his analogical list with conversational asides that pre-empt any scepticism or confusion Decourt may be experiencing: 'Sont-ce là des preuves, ou n'est-ce qu'une analogie vague? Mais ce n'est pas tout, et nous ne faisons que commencer', and 'en voici bien d'autres, mais toujours des faits.' As the list progresses, it shifts from statements of physical 'fact' into statements of an anecdotal character, and his conversational questions become a series of rhetorical questions, a device known as *anacoenosis*. This creates an effect of accelerating agreement, as the reader's implied series of 'yes' responses mount up between the questions, until Castel arrives at the culmination of his analogy:

> Enfin, 8. Pour terminer ce parallèle qui n'est pas si poétique qu'il ne soit aussi tout philosophique, le son et la lumière ne consistent-ils pas également dans les trémoussements insensibles des corps sonores et lumineux, et du milieu qui les transmet jusqu'à nos oreilles? Pourquoi donc, disais-je, en suivant le fil de cette analogie? Pourquoi ne ferait-on pas des clavecins oculaires, comment on en fait d'auriculaires ?[36]

Castel asks Decourt to judge the soundness of his reasoning, which he acknowledges has been swift, and digresses into a commonplace on the perfection of the arts and

[35] Ibid., p. 2556.
[36] Ibid., p. 2557.

science, pleading for time to make his case, should his reader still be unconvinced, 'car il ne faut pas croire qu'une découverte raisonnée se fasse tout d'un coup, et par une espèce de hasard'. Having slowed his pace, Castel again takes up his parallel between light and sound:

> Ou plutôt je l'élève un degré plus haut, et ce sont désormais les affections de la lumière que je compare avec celles du son. La lumière modifiée fait les couleurs, le son modifié fait les tons. Les couleurs mêlées font la peinture, les tons mêlés forment la musique. Il s'agit donc de voir si l'analogie ébauchée entre la lumière et le son, se soutient entre les couleurs et les tons, entre la peinture et la musique, rien n'est mieux soutenu, défiez-moi de le prouver; mais je ne vous les conseille pas car 1. j'ai toujours mon Allemand à mon côté qui m'apprend encore que les couleurs suivent la proportion des tons de la musique.[37]

By referring to 'a higher degree', Castel implies that his argument is about to become more convincing or abstract, but instead he produces a tighter sequence of analogies, while continuing to refuse to advance his central claim: that colour music will offer eyes the same harmony that music offers ears. Castel compensates for this using a figure of speech known as *mesodiplosis*, in which the middle section of a clause is repeated to build emphasis: 'modifiée fait les', 'mêlées forment la', and 'entre les/la'. Castel uses this device to tie together three separate analogies—light and sound, colour and tone, painting and music—reinforced by repetition of 'soutenir'. Recognising that this structure may seem suspiciously confusing, he defies his reader to defy him to prove it, then counsels him not to, and begins another list.

This list also uses emphatic devices based on repetition. The first, *epistrophe*, is related to the *mesodiplosis* used earlier, but repeats the end of a clause ('analogie et système'). The second, *polyptoton*, repeats the same word in different grammatical cases (découverte, découvre, découvrir), and is signalled by the phrase, 'en un mot':

> Il est vrai que Kircher ne donne point de preuve bien précise de ce qu'il dit là, il en parle en homme que la force de l'analogie et du système entraine, et qui sent bien plus ce qu'il dit, qu'il ne peut le rendre sensible à tout autre qui aurait à un moindre degré

[37] Ibid., pp. 2558-9.

l'esprit d'analogie et de système; en un mot, il en fait la découverte, ou plutôt il découvre la chose, laissant à d'autres le soin d'en découvrir les preuves précises.[38]

At this point, Castel's argument becomes circular. His first and third analogies (light/sound; painting/music) are linked by a second analogy (colour/tone) that was proposed by Kircher (his 'Allemand'), who was very good at analogy; Kircher discovered this analogy, but left the precise proof for others to discover. Yet if Kircher provided the analogy that serves as pretext for the ocular harpsichord, then the 'others' referred to here ought to mean Castel himself. Castel has primed his reader to expect a proof in precisely this passage, but instead falls back on the point he opened with. The second point of this list is semantic, stating that painters and musicians use musical and visual terminology to discuss their arts, before the third repeats again that, 'le fait est certain, les couleurs ont leur tons précis qui suivent entre eux les mêmes proportions de la Musique',[39] sending the reader to Newton's *Optics.* Castel then moves into his *confirmatio*, followed by his *confutatio,* which he closes using a device known as *paralipsis*, in which a criticism that the speaker refuses to answer is invoked:

Mais à quoi bon cela? me diront ceux qui avant que d'en entrevoir l'exécution, le regardaient comme une si belle chose qu'ils auraient crû parfaitement impossible: gens également incapables de faire des découvertes dans les arts, et d'estimer ce qu'elles valent, celles qui sont faites par d'autres que par eux: sera-ce donc, diront-ils, un si grand agrément pour les yeux, de voir de simples couleurs se succéder l'une à l'autre, ou se combiner différemment ensemble? étrange situation que celle où se trouve quiconque a quelque chose de nouveau à proposer au public![40]

He then transitions into his *peroratio* using a commonplace on the ancient roots of all novelties advanced by modern authors, and appeals to the reader's emotional response (*pathos*) through another use of *anacoenosis*: 'Concevez-vous bien en quoi consiste tout le charme de cette musique et de cet instrument? Car il faut que des gens comme vous s'accoutument à raisonner sur ce que le peuple se consente de sentir et

[38] Ibid., p. 2559.
[39] Ibid., p. 2560.
[40] Ibid., pp. 2568-9.

d'éprouver.'[41] He continues with a series of comments on the charms of different sounds, digressing into a humorous anecdote taken from Kircher, in which a melancholic prince was pulled from the brink of despair by the invention of a 'cat piano' whose keys produced a 'miaulis bien diapasonné' by provoking a 'scale' of cats with sharp points.[42] Castel repeats his reasoning on the fugitive nature of sound, tying it into an idea for an inverted ocular harpsichord—a room lined with colourful tapestries woven according to the harmonies of music. As he approaches the end of his letter, he uses more *anacoenosis* to shift into an appeal to pity, using an inverted reference (*chiasmus*) to the 'peinture parlante' of his opening remarks:

> Et croyez-vous que ces endroits pathétiques, ces grands traits d'harmonie, ces changements inespérés de tons, qui causent à tous moments des suspensions, des langueurs, des émotions, et mille sortes de pitiés dans l'âme qui s'y abandonne, perdent rien de leur force et de leur énergie en passant des oreilles aux yeux, et de la musique à la peinture, qui désormais pourra être appelée à bien plus juste titre qu'elle ne l'a été jusqu'ici, une musique muette; mais d'autant plus efficace pour aller jusqu'au cœur; qu'elle s'y insinuera avec moins de bruit et de fracas.[43]

Castel suggests that Rameau's music would be ideal for the ocular harpsichord, and then concludes his letter with an apology for having packed his article with so many 'principles' and 'reasonings':

> Je n'ai pas crû devoir vous dire la chose nument et sans l'accompagner de tous ses principes et raisonnements auxiliaires, craignant que vous ne m'accablassiez d 'objections telles qu'en peut mériter une chose si nouvelle, et que peut vous en fournir vôtre bon caractère d'esprit qui va toujours à la raison des choses, et ne se paye ni de promesses, ni de paroles.[44]

These closing remarks once again appeal to his reader's goodwill, creating a useful distraction from the fact that this letter delivers many more 'promesses' and 'paroles' than it does 'principes' and 'raisonnements'.

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[41] Ibid., p. 2570.
[42] Ibid., p. 2571.
[43] Ibid., p 2576.
[44] Ibid., pp. 2576-7.

4. *Démonstration géométrique du clavecin pour les yeux* (1726)

Though it is considerably lighter on rhetorical ornament than the first text, and entirely devoid of appeals to the reader's pity or emotion, Castel's two-part 'Démonstration géométrique du clavecin pour les yeux et pour tous les sens, avec l'éclaircissements de quelques difficultés, et deux nouvelles observations',[45] continues to use repetition as its primary emphatic device. There are no calculations or diagrams, so his claim that this is a 'geometric' text is supported solely by the fact that it is labelled as a series of propositions, proofs ('démonstrations'), and occasional commentaries (*scholie*), so that it resembles a mathematical theorem. It employs the same analogical reasoning as the first article and has a similarly conversational tone, particularly in his *scholie*. He begins with the physics of light and sound, and moves through the physiology of sight and hearing, to arrive at a theory that attributes pleasure to harmonic vibrations:

> 1. Proposition. Les sons excitent uniquement des vibrations ou des ondulations dans l'oreille, et ce n'est que par ces vibrations ou ces ondulations, qu'ils frappent l'âme agréablement ou désagréablement. II. Prop. On peut en même temps entendre distinctement plusieurs sons différents. C'est l'expérience.[46]

These first two propositions are followed by a *scholia*, which comments that because we can distinguish between multiple noises sounding simultaneously, that means that combined sounds are fundamentally unmodified by combination, and so affect the ear just as they would when sounding on their own. In a moment that recalls the skilfully glossed contradictions of his first article, Castel shrugs off any need to account for how this works, suggesting that such an explanation would be inappropriate: 'Je ne dis pas comment cela s'exécute; je ne parle que du fait.' Before his reader has time to

[45] 'Démonstration géométrique du clavecin pour les yeux et pour tous les sens, avec l'éclaircissement de quelques difficultés, et deux nouvelles observations,' *Mercure de France* (1726), 277-292.
[46] Ibid., pp. 277-8.

consider that this is therefore not a fact at all, but a conjecture, Castel makes an irreverent analogical shift: 'Du reste ce fait n'a rien d'extraordinaire, puisque nous voyons tous les jours, que deux ou trois pierres qu'on jette dans l'eau y causent chacune des ondulations et des vibrations fort distinctes.'

Though Castel has just said that he doesn't intend to explain how the ear perceives multiple sounds simultaneously, that is precisely what he then proceeds to do, making 'un petit détour' (proposition III) that accounts for this phenomenon by announcing that, 'chaque son divise la membrane auditive en un certain nombre déterminé de petites parties égales, qui font chacune en même temps un certain nombre de vibrations' (proposition V).[47]

Castel's ideas on how the eardrum works are fairly specific, and it would be interesting to know if they are consistent with earlier or contemporary accounts of the physiology of hearing. However, for the purposes of interrogating the rhetorical structure of this article, these passages are significant because of the contradictory circuitousness with which Castel produces his ideas. The article's contrivance as a 'démonstration géométrique' may be an artificial stylistic choice, but it could still allow for the advancement of a logical argument. Instead, Castel chooses to subvert himself, claiming that he doesn't need to offer an explanation, and then paragraphs later, presenting that explanation as a separate proposition.

Castel's finessing of his readers' expectations is frustrating for a reader seeking scholarly perspective, but read casually, and once one knows what's happening, it is almost fun. A little like being on a merry-go-round, it is delightful to be dizzy so long as you can trust that whoever is spinning you around is in control. Castel's fanciful, beguiling tone establishes control over his reader, and while he presented the ocular harpsichord as an entertaining, novel source of pleasure, he also insisted that readers conceive that pleasure on his own strict terms. In his system, when harmonic vibrations are applied to the body, the soul experiences pleasure, because it identifies

[47] Ibid., p. 279.

those vibrations as numerically proportionate: 'VIII. Propos. Dans quelque partie du corps que l'âme sente des vibrations modérées, et commensurables, c'est-à-dire, dont le rapport soit numérique, elle doit en avoir du plaisir.'[48] Pleasure is thus not a physical phenomenon, or even a physical experience, but an immaterial response to intellectual harmony:

> Démonstration: Toutes les parties du corps sont susceptibles de plaisirs; c'est un fait. Or ce n'est pas parce que l'oreille est l'oreille, que des vibrations commensurables lui plaisent, mais parce qu'elles sont commensurables, et que l'âme peut distinguer ses objets et en connaître ou sentir le rapport.

Because all physical pleasure experienced through the senses is caused by an internal concept of harmony, there is no meaningful difference between the pleasures of different sense organs. The only thing that matters is whether or not the vibration is mathematically harmonious:

> Tout le monde a voulu dire son mot sur le clavecin oculaire: aussi l'avais-je proposé en style intelligible. Une chose m'a surpris de la part de quelques philosophes et philosophes cartésiens; il y a bien de la différence, ont-ils dit, entre l'oreille et les autres sens. Quelle différence? le son fait impression sur l'oreille par des vibrations, mais l'impression des autres sens consiste dans un je ne sais quel mouvement, etc.[49]

If Castel's recourse to *je ne sais quoi* to explain how the other senses experience vibration seems almost jarringly evasive, that's because it is. Recognising this, he suggests a brief explanatory digression, 'car je n'ai jamais aimé les je ne sais quoi dans la philosophie'. What follows is not an explanation; instead, Castel repeats the same point—that all vibration is the same—using different lists, a figure of speech known as accumulation. This creates the impression that his argument is moving from one point to another, when in fact it is the same point made repeatedly, with lists provided in between to space out and disguise the repetition. He offers an accumulation of things that can strike:

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[48] Ibid., p. 282.
[49] Ibid., pp. 283-4.

De la part des membranes, la diversité ne fait rien, fut-elle encore plus grande: car soit qu'on frappe une corde de fil, de soie, de boyau, de fer, d'acier, de cuivre, d'or, d'argent, soit qu'on frappe un verre, un morceau de bois, une pierre, une cloche, un chaudron, une timbale; soit qu'on souffle dans une flute, dans une trompette, dans un chalumeau, etc. Toujours il s'excite dans tous ces divers corps une même manière de vibrations.[50]

And of ways that one can 'strike' a sense organ:

Quel qu'autre diversité qu'on y imagine, soit que l'organe soit tiré, pincé, piqué, chatouillé, caressé, raclé, il n'est géométriquement que poussé simplement, la diversité de nos termes n'influant que dans nos jugements, et nullement dans le procédé de la nature.

Following these lists, he repeats this point yet again, in the form of a conclusion:

Qu'on pince une corde, qu'on la frappe; qu'on la racle, qu'on la morde, le je ne sais quoi n'a point de lieu, ce sont toujours foncièrement des vibrations et une même manière de vibrations qu'on y excite. Je crois cela assez démontré.[51]

This first 'démonstration' of the ocular harpsichord is followed by another 'nouvelle démonstration du clavecin pour tous les sens', which repeats the same points of the previous one, in a different order. There is no discussion of the other senses.

The second part of this article, the 'Difficultés sur le clavecin oculaire, avec leurs réponses,' was published in March.[52] There is no preamble or reference to the previous articles, which suggests that both Castel and the editorial staff of the *Mercure* assumed readers were already familiar with its subject. Though Castel's use of a numbered list is an echo of the previous work's 'geometric' style, it reads more like a dialogue between Castel and a single, non-specialist, questioner, as Castel expresses

[50] Ibid., pp. 284-5.
[51] Ibid., p. 286.
[52] 'Difficultés sur le clavecin oculaire, avec leurs réponses,' *Mercure de France* (1726), 455-463.

frustration, admiration, or patience in response to the questions, and several of the 'difficulties' interact with and suggest awareness of Castel's responses.

The first difficulty asks why Castel doesn't produce an ocular harpsichord himself, he repeats his reply that he is a philosopher and geometer, not a luthier, but then cheekily suggests that someone may be making it anyway, 'je ne suis pas d'avis de me faire maçon pour faire mes preuves d'architecte; et puis, qui vous a dit qu'on n'en fait pas?'[53] Still, the questioner would like to know how it could be made: 'Mais comment exécuter ce clavecin pour les yeux?' Castel says that one would need only put a series of colours into any order one found pleasing, and then experiment with 'playing' and retuning it until both the eye and ear 'soit content'. The questioner complains that this might take a long time, and that it may still not work. Castel patiently indulges them and repeats himself: 'Je réponds à tout. Rangez toujours à votre fantaisie, et comme à vue de pays, vos couleurs : tout arrangement plaira.'[54] In other words, the use of a fixed relation between certain tones and colours is not strictly necessary, at least not at the beginning of this new art, as colour music, even before it has been properly 'tuned', will nonetheless be fun. In the course of playing it, the eye-ear relation will gradually become more sophisticated, and one's taste in colour music more refined: 'On ne se lassera d'un clavecin oculaire mal montée, que lorsqu'on sera en état de le mieux monter.'[55]

The questioner seems placated by this observation, as they now begin to latch on to the general idea: 'On fera donc des clavecins pour tous les sens.'[56] Planting this notion is possibly what the previous article's spurious 'démonstration du clavecin oculaire pour tous les sens' was meant to achieve, as Castel enthusiastically accepts the suggestion, adopting a playfully defensive posture:

Ce n'est pas moi qui élude les difficultés. 1. Mettez de suite une quarantaine de cassolettes pleines de divers parfums, couvrez-les de soupapes, et faites en sorte que

[53] Ibid., p. 455.
[54] Ibid., p. 457.
[55] Ibid., p. 458.
[56] Ibid., p. 459.

le mouvement des touches ouvre ces soupapes: voilà pour le nez. 2. Sur une planche, rangez tout de suite, avec une certaine distribution, des corps capables de faire diverses impressions sur la main, et puis faites-la couler uniment sur ces corps : voilà pour le toucher. 3. Rangez de même des corps agréables au goût, entremêlé de quelque amertume. Mais parlai-je à des gens à qui il faille tout dire?

Following this talkative display of good-natured frustration, Castel segues into a discussion of people who are already able to compensate for limitations in one sense organ by supplementing with the sensations of another:

J'ajouterai qu'il y a des gens, qui par le simple toucher connaissent les divers bois, les diverses étoffes, les cartes, l'écriture, les couleurs, etc. Il y a à Paris un homme qui a appris à son fils aveugle, par le seul tact, à lire, à écrire, à chanter, à déchiffrer la musique, etc. Nos sens sont tous capable d'une grande perfection; mais ceux qui n'ont rien vu ne conçoivent que ce qu'ils voient.

As we saw in Chapter III, the assumption behind this claim comes from the *sous-entendre*, and the idea that the refinement of sensation has no limit whatsoever. Sensation is not strictly physical, but an experience of harmony, defined by numerical proportions. The mind is not only affected by the sense organs, but can 'speak back' to them as well, using the language of harmony. So Castel makes no distinction between sensation, aesthetic pleasure, and knowledge; they all exist along the same scale, in varying degrees of refinement. For this reason, the blind people he mentions are able to perform tasks that normally require the ability to see because they have 'taught' their sense of touch to a previously unknown level of 'perfection'. So when Castel arrives at his eighth and final difficulty, he writes, 'C'est le pont aux ânes. Y a-t-il tant de plaisir dans ce clavecin oculaire?'[57]

The 'pont aux ânes' is a reference to one of Euclid's propositions, which explains that if you have an isosceles triangle where the angles at the base are equal to one another, and you extend its equal lines, then the angles at the base that those extended lines produce will also be equal. It is known as the *pons asinorum* because what looks like a problem is actually the solution, as is the case when a donkey stands

[57] Ibid., p. 460.

in front of a bridge, which is angled upwards so that it cannot see the other side. The donkey thinks that the bridge is an obstacle, and refuses to cross it, because it is too stupid to grasp that the bridge is the solution to the real obstacle, the river or ravine that it traverses. Castel thinks it is stupid to ask if the ocular harpsichord will cause pleasure, because pleasure is its organising principle. As all pleasure consists in physically identical vibrations, and is unmodified by the apparent diversity of our sense organs, the sensations of colour and sound are already identical; we simply do not know it yet, because they are not in tune. This can be corrected by exercising the senses together until they are equally perfected, which is precisely the function that the ocular harpsichord would be able to perform. Colour music would not only be pleasurable; it would offer super-sensual pleasures that music and painting could never attain. 'Plus une nature est perfectionnée,' Castel writes, 'plus elle est belle et agréable: et un plaisir savant et profond est double et triple d'un simple plaisir.'[58]

5. *Lettre de M. Rondet*

If readers of the *Mercure* were eager to experience this pleasure, then they did not have to wait long for an encouraging sign of activity, as Rondet's letter was published the following month. In addition to supplying the construction plans discussed in Chapter II, Rondet recounted case histories from an ocular surgeon named Woolhouse, which suggested that the ocular harpsichord's pleasure was a real possibility.

Castel had a personal relationship with Woolhouse, who spent some time in Paris as the head of the Quinze-Vingts hospital for the blind, and wrote to Hans Sloane to recommend Castel's election to the Royal Society. Rondet claims to have been a witness to an extraordinary case in which Woolhouse cured a man of blindness by prescribing attendance at a series of concerts.[59] He then offers an anecdote similar to

[58] Ibid., p. 461.
[59] 'Lettre […] en réponse au clavecin oculaire,' p. 654.

the cases of blindness supplemented by touch that Castel had described at the end of his 'difficulties':

M. de Woolhouse m'a raconté plusieurs fois, qu'il avait vu a Maastricht un aveugle, qui distinguait les couleurs par le toucher : c'était le fils d'un mercier, qui avait perdu la vue à l'âge de 6 années. Lorsqu'on donnait à cet homme un drap rouge, il disait, en le touchant, que cette couleur lui faisait le même effet, que le son d'une trompette, ou d'un tambour. Le noir, il le connaissait, parce qu'il était raboteux. Pour le blanc, ou le jaune, il disait seulement, qu'il fallait que ce fût l'un ou l'autre ; aussi-bien que le vert avec le bleu, apparemment par l'accord qui se trouve entre ces couleurs.

If Woolhouse did witness such a thing, it is a remarkable coincidence that Locke had previously recounted a similar example of intersensory analogy that drew the same connection between the sound of a trumpet and the colour red:

A studious blind man, who had mightily beat his head about visible objects, and made use of the explication of his books and friends, to understand those names of light and colours which often came in his way, bragged one day, that he now understood what scarlet signified. Upon which, his friend demanding what scarlet was? The blind man answered, it was like the sound of a trumpet. Just such an understanding of the name of any other simple idea will he have, who hopes to get it only from a definition, or other words made use of to explain it.[60]

While Woolhouse's blind man experiences the 'effect' of the sound of a trumpet upon touching the red cloth, Locke's blind man 'understands' the connection only after careful study, motivated by a desire to grasp an idea. Yet Woolhouse's blind man has also acquired his colour-sound analogy through study, as the detail that he is a mercer's son suggests that his ability to tell the colour of fabric through touch was a practical development that allowed him to contribute to his father's business. Further, Woolhouse's example is not a straightforward colour-sound analogy: he arrives at it through an analogy between sound and touch. In Rondet's account, the mercer's son doesn't explicitly identify the cloth as red, so it is only relevant that he thinks it feels

[60] John Locke, *An Essay Concerning Human Understanding,* ed. P H Nidditch (Oxford: Clarendon Press, 1979), p. 425.

like the sound of a trumpet if the reader has already accepted an analogy between that sound and that colour.

The differences between these two examples, and the details of Woolhouse's case, are convenient for Castel, as the ocular harpsichord depended upon a similarly vague yet prescriptive analogy between colour and sound. In his first articles, he had proposed two different ways to go about tuning the ocular harpsichord: either by finding the precise proportion between sounds and colours using geometrical analogies, or by using any order one pleases, and simply rearranging them until the colour music is enjoyable. In Castel's system, both techniques could work because there is already a precise and perfect proportion between sound and colour, hinted at by semantic analogies, and similarities in the language used by painters and musicians.

Thus, the only reason that these analogies are uncommon is that most people never need to develop their sensitivity to them. Locke's anecdote discusses the reason why ocular harpsichords are impossible, because the blind man's 'red' is an artificial mock-up of a simple idea, developed in response to intellectual frustration with the limitations of his senses. In contrast, Woolhouse's analogy proves that the ocular harpsichord is possible, because the mercer's son's has found an intuitive response to a practical problem, finding other routes to 'red' over years of exposure, and from a young age. An ocular harpsichord would not only be possible, but a transformative pedagogical tool, if there were no barriers between the senses that could not be unlearned, and eventually removed.

6. *Lettre d'un philosophe gascon*

In the *Mercure*'s May issue, an incisive critique of this argument gave voice to Locke's line of argument. The *philosophe gascon* opened his letter by quoting the first article, and playing on his pseudonym:

Je suis d'un pays, où les pensées hardies, comme celles-là, plaisent infiniment : quand elles nous viennent, nous nous en réjouissons les premiers, et nous cherchons à en faire un régale aux autres, afin qu'ils en rient avec nous, mais à vous parler naturellement, il arrive souvent que nous ne sommes guères persuadés nous-mêmes de nos propres pensées. N'auriez-vous pas voulu pour cette fois nous imiter un peu? Pardonnez-moi ce doute, mon Révérend Père, vous savez que nos idées gasconnes sont sans malice, et que nous ne trouvons pas mauvais nous-mêmes qu'on nous accuse quelque fois de ne pas nous croire; ainsi j'aimerais autant avoir ce doute à votre sujet, que de vous dire que votre système me paraît absolument impossible, et il l'est en effet.[61]

This critic's pseudonym is a reference to a piece by Adrien de Monluc, *Le Philosophe gascon*, published in *Les Jeux de l'inconnu.*[62] This harangue against vanity is directed at an aristocrat who believes that fortune has treated him unfairly, because his ambitions at court and in politics have not been realised, when the real reason lies in his choice to lead an easy, lazy life in the countryside. So the choice of pseudonym takes aim at Castel's vanity in seeking attention for something as silly as an ocular harpsichord, while the passage above invites Castel to confess that even he doesn't find his argument convincing. Having called Castel a charlatan, the Gascon philosopher begins his critique by differentiating between the senses. People cannot see with their ears, and if we could, then we would not have ears in the first place:

L'Auteur de la Nature nous a donné cinq sens, dont tous les hommes, philosophes, et autre voient et sentent, ont toujours vu et ont toujours senti la différence; […] Comment donc, je vous prie, avez-vous pu confondre tout cela dans un moment, en nous voulant persuader que les yeux pourront goûter les plaisirs des oreilles, et qu'un sourd pourra juger de la beauté d'une musique? Mais si cela est, pourquoi, par une machine semblable à votre clavecin, ou par votre clavecin lui-même, les sourds ne pourraient-ils pas jouir par les yeux d'un entretien de plusieurs personnes qui s'entre-parleraient? et ainsi dès que cette machine sera construite, les oreilles deviendront inutiles, ou du moins peu nécessaires, et voilà bien des oreilles de reste.[63]

[61] 'Lettre d'un philosophe gascon au R.P. Castel, jésuite, sur son clavecin oculaire', *Mercure de France*, (1726), 929-939, (p. 930).
[62] Adrien de Monluc, *Les Jeux de l'inconnu* (Paris: au Palais, 1630). There is an intriguing link to the 'Don Quixote' nickname here, as the *Philosophe gascon* is paired with another text, *Le Don Quichotte gascon*.
[63] 'Lettre d'un philosophe gascon', pp. 932-3.

After considering the potential similarities between light and sound, the philosopher offers an answer to his own question:

> Ce qui vous a trompé, à mon avis, c'est l'uniformité que nous convenons être vraisemblablement entre les causes occasionnelles des sons, et celles de la lumière et des couleurs: vibrations, disons-nous, causes occasionnelles des couleurs: vibrations, causes occasionnelles des sons.[64]

In arriving at this point, he uses a couple of examples that point to the empirical basis of his critique. In a moment that recalls Locke's mind of 'white paper, void of all characters', he asks if he ought to suppose a connection between the whiteness of the page before him as he writes, and the ringing of a nearby bell, simply because he notices them at the same time:

> Actuellement que j'ai l'honneur de vous parler, je vois le papier blanc que j'écris, et j'entends une cloche, je vous proteste en honnête homme, que je ne vois, ou pour mieux dire, que je ne sens pas qu'il y ait plus de ressemblance entre la blancheur de ce papier et le son assez aigu de cette cloche, qu'entre le jour et la nuit.[65]

In addition to being apt, this point is structured using rhetorical irony—the *philosophe gascon* is not speaking, but writing, thus the paper before him is covered with text that ironically discusses its blankness. He insists that diversity of sensation is caused by diversity of sense organs, and informs Castel that he cannot reason his way out of this diversity, because it is not intellectual, it is raw material sensation 'considérée dans l'âme.'

The *philosophe gascon* concludes by reducing Castel's claim for an ocular harpsichord to two points, and contesting them. The first is that once colours are in the right harmonic proportion, they will produce the pleasure of music: 'Mettez entre les couleurs telle proportion que vous voudrez harmonique, géométrique, arithmétique, vous n'aurez que des couleurs et jamais des sons.'[66] The second is that

[64] Ibid., p. 935.
[65] Ibid., pp. 935-6.
[66] Ibid., p. 938.

each object of our senses excites the same type of vibration, and the diversity of our sensing 'membranes' does nothing to transform or modify them: 'Les objets de nos sens peuvent bien exciter une même manière de vibrations dans l'air; mais quand ces vibrations tombent immédiatement dans l'organe des sens, alors elles sont aussi diverses que ces organes eux-mêmes'.[67]

7. *Lettre à M. de la Roque*

Castel apparently made no response to these critiques, as he refused to direct his response to the *philosophe gascon* himself, and instead wrote a letter to the editor of the *Mercure,* which is largely concerned with complaining about anonymity, and referring to previous occasions on which writers attempted to attack him anonymously, but failed to conceal their identities for long. This approach is a little hypocritical, given Castel's habitual anonymity in the *Journal de Trévoux*, not to mention the possible pseudonymity of Rondet. However, apart from agreeing with his critic and never speaking of the ocular harpsichord again, it is difficult to see what other options Castel had. By painting the *philosophe gascon*'s anonymity as dishonourable, and making a show of responding indirectly to his points, Castel was able to manipulate those points into a form he could comfortably respond to. For example, he quotes the *reductio ad absurdum* that the deaf could use the ocular harpsichord to listen to a conversation as if it were meant literally, and says that he is willing to show his machine to the *philosophe gascon* 'quand il lui plaira.'[68] He embellishes his response with commonplaces on the ancient roots of all novelties and the small-mindedness of those who attack them, and another numbered list. He suggests that that the *philosophe* does not know what he is talking about, because he has made the error of mistaking analogy for equation:

[67] Ibid., p. 939.
[68] 'Lettre du P. Castel, jésuite, à M. de la Roque, écrite à Paris le 9 juin 1725', *Mercure de France* (July, 1726), 1537-1543 (p. 1541).

Ajoutez qu'en proposant ce clavecin, je n'ai contredit personne, et que je m'y suis même aidé des découvertes de mes prédécesseurs: or j'ai toujours pensé que pour contredire il fallait en savoir plus que celui qu'on prétend rectifier; pour le moins faut-il savoir l'état de la question, et se donner le temps d'y penser, afin de ne me venir point dire qu'avec les couleurs on n'aura *que des couleurs et jamais des sons,* et de ne pas prendre la *similitude* et *l'analogie* pour *l'équation*.[69]

If this is a response to the *philosophe*'s most significant criticism, that Castel confused sensations with the phenomena that cause them, then it is not a very good response. Castel had claimed that because similarities could be found in the behaviour of light and sound, and because there are semantic and aesthetic similarities between painting and music, then if you tuned colours to their proper notes, you could collapse their separate pleasures into one overarching pleasure. He had equated the causes of sensation (vibrations) in order to equate the aesthetic pleasures they made possible.

It is clear that Castel felt the force of the *philosophe gascon*'s argument, as he published nothing else about the ocular harpsichord for a decade. He also never forgot this critique; the manuscript of his unpublished journal of the 1750s contains no fewer than ten drafts of his account of his dealings with the *philosophe*. Each version is carefully constructed to seem offhand:

L'anonyme a eu le temps de mourir, j'en suis très fâché. C'était un homme d'un mérite que je ne nommerai pourtant pas, et à qui j'ai toujours laissé ignorer que je fusse instruit de son vrai nom.[70]

Or dismissive:

Mr. un anonyme très anonyme, s'intitulant lui-même *Le Philosophe gascon*, trancha la question dans le *Mercure* qui suivit l'annonce de mon clavecin ; et pour prouver l'impossibilité de mon projet, me défia tout net de l'exécuter.[71]

[69] Ibid., p. 1542.
[70] *Journal,* fol. 3v.
[71] Ibid., fol. 30r.

Or, least convincingly of all, unruffled: 'J'avais dit qu'on pourrait faire, je n'avais point dit que je pouvais ni que je voulais faire mon clavecin, et si je l'ai fait c'est librement, de surérogation en homme d'honneur...'[72] None of these drafts names the *philosophe gascon*, and I have seen no indication that Castel ever did discover his identity; his insistence that he had was probably intended to flush his critic out into the open. There is also no discussion or acknowledgement of the points he made, only repeated claims that he had defied Castel to prove his ocular harpsichord by producing it, and that Castel had responded honestly that he was a philosopher, not a mechanic:

> Pour le philosophe gascon, qui voulait finement dériver sur moi le nom qu'il affectait, je me contentai dans le temps de lui répondre que j'étais architecte non maçon, penseur non faiseur, écrivain non facteur, philosophe-géomètre non artiste ou artisan-luthier.[73]

As we have seen, this critic never demanded to see the instrument produced: his letter was solely concerned with showing why the ocular harpsichord was impossible. By portraying critics like the *philosophe gascon* as defiant, Castel could emphasize that he was humbly doing all he could to respond to public pressure to see the thing produced; he was therefore not only justified but obligated, out of duty to his demanding public, to continue writing articles about the slow and complex progress of his instrument's construction.

8. Castel's Thoughts on Style

Castel touched upon rhetorical subjects when he engaged in contemporary discussions on the *je ne sais quoi* and the sublime. His thoughts on these subjects apparently attracted a significant readership, as several of his pieces were reprinted, sometimes more than once. When La Porte was editing his compilation of Castel's works, he gave special weight to these kinds of comments, including and creating

[72] Ibid., fol. 54[r].
[73] Ibid., fol. 57[v].

excerpts on discoveries, novelties, and style—further evidence that Castel's contemporary notoriety resulted, in part, from his style.

Castel's rhetorical training with the Jesuits, which emphasized an adversarial and extemporaneous approach, apparently led him to follow a specific compositional process. According to Berthier, Castel 'écrivait toujours, effaçait peu, imaginait sans cesse, réalisait jusqu'à l'impossible, possédait une mémoire infinie, une facilité presque sans exemple.'[74] Castel himself claimed that it was difficult for him to correct his work, according to a letter that Montesquieu wrote to D'Alembert: 'Le P. Castel dit qu'il ne peut pas se corriger, parce qu'en corrigeant son ouvrage il en fait un autre et moi je ne puis pas me corriger parce que je chante toujours la même chose.'[75] Castel's manuscripts tell a more complicated story: while he evidently wrote new material spontaneously and with great facility, he redrafted his works over and over again, adding words and phrases in between lines and in the margins before recopying anew, and making new additions as he went.[76] He evidently composed his works with care, which suggests that his spontaneous and naïve style was deliberate.

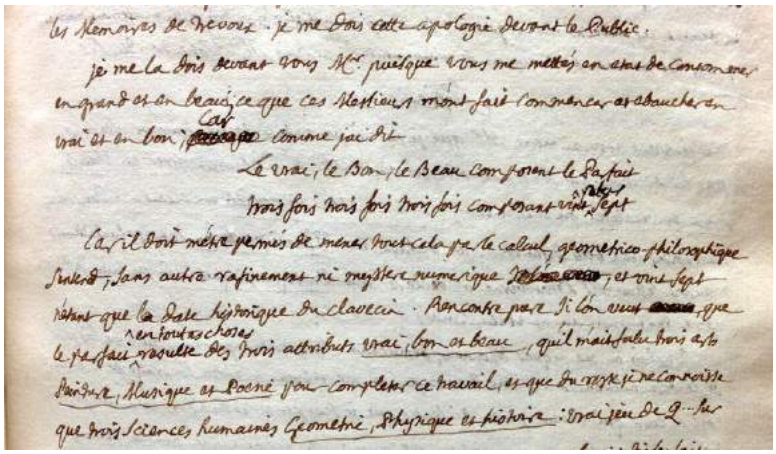

Illustration 9. One of Castel's Manuscripts

[74] Claude Le Cat, 'Éloge du P. Castel, Jésuite', in *Précis analytique des Travaux de l'Académie Royale de Rouen, 1761-1770* (Rouen: P. Periaux, 1817), pp. 236-240 (p. 239).
[75] Montesquieu, *Correspondance,* eds François Gebelin and André Morize, 2 vols (Paris: Honoré Champion, 1914), II, p. 492.
[76] See Manuel Couvreur and Philippe Vendrix, 'Annexe II: Liste des manuscrits du père Castel conserves à la Bibliothèque royale Albert Ier de Bruxelles', in *Autour du père Castel et du clavecin oculaire,* eds Roland Mortier and Hervé Hasquin, *Études sur le XVIIIe Siècle*, XXIII (Brussels: Éditions de l'Université de Bruxelles, 1995), pp. 191-205. This catalogue is incomplete, due to the way Castel kept and used his papers, and his frequently illegible handwriting, but it represents an arduous and deeply valuable effort.

Castel's ideas on literature justified the role he carved out for himself in the world of letters, as a philosopher-geometer using his expertise to develop the arts. It also justified the ocular harpsichord, a musical instrument designed to create a transformational aesthetic experience by discovering the geometrical proportion between colour and tone. Colour music was meant to be a scientifically prescriptive art form, so in Castel's literary theory, 'poets' and 'philosophers' treat the same objects (discoveries about 'la Nature'), but approach them at separate stages in their development.

A poet introduces new truths to the public, which is naturally inclined to resist new ideas and 'novelties'.[77] Castel refers to this as a kind of poetic 'envelope', as it takes a truth that on its own would be 'blindingly' sublime, and dims its brilliancy with 'mysterious' language, so that it is easier to see and more pleasant to consider: 'L'enveloppe pique toujours la curiosité, d'autant plus qu'elle le satisfait moins.'[78] Once poets have have accustomed readers to a new idea, then it is time for philosophers and mathematicians to bring the idea to maturity. The link between these two domains, artistic and intellectual, is analogy:

> Ce qu'on appelle chez les poètes ou chez les orateurs, métaphore, similitude, allégorie, figure; un Philosophe, un Géomètre non hérissé l'appelle Analogie, proportion, rapport. Toutes nos découvertes, toutes nos vérités scientifiques, ne sont que des vérités de rapport.[79]

Castel's 'analogy' was at once scientific, poetic, and rhetorical, when he used it to create a link between the methodologies and objectives of *philosophie* and *belles-lettres*. Defining its exact meaning is difficult, as early-modern definitions considered it from a number of different angles. Scientific analogy, the use of known things to

[77] La Porte published this excerpt as 'Des Nouveautés', (ESS, pp. 94-101); he constructed it by combining and rearranging three sections of a 1735 article on the ocular harpsichord.
[78] 'Réflexion sur la nature et la source du sublime dans le discours', *Mercure de France,* (Jun, 1733), 1309-1322. This piece was reprinted five months later in the *Trévoux*'s October issue (1747-1762).
[79] Ibid., p. 1320.

infer unknown things, was debated at length by early modern scientists like Galileo, Bacon, and Descartes; its waning use is discussed by Foucault in *Les Mots et les choses*. Poetic analogy highlights one quality in two unrelated things in order to create an effect of similarity, while rhetorical analogy draws upon semantic similarities in unrelated terms, to reinforce an argument that may be weak, or to transition between different sections.

The ocular harpsichord united a number of implied analogical strands: a scientific analogy between colour and sound; an aesthetic analogy between painting and music; a disciplinary analogy between the arts and the sciences; a generic analogy between literature and philosophy. Castel did not make an explicit distinction between these various analogies, and so to a certain extent it is a contrivance to view the ocular harpsichord as their product, but his use of emphatic devices to repeat and reframe his 'analogy' testifies to an attempt to forge disparate traditions into a single concept. If Castel was constructing and deploying the ocular harpsichord as a rhetorical device, then it was not in his interest to enumerate the various conceptual elements he intended to employ. He needed only repeat them together often enough, and entertainingly enough, until the phrase *clavecin oculaire* was able to simultaneously invoke these elements in the mind of his reader. The success of the ocular harpsichord as a literary figure lay in its potential to imply all these analogies by collapsing them into the singular image of an instrument, and the imagined experience of colour music.

His most articulate justification for collapsing the distinction between scientific analogy and poetic metaphor appears in his chief work on style, which is titled: *Dissertation philosophique et littéraire, où, par les vrais principes de la physique et de la géométrie, on recherche si les règles des arts, soit mécaniques, soit libéraux, sont fixes ou arbitraires; et si le bon goût est unique et immuable, ou susceptible de variété et de changement*. This piece, which was printed at least three times in a five-year period, contains a paragraph that is effectively a manifesto of his rhetorical and aesthetic theories:

> La beauté, beauté physique, beauté des choses créées, consiste, selon tout le monde, dans la juste proportion des membres, des parties, des traits; s'agit-il de proportions? Comment la géométrie ne nous serait-elle point ici toute seule du plus grand secours? La doctrine des proportions est sa propre doctrine. […] La géométrie nous apprend qu'il y a plusieurs sortes et une infinité de proportions ou de rapports; donc il y a plusieurs sortes et une infinité de différentes beautés toutes aussi justes, aussi proportionnées, aussi régulières les uns que les autres. C.Q.F.D. Car je pense en bonne géométrie, que c'est là une démonstration dans toutes les règles de l'art.[80]

When a 'geometrically-minded' individual explains the mathematical principles at the heart of an aesthetic experience, they must ensure that their explanation is clear, direct, and entertaining, and not too detailed. 'L'esprit du vulgaire est un esprit de détail',[81] he wrote in a passage La Porte excerpted as *Des découvertes*. Entertainment is an important component of making a discovery accessible, as the public requires repeated opportunities to grasp it, in various forms, so that everyone can 'appropriate' the new idea for themselves: 'Dès-là qu'une découverte est faite, elle n'est pas faite pour tout le monde; il faut bien du temps, avant que chacun se l'approprie par son propre génie: répétitions, commentaires, rien n'y est inutile.' As the introduction of a new concept to the public is dependent upon these various forms of repetition, it is incumbent upon authors to make sure that they use style effectively, to retain the attention of their readers. Castel wrote, 'il me semble que la plupart des auteurs préféraient d'avoir un style serré, plein, nerveux, sentencieux, fort de choses, comme on dit, en pareil style, plutôt qu'un style vague, lâche, et noyé dans les paroles.'[82] Referring to his work as a science teacher, he wrote that authors are advised to avoid an 'overblown' style, in which an empty argument is made to seem substantial by the use of rhetoric:

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[80] Originally published as a monograph in 1738, but reprinted in: *Nouveaux Amusements du cœur et de l'esprit,* II (1741), 7-65 (p. 28).
[81] ESS, p. 91.
[82] Ibid., pp. 272-3.

Un style, un discours, purement enflé, est, pour finir par un trait de mon métier, comme ces grandes bulles de savon, qui n'importent qu'à des enfants, lors même que des faux jours les parents des plus belles couleurs.[83]

Castel fixated on these questions of style because he was encountering difficulty following his own rhetorical rules, especially when it came to the ocular harpsichord. 'Toute nouveauté,' he wrote, 'jette dans un cercle vicieux: car, pour goûter on veut connaître ; et pour connaître, il faut goûter.'[84] Maybe Castel thought he could allow himself the liberty of blowing rhetorical 'soap bubbles' instead of making sound arguments, in order to establish the idea in the public mind, so that he could later have the opportunity and the means to develop the science behind it. The concluding line of his letter to M. de la Roque quoted an aphorism that translates as, 'art is long, life is short': 'Ars longa, vita brevis, disait Hippocrate, que je donne, en finissant, pour médecin à ceux qui voudront le prendre.'[85] By prescribing this 'medicine' to the *philosophe gascon*, Castel maligned his critique as an attack on an idea that had not yet been given the chance to develop. This is a point he further emphasized by publishing numerous short pieces on the ocular harpsichord, instead of one coherent explanation.

Castel referred to this element of his style as *découpure*, chopping longer pieces into shorter, serialised articles that refer to one another. In a letter titled 'projet d'impression', which is among his manuscripts, he discussed this preference as both a product of his writing process, and a deliberate stylistic choice, which he used to prevent his articles from being boring or monotonous. Castel considered that he had made *découpure* his speciality, and wanted to advance it as a literary trend:

Je veux le mettre à la mode du moins, car on me traite de novateur dans les arts et sciences, et voilà toute ma façon d'inventer en mettant à la mode ce qui veut y être, fut ce mon clavecin: le public me saura gré de chercher à justifier son gout. Car la découpure est son gout savoir dans la littérature même, et surtout dans la littérature.

[83] Ibid., p. 277.
[84] Ibid., p. 97.
[85] 'Lettre à M. de la Roque', p. 1543.

Découpure refers to both the use of rhetorical variety to appeal to a public taste for light and entertaining literature, and to the decision to publish short excerpts of a larger project rather than a long, integral argument. The role this stylistic choice played in Castel's public persona is suggested by a letter from Castel to La Condamine, in which Castel recollected that Maupertuis had told him that literature was dominated by those who published short works, often, as they were always subjects of discussion.[86] In the same manuscript quoted above, Castel describes the way in which such an approach naturally led to the use of an epistolary format, another indication that his framing of his early articles as correspondence was a stylistic contrivance. Castel recognises that this style suits both a preference for multiple short works over longer ones, and the cultivation of *eunoia*, through his 'naïve' and 'singular' voice, writing that this style came naturally to him, and that he thought that it appealed to the public.

As it developed over time, becoming inextricable with Castel's literary persona, the ocular harpsichord came to embody all these qualities of Castel's style: a mixture of art and science, a source of entertainment founded in variety, and cut up into many shorter pieces, where it was glimpsed frequently and incompletely, rather than subjected to prolonged examination. As the idea became increasingly recognisable to readers, the ocular harpsichord became a commonplace for other eighteenth-century writers: a rhetorical device rather than a mechanical one, which, when wound up and dropped into a text, played a number of familiar intellectual and aesthetic refrains.

[86] Mary Terrall, *The Man Who Flattened the Earth: Maupertuis and the Sciences in the Enlightenment* (Chicago: University of Chicago Press, 2002), p. 5. Terrall's source for this 1751 letter is an excerpt in an auction catalogue; the current location of the letter is unknown.

9. Contemporary Reactions

The subliminal dialogue of the 'Difficultés' provides an insight into how and where the ocular harpsichord was discussed in social conversation, and outside the printed page. Castel's casual, engaging tone and the general nature of the questions posed by his interlocutor are suggestive of conversation, like that of a café or salon. Castel was evidently an enthusiastic and well-liked participant in salon culture. He began frequenting Madame de Tencin's in the 1720s,[87] and in 1734, the Marquise de Pons ended one of her letters to Montesquieu by asking him to, 'faites mes amitiés je vous prie au petit Castel vous savez comme je pense sur son compte'.[88] When Rousseau, newly arrived in Paris in 1741, was introduced to 'le P. Castel, jésuite, auteur du clavecin oculaire',[89] he initially found him to be a very helpful new acquaintance. Castel introduced Rousseau to Madame de Besenval, Madame de Broglie, and Madame Dupin, and advised him to cultivate the friendship of women, commenting picturesquely that, 'on ne fait rien dans Paris que par les femmes. Ce sont comme des courbes dont les sages sont les asymptotes; ils s'en approchent sans cesse, mais ils n'y touchent jamais.'[90] It is easy to imagine what an ideal calling card the ocular harpsichord would have made in a social milieu: charming, funny, easy to explain, and suggestive of hidden insights and profound complexity.

As we've seen from Castel's interaction with the *philosophe gascon*, the ocular harpsichord was a controversial subject from the beginning, and inspired other writers to publish their reactions to it. Many of Castel's critics specifically chose to attack his use of rhetoric and style. When Saurin anonymously ridiculed Castel in 1730, he began by acknowledging that Castel was well known for his unique ideas, but above all for his tone, which employed a 'systematically confusing' degree of stylistic license:

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[87] Fontenelle*, Œuvres complètes,* ed. Alain Niderst (Paris: Fayard, 1989), p. 364.
[88] Montesquieu, *Œuvres completes*, ed. Jean Ehrard (Lyon: ENS Editions, 2014) XIX, p. 62.
[89] OCR I, p. 391.
[90] Ibid., p. 399.

Le P.C. est connu dans le monde par différents ouvrages plus singuliers les uns que les autres ; singuliers par les idées qui sont de lui ; encore plus singuliers par le ton. Tel est le Traité de mathématique qu'il vient de donner au public. C'est une confusion systématique, un chaos mal débrouillé, de définitions, de divisions, de subdivisions capable de rebuter le lecteur le plus patient.[91]

Concluding his attack, Saurin remarked that his critique also applied to the ocular harpsichord, Castel's book on gravity, and everything he had published in journals, as well:

Je ne vous parle point, Mr, des autres ouvrages du P. C. de son clavecin oculaire, de son traité de la pesanteur, de plusieurs morceaux détachés, répandus dans différents mercures et mémoires de Trévoux. Ils sont tous marqués au même coin.[92]

Five years later, Castel left his *Nouvelles expériences* exposed to the same reproach. Though they were styled as a series of mathematical proofs, Castel did not make mathematical arguments, but instead focussed on persuading and entertaining his reader with anecdotes and rhetorical flourishes.

This use of style was strongly criticized by the abbé Prévost who, following publication of the first part of the *Nouvelles expériences* in August 1735, spent an issue of *Le Pour et Contre* criticising the *Journal de Trévoux*'s style, and extensively mocking the ocular harpsichord. He began by reflecting that journalists ought to cultivate a tone of impartiality and restraint. The writers at the *Journal des Savants* were very good at following this principle, he wrote, but their simple style could sometimes come across as dry and inattentive.

On ne fera point ce dernier reproche au Journal de Trévoux. L'esprit et l'imagination y brillent à l'envi. Les fleurs y sont prodiguées. On prendrait chaque Article pour une pièce d'éloquence, et j'en nommerais plus d'un qui mérite le nom de chef d'œuvre de Rhétorique. Tant d'art et d'ornements ne peut manquer d'en faire un livre agréable,

[91] *Lettre critique de M*** à M*** sur le traité de mathématique du P.C.* (Paris: Gabriel Martin, 1730), p. 2.
[92] Ibid., p. 50.

mais je suis trompé s'il n'y perd quelque chose en qualité de Journal. L'exactitude, la justesse, et l'impartialité s'accordent difficilement avec les figures et les tropes.[93]

Prévost argued that the *Journal de Trévoux*'s vivacious rhetoric caused them to overstep the bounds of decent and logical argument: 'C'est une vivacité qui ne se modère plus, et qui s'emporte souvent fort loin au-delà des bornes.'[94] Discussing the ocular harpsichord, he implied that the *Trévoux*'s style was intended to disguise their journalists' superficiality and arrogance. He wondered if Castel's 'discovery' could really be as new and glorious as he claimed if the painters and musicians who would presumably benefit the most instead appeared to be indifferent. This, he implied, was just another example of Castel inflating the value of his project in order to stroke his own ego:

On n'entend point les applaudissements qu'elles devraient faire retentir, et tout ce que j'ai pu recueillir du jugement du public, c'est que l'Auteur est l'homme du monde qui présente ses idées sous le tour le plus neuf et le plus agréable, et qui joint le mieux la pénétration et la netteté de l'esprit aux grâces et même à la chaleur de l'imagination. Je ne sais pas si la profession qu'il fait *de ne se mêler volontiers que de physique et de géométrie*, ne l'empêchera point d'être sensible à ce dernier éloge; mais ceux qui connaissent son style ne trouvent point d'autre raison que sa modestie qui puisse le porter à s'en défendre.'[95]

Prévost concluded that, stripped of all rhetorical embellishment ('tous les traits d'imagination dont l'Auteur a pris soin de l'orner') the ocular harpsichord boiled down to the same comparative principles that already underpinned not only all the arts and sciences, but even everyday pursuits, like cooking—a remark that probably inspired Algarotti's joke about musical sauces.[96] In any case, he added, even if colour music were possible, it would be unbearable, because the optic nerve is not designed for such minute and rapid stimulation.[97]

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[93] Antoine François Prévost, 'Musique des couleurs, clavecin oculaire', *Le Pour et Contre* VI, no. XVI (1735), 11-20 (p. 5).
[94] Ibid., p. 6.
[95] Ibid., p. 13.
[96] Ibid., p. 15.
[97] Ibid., p. 19.

When the *Journal de Trévoux* responded to Prévost in November, they characterized his article as an explicit attack on Jesuit rhetoric, observed that this was not the first time Prévost had baselessly impugned their style, and proclaimed that they refused to be intimidated by insults to their order. They rebuked him for singling out the ocular harpsichord, and wrote that Castel would not change his tone to please Prévost:

> Nous lui passons les traits offensants qu'il lance contre le feu Père Daniel dans sa traduction du premier volume de M. de Thou, quand il dit que ce Père s'est exprimé sur bien des fait historiques en des termes 'qui sentent le Jésuite'. […] M. Prévôt paraît en vouloir nommément au P. Castel, il le chicane sur son Harmonie des couleurs. Mais ce Père n'a pas besoin de fécond, il suffit seul pour se défendre, et ne changera pas de ton pour plaire à son agresseur.[98]

It is worth remarking here that Voltaire used the same term as Prévost, 'orné', to ridicule Castel's rhetorical embellishment. Voltaire had sometimes found the style of the *Journal de Trévoux* to be annoyingly cavalier,[99] but in the *Lettre à Rameau,* he heaped his scorn upon Castel's pseudo-mathematical styling:

> Avec quelle bonté, quelle condescendance pour le genre humain, daigne-t-il démontrer dans les Lettres dont les Journaux de Trévoux sont dignement ornés, je dis démontrer par Lemmes, Théorèmes, Scholies, 1. Que les hommes aiment le plaisir. 2. Que la Peinture est un plaisir. 3. Que le jaune est différent du rouge, et cent autres questions épineuses de cette nature.[100]

However apropos these critiques of Castel's style may have been, they evidently did very little to quell general excitement over the ocular harpsichord. When Telemann visited Castel, he was impressed enough to publish a positive description of the instrument, which was then translated into French and published in *Le Pour et Contre*. Introducing it, Prévost was obliged to retract his earlier dismissal: 'Est-il quelqu'un qui n'ait pas entendu parler du clavecin oculaire du R.P. Castel? On en a d'abord traité

[98] 'Nouvelles Littéraires', *Journal de Trévoux* (November, 1735), 2382-2390 (pp. 2387-8).
[99] 6 January 1736, D980.
[100] 'Lettre à Monsieur Rameau', ed. Gerhardt Stenger, OCV 18C, 3-23 (p. 18).

l'idée de chimérique, mais on commence à croire aujourd'hui qu'il n'est pas impossible de la réaliser.'[101]

[101] Georg Philipp Telemann, 'Description de l'orgue ou clavecin oculaire du P. Castel, traduite de l'Allemand du célèbre M. Telemann, musicien,' trans. Lefebvre de Saint Marc, *Le Pour et Contre* 18, no. 266 (1739), 313-326.

VI

Conclusion

Despite his lifelong attempts to construct it, Castel framed the ocular harpsichord's physical existence as, at best, a secondary concern, and ultimately as unnecessary: 'Je ne suis point du tout de l'avis de ceux, qui croient qu'il n'y a qu'à voir ici, pour sentir et juger; dans la musique vulgaire tous les auditeurs ne son pas juges.'[1] Nevertheless, his references to the instrument as a 'possibility' and to its immanent completion and appearance kept it alive in the public imagination, and allowed him to continue publishing new works relating to it.

Castel was a skilled self-publicist, and he knew that the ocular harpsichord was his greatest source of publicity. With this in mind, we ought to understand the ocular harpsichord as a rhetorical device in Castel's popular journalism, which was intended to make philosophical and scientific ideas appealing to an audience of cultivated elites, whose interests were general rather than specialist.[2] This means that in addition to being erudite, eloquent, and informed, his articles had to be entertaining, as he acknowledged when noting that style's successful use, 'amuse merveilleusement son lecteur, et, à la moderne, il suffit d'amuser.'[3] Yet the ocular harpsichord was never just intended to amuse, but also to reveal philosophical truths about the physical world, and the way the mind and body generate aesthetics. On Castel's own strict terms, it necessarily had to do both: it could only give pleasure if its harmonies were geometrically proportionate.

Ultimately, Castel's colour-music theory could not contain the ocular harpsichord. The evasiveness that enabled him to keep publishing new articles about it also served as an invitation for other writers to expand upon it, and

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[1] NE.V, p. 2337.

[2] The *Mercure de France* published much less on theology, law, and history than the *Journal de Trévoux*, and much more on 'belles lettres'. See, *Presse et histoire au XVIIIe siècle: l'année 1734,* eds Pierre Rétat and Jean Sgard (Lyon: Éditions de CNRS, 1978), p. 112.

[3] NE.V, p. 2340. Also in ESS, pp. 272-78.

interpret what it meant. The simple idea of a coloured-lightning-music spectacle caused polyvalent ripples of excitement and discussion to spread across Europe, and the century, and out of Castel's reach.

1. The Widespread Reactions of Castel's Contemporaries

The great number of published references to the ocular harpsichord testifies to the enormous quantity of chatter about the idea throughout the century and across Europe, and since Castel never provided people with the definitive description or machine that they were waiting for, they evidently filled in the blanks for themselves.

The proof of this phenomenon lies in the variation between different accounts of what it looked like. We've seen (our best guess of) what Castel imagined, but other writers frequently had different details in mind. Diderot, for example, thought that the instrument was meant to be silent, instead of playing tones and colours simultaneously. Other writers clearly thought so too, though it sometimes is not obvious in the works of writers whose descriptions are either briefer, vaguer, or fewer in number than Diderot's. For example, Guyot's summary of Castel's idea describes it as 'substituting' colour for sound.[4] Guyot also explained how to make a toy version of the instrument, which was silent, and, according to him, disproved Castel's analogy. Savérien also believed it was silent, and, with a great deal of authority, describes the ocular harpsichord as 'une table sur laquelle est élevé une espèce de théâtre avec des décorations'.[5]

[4] Cited by Maarten Franssen, 'The Ocular Harpsichord of Louis-Bertrand Castel', *Tractrix* 3 (1991), 15-77 (pp. 35-7). Guillaume-Germain Guyot, *Nouvelle recreations,* 4 vols (Paris: Gueffier, 1770), III, p. 235.

[5] Alexandre Savérien, *Histoire des progrès de l'esprit humain* (Paris: Lacombe, 1766), p. 268.

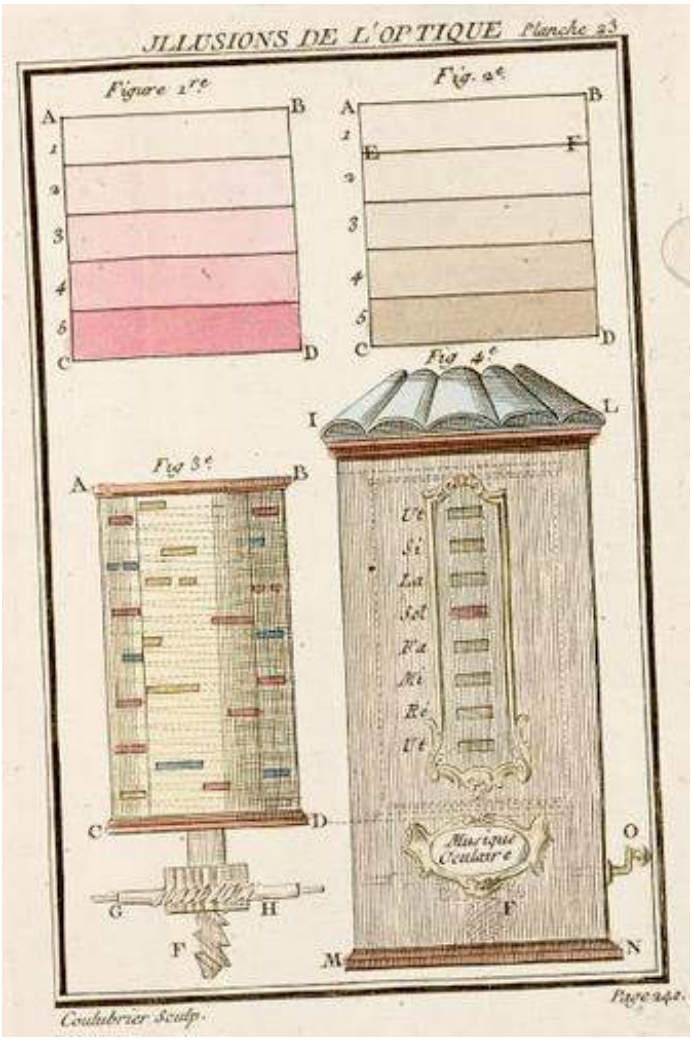

Illustration 10. Guyot's Ocular Harpsichord

The ocular harpsichord also inspired a slew of other ideas for hybrid harpsichords, which either referred directly to Castel's idea, or alluded to it by appropriating his arguments and language. Within the eighteenth century, there were serious proposals of an electric harpsichord (which was both ocular and auricular, because of the visible sparks one saw when it was in a darkened room),[6] a flavour harpsichord (over which there was a priority dispute conducted in footnotes over a twenty-year period),[7] and a speech harpsichord, whereby one could form sentences using a keyboard.[8] It was also suggested that

[6] See Appendix II, nos 62 and 63.
[7] Ibid., nos 46, 52, 74, 79, and 85.
[8] Ibid., no. 83.

Castel and Vaucauson construct a 'pneumatic' harpsichord to mimic the voice.[9] This is not to mention ideas that followed in the nineteenth and twentieth centuries, like the liquor harpsichord in Huysmans' *À Rebours*.

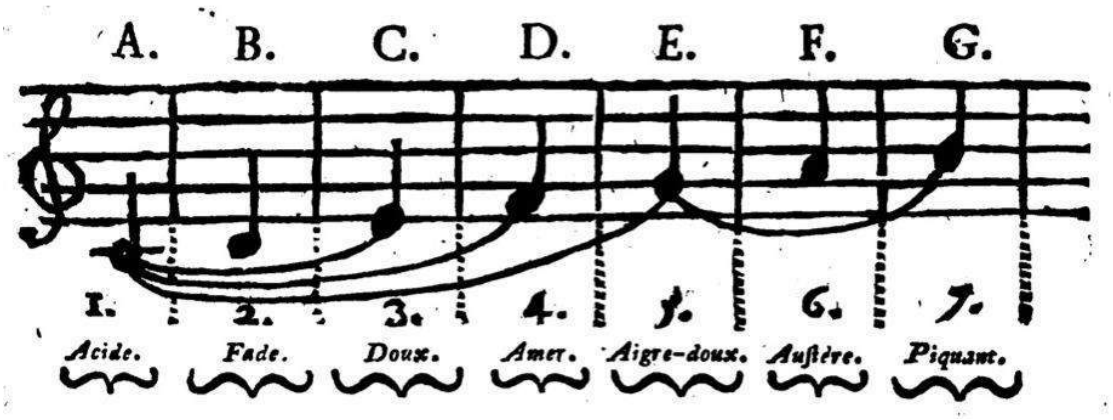

Illustration 10. Poncelet's Flavour Scale

The ocular harpsichord's zenith was the second half of the 1730s, when it sparked a mix of divisive criticism and general approbation. Perhaps the suspense of waiting for the instrument was itself a form of good publicity. For example, a M. Arnaud commented in his *épître* to Helvetius that 'personne n'ignore l'ingénieux système du Père Castel au sujet de l'harmonie des couleurs. Je l'adopte plutôt par raison de probabilité, que par démonstration d'évidence. Ce chaos nous fait longtemps attendre un brillant Univers.'[10] Once the most heated debates on Newton had concluded, and following Mairan's paper to the Académie, and Castel's *L'Optique des couleurs*, the tides began to shift in new directions. Perhaps this is why, in a 1741 reprint, Arnaud removed the second sentence of his note.

[9] Ibid., nos 39 and 40.
[10] M Arnaud, 'Epître à Monsieur H[elvétius]', *Nouveaux Amusements du cœur et de l'esprit* III (1739), 395-400.

2. Between Two Fires

Castel's comment about being between two fires (Ch. I.4, p. 20) was formulated in response to Goujet, who rejected Castel's thoughts on literature in biting terms.[11] In his reply, Castel accused Goujet of excluding him as a mathematician, in order to consolidate his own influence in literature. Goujet had no right to claim that *belles lettres* were such an exclusive terrain, when all that was required to cultivate one's skill was practice:

> Si je suis un peu Géomètre, comme vous me faites la grâce de le supposer, je vous proteste que ce n'est que pour avoir étudié la géométrie. Or le train commun, et puis mon état et un gout assez décidé m'ont fait cultiver, c'est-à-dire, étudier les belles lettres avant, pendant, et après la géométrie, qui n'a jamais occupé le tiers de mes études littéraires. Je ne crois pas qu'il faille à tout cela autre chose que de l'étude: si vous y connaissez d'autre finesse, je m'en instruirai fort volontiers avec vous.[12]

Castel was not alone in taking this view; in his anthology of eighteenth-century scientific *belles lettres*, Charbonneau claims that such an attitude was standard:

> À l'aube des lumières, non seulement il n'y a pas d'opposition entre la poésie, l'éloquence et les 'sciences solides', mais elles composent ensemble un organisme bicéphale et siamois, qu'il faut attendre la fin du XVIIIe siècle pour voir se scinder tout à fait.[13]

Yet even if, to use Charbonneau's metaphor, the twins of poetry and science were conjoined, they were nevertheless separate beings. Castel wanted to be seen as a literary scientist, not as a scientific *littérateur*, and he was at pains to distinguish

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[11] Claude-Pierre Goujet, *Bibliothèque française, ou histoire de la littérature française,* 2 vols (Paris: Mariette et Guerin, 1740), I, p. 459-60.
[12] 'Réponse du P. Castel, Jésuite, à M. l'Abbé Goujet auteur de la *Bibliothèque française*'. *Mémoires de Trévoux* (July, 1740): 1440-1453 (p. 1442).
[13] Frédéric Charbonneau, *L'Art d'écrire la science: anthologie de textes savants du XVIIIe siècle français* (Rennes: Presses Universitaires de Rennes, 2005), p. 5.

himself and his enterprises from that of *philosophes* like Voltaire, who bridged the same gap, coming from the opposite direction.

We must also consider that Castel occupied a space between the clergy and the literary avant-garde, an influential but ultimately tenuous position that more or less evaporated in the years after his death. Even after Castel had been removed from the *Journal de Trévoux*, he evidently maintained his influence elsewhere, buoyed by his unique voice and persona. When he was sparring with Berthier over the *Encyclopédie*, Diderot sought assistance from Castel, just as Montesquieu had done before him.[14] Pomeau writes:

> Dans la première moitié du siècle, un P. Buffier, un P. Porée, un P. Castel, et même ce fou de P. Hardouin, étaient des hommes qui comptaient. Le P. Tournemine avait réussi à maintenir, par ses relations avec Voltaire et Fontenelle, un certain contact avec l'avant-garde du siècle. Son successeur sera le P. Berthier: on a voulu faire l'éloge de cet honnête religieux, et il est bien certain qu'il valait mieux que ne prétendaient les encyclopédistes. Mais force est de constater qu'à la différence du P. Tournemine il a manqué à la vocation traditionnelle de sa compagnie. Son périodique ne suit plus le mouvement des idées. Les *Mémoires de Trévoux* restent encombrés de théologie; l'esprit que les inspire paraît suranné.[15]

In a letter apologizing for not having included journals in the 'Arbre encyclopédique', Diderot suggested that Castel was moving in circles that were closer to the encyclopaedists than Berthier, and laments that his removal from the *Journal de Trévoux* had been, in their opinion, a mistake:

> On tâchera surtout que vous ne soyez pas mécontent de l'article JOURNAL. Nous y célébrons avec justice vos illustres prédécesseurs, dont nous regrettons la perte encore plus que vous. Nous dirons que le P. Bougeant mettait dans vos Mémoires de la logique; le P. Brumoy, des connaissances; le P. de la Tour, de l'usage du monde; votre ami le P. Castel, du feu et de l'esprit.[16]

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[14] This dynamic was clearly transactional; see Huguette Cohen, 'The Intent of the Digressions on Father Castel and Father Porée in Diderot's "Lettre sur les sourds et muets"', *SVEC* no. 201 (1981), 163-183.
[15] René Pomeau, *La Religion de Voltaire* (Paris: Nizet, 1969), p. 256.
[16] Denis Diderot, *Correspondance,* eds Georges Roth and Jean Varloot, 16 vols (Paris, 1955), I, p. 105.

Even though most of his articles were anonymous, Castel's literary 'feu' and 'esprit' were likely recognisable for readers, some of whom were delighted, some of whom were infuriated, and some of whom were both delighted and infuriated. 'Qu'il meure,' wrote one particularly animated critic, 'cinquante ans après sa mort il sera jugé avec impartialité: on admirera dans ses écrits quelques découvertes qui y sont répandues au hasard comme les perles sont semées dans le vaste Océan'.[17] This death wish comes several paragraphs after the anonymous author grudgingly observes that, 'il lui arrivera quelquefois d'écrire comme par instinct d'un style naïf, ingénieux, fort et sublime: le génie agira sur son cerveau comme le ressort d'une montre agit sur elle.'[18] The interplay of these extreme characterizations is easier to understand if we acknowledge how distinctive Castel's voice was, and how pervasively it spread throughout his culture, cultivated in hundreds of articles and books. Castel was a well-known figure during the Enlightenment; clearly thought of as eccentric, but very widely published, known, and read. In unearthing and discovering Castel's long-forgotten contributions to his era, critics may be well advised to follow Fontenelle:

> Un jour qu'on parlait devant le célèbre Fontenelle du père Castel, et qu'on louait le caractère de l'originalité qui distingue ses ouvrages, quelqu'un ajouta: 'Mais il est fou.' 'Je le sais bien', répondit M. de Fontenelle, et j'en suis fâché; car c'est grand dommage. Mais je l'aime encore mieux original et un peu fou, que s'il été sage sans être original.'[19]

3. Ocular Harpsichord, Rhetorical Device

We should take the fact that Castel wanted readers to accept the ocular harpsichord without ever seeing it as evidence that it was above all a rhetorical

[17] *Idée du siècle littéraire présent, réduit à six vrais Auteurs* (s.l: s.n, 1754), pp. 23-4.
[18] Ibid., pp. 21-2.
[19] Honoré Lacombe de Prezel, *Dictionnaire des portraits historiques, anecdotes, et traits remarquables des hommes illustres,* 3 vols (Paris: Lacombe, 1768), I, p. 231-2.

device. In December 1735, one year after the first prototype was finished, the *Mercure de France* published a poem written to commemorate it, entitled 'vers philosophiques'. An accompanying explanation announced that Saint Thomas had been chosen as the ocular harpsichord's patron saint, therefore conferring a motto upon it: *nisi videro, non credam*, from John 20:25, 'Unless I see, I do not believe'. Sceptics' refusal to believe in the ocular harpsichord until they'd heard and seen its colour music echoed Doubting Thomas' refusal to believe the resurrection until he'd seen and touched the wounds of Christ. The *Mercure's* verses used the story of Thomas to encourage readers to 'immolate' their senses to their spirits:

> Dit Jésus à Thomas, confus de la leçon,
> vois l'homme et connais Dieu, mais sache à mon école
> qu'à l'esprit désormais il faut que l'œil s'immole:
> et qu'heureux est celui qui croit sans vision;
> car l'esprit voit; les sens ne sont qu'illusion.[20]

No author's name is given for these verses, but their didactic style, prosody, and religious subject matter resemble Castel's poetry, written two decades later in his unpublished 'journal historico-poétique' of the ocular harpsichord. As he approached the end of his life, Castel regretted that his youthful inability to write good rhymes had prevented him from celebrating the ocular harpsichord in verse, as it truly deserved: 'Mais sans la Rime qui me poursuit aujourd'hui, sans doute à mesure que la raison m'abandonne, j'aurais réellement été de tous temps poète, et mon clavecin aurait passé en vers. On passe tout aux poètes, *Pictoribus atque Poetis Quid libes audendi semper fuit aequa potestas*.' This quotation, from Horace, expresses the idea of poetic license, the power of poets and painters to be as daring as they like. Castel apparently felt that he had been denied this power, and he wished Voltaire had composed verses for the ocular harpsichord,

[20] 'Vers philosophiques,' *Mercure de France* (Dec, 1735), 2802-2803.

instead of prose: 'Car je sentais qu'absolument il manquait des vers à mon affaire: mais je ne voulais pas en être refusé.

J'invoquais, mais tous bas, le sublime V…
De Newton idolâtre, idole du parterre
D'une savante prose honorant mes concerts
Pour sa belle *Mérope* il garde tous ses vers.[21]

The 'savante prose' that Castel refers to is the chapter on the instrument in the *Éléments de la philosophie de Newton*, which had long been removed from subsequent editions. Surely Castel cannot have forgotten that, at the time, he'd accused Voltaire of exploiting his poetic license, 'un droit de licence et de frénésie poétique', by ignorantly overrunning science and philosophy in order to attack religion, 'de la défigurer, et de la travestir'.[22] Perhaps Castel had changed his mind because he saw that Voltaire's scheme had been somewhat successful, and he knew that if the ocular harpsichord was going to remain appealing to his readers, then he needed to adapt it to their changing tastes. Perhaps he even regretted not having followed a similar strategy, and of having been too rigidly didactic with his readers, styling his works as mathematical proofs, rather than persuading them with open *bel esprit*. Considering the ocular harpsichord from the perspective of Jesuit esotericism, Barthet writes:

En faisant intervenir la vision dans le plaisir des sons, Castel propose une synthèse entre le sensible et le spirituel, à travers une communion totale entre le plaisir—d'ordre sensuel—et l'harmonie—d'ordre structurel. Le clavecin structure, éduque, entraîne imagination de l'auditeur vers la découverte non seulement de la beauté des formes de la nature, mais également de ses lois profondes, de sa vérité cachée.[23]

[21] *Journal,* fols 33^{v}-34^{r}.
[22] Review of Leibniz, *Essais de théodicée*, *nouvelle édition par M.L. de Neufville*, *Journal de Trévoux* (Feb, 1737), 197-241 (p. 222).
[23] Bernard Barthet, *Science, histoire et thématiques ésotériques chez les jésuites en France (1680-1764)* (Bordeaux: Presses Universitaires de Bordeaux, 2012), p. 164.

Outside of Castel's own work, I have found no contemporary references to the instrument that discuss it in these terms. Perhaps this is why, towards the end of his life, Castel was exasperated by the degree to which his youthful invention had eclipsed his more mature philosophy, and by how little help he had received from the public in bringing it to fruition. In a letter that dates from around 1754, Castel described the ocular harpsichord as an 'apple of discord', a reference to the golden fruit that was only intended to cause a scene at a party, but instead triggered the chain of events that became the Trojan War:

> Ce clavecin trop brillant fut une sorte de pomme de discorde à la tranquillité de ma philosophie. Il y a 15 ou 20 ans le public et vous plus que personne me retirâtes de ma solitude. Ce n'est qu'une fleur de jeunesse ce clavecin. Elle m'annonçait des fruits plus solides. Je n'aime que les fruits. Le public ne m'aida point à cueillir cette fleur pour la lui présenter à lui même. Je rentrai dans mon verger pour ne penser qu'à la culture des fruits.[24]

Modern critics sometimes describe the end of Castel's life as embittered and filled with regret that his ocular harpsichord had failed. Yet like his change of tune regarding Voltaire's poetry, Castel's grumpy, late-life sense of regret is only a small part of a much more complex story. As we have seen, when Castel saw that the ocular harpsichord provided opportunities for self-promotion, he seized them. Castel used the ocular harpsichord to attract readers to his other theories, arguing that God designed the universe around his greatest creature, man, whose sensual pleasures were a spiritual response to harmony, and could therefore be perfected and refined into infinity. However, as the culture that Castel had come of age in shifted radically around him, the ocular harpsichord came to take on meanings that were all quite different from what he had intended: frustration with the senses' limitations; the over-determination of geometry when used to describe pleasure and the arts; the delirium and chaos of ideas with no empirical foundation. Castel's inability to ensure that his instrument only played his tune

[24] KBR, Ms. 20758, fol. 27.

does speak to the fact that his theories failed to catch on, but it also speaks to the ocular harpsichord's immense success. Evidently, when other writers saw what Castel was using it to do, and saw the crowds of readers who gathered to observe, they wanted to try playing it themselves. Castel's regret was perhaps not due to the ocular harpsichord itself, but rather that he'd shared his toy with others, and they'd used it to play tunes he did not like.

Castel repeatedly insisted that as the instrument's inventor, he should be seen as a *philosophe-géomètre*, and not a luthier, artisan, or mechanic. He was therefore not obliged to produce the instrument himself, and nobody could blame him if he didn't. Still, some thought that Castel deserved the benefit of the doubt, and not in spite of his style, but because of it. Castel's fantastical, dizzying way of writing about colour music was a prelude to the experience people imagined the ocular harpsichord would provide, which is why he adopted it as a symbol of his style. The ocular harpsichord promised a torrent of sensual pleasure, unmediated by language or even by thought: overwhelming, dazzling, and limitless. It might make you giddy, or tired, or confused, but once you gave in and got used to it, that visceral intensity would only make it more delightful. Like the merry-go-round of Castel's rhetoric, there's no reason not to enjoy it, provided you can trust that whoever is playing the keyboard can do so with skill, and are willing to give up your expectations and control. As Descazeaux put it, colour music was going to be the definitive pleasure, and would extinguish desire for others:

Quel torrent inonde mon âme
Des plus légitimes plaisirs!
Le transport excité, l'enflâme,
Je ne forme plus de désirs.[25]

[25] Descazeaux, 'Stances sur le merveilleux clavecin oculaire', *Mercure de France* (April, 1739), 768-769.

Given that there were so many different versions, so many quarrels, so many contradictory comments, and so much emotion in the primary sources that survive, how are we to understand what the ocular harpsichord meant to Castel and to the people who read and heard and talked and wrote about it in his time?

We can chart a path to understanding what the ocular harpsichord meant once we accept it as a rhetorical tool for pleasing, persuading, learning and imagining. A similar dynamic is at play in our practice of artificially enhancing black-and-white images of space with 'false' or 'unreal' colours.[26] These images are not literal representations of how a star or galaxy would look to human eyes. Instead, they are imaginative aids that allow us to visualise the chemical components of celestial bodies, and thereby explore our knowledge of them. So they are not intended to be strictly factual, but also rhetorical, and consequently captivating—an aesthetic means of inspiring us to feel excited by our knowledge, and awed by its limits. One day, perhaps, that knowledge will be very out-of-date, and these colours might seem like incomprehensible relics to future eyes, a superfluous rhetoric of colour with no serious foundation. Imagine what a society of people accustomed to travelling through the almost uninterrupted emptiness of space might make of the Hubble image of the eagle nebula: they might think that the scientists who produced it were insane, or that the people who shared and discussed it were carried away by a quaint and ignorant imagination. If so, then they'll be looking down upon us with an unconstructive arrogance, and consequently they will struggle to understand the image, and its meaning.

[26] Ray Villard, and Zoltan Levay, 'Creating Hubble's Technicolor Universe', *Sky and Telescope* (September, 2002), 28-34.

Appendix I: Corpus of Castel's Texts on the Ocular Harpsichord

#	Year	Title	Publication	Months And Length						Total Length
1	1725	Clavecin pour les yeux, avec l'art de peindre les sons	*Mercure de France*	Nov, 25 pp.						25 pp.
2	1726	Démonstration géométrique du clavecin pour les yeux et pour tous les sens, avec l'éclaircissement de quelques difficultés, et deux nouvelles observations, par le R.P. Castel, jésuite	*Mercure de France*	Feb 15 pp.	Mar 8 pp.					23 pp.
3	1726	*Lettre par M. Rondet*	*Mercure de France*	Feb 10 pp.						10 pp.
4	1726	Lettre du P. Castel, jésuite, à M. de La Roque	*Mercure de France*	Jul 6 pp.						7 pp.
5	1735	Nouvelles expériences d'optique et d'acoustique, adressées à M. le président de Montesquieu	*Journal de Trévoux*	Aug 38 pp.	Aug 47 pp.	Sep 32 pp.	Oct 35 pp.	Nov 37 pp.	Dec 126 pp.	315 pp.
6	1739	Lettre du Père Castel, jésuite à Mr. le Président de Montesquieu	*Journal de Trévoux*	Aug 3 pp.						3 pp.
7	1739	Réponse du P. Castel jésuite à la lettre de M. D***, datée du 2 juillet 1739, et insérée dans nos Mémoires	*Journal de Trévoux* oux	Dec 29 pp.						29 pp.
8	1740	L'Optique des Couleurs	Book	487 pp.						487 pp.
9	1751	Arts résultats du clavecin oculaire	*Mercure de France*	Dec 14 pp.						14 pp.
10	1755	Lettre du P.C. à M. Rondet	*Mercure de France*	Jul 14 pp.						14 pp.
11	1750s	Journal historique et démonstrative de la pratique et l'exécution du clavecin des couleurs et des découvertes et machines nouvelles qui l'ont fait et perfectionné depuis 27 ans, en style épistolaire.	Unpublished manuscript, multiple drafts.							303 pp.

Appendix II

Chronology of Published Commentary on the Ocular Harpsichord 1725-1800

1. Desfontaines, *Pantalon-Phœbus*, 1726.

In the midst of a passage that satirizes Castel and his ideas, Desfontaines' Pantalon-Phœbus invents the ocular harpsichord:

> Il avait aussi inventé une machine mirifique, pour faire entendre la musique par les yeux, c'est-à-dire une sonate de couleurs à six parties. … La machine s'appela par lui clavecin oculaire. Il avait envie aussi de trouver le moyen de peindre le son par des images propres et immédiates et de dresser une machine voluptueuse pour satisfaire tout à la fois les cinq sens de l'homme. (pp. 115-6.)

He also invents a machine for seeing without light, and a sundial for rainy days, but ultimately none of these devices can be made, 'vu que ce sont œuvres improductibles à tout être borné.'

2. Rameau, *Nouveau système de musique théorique*, 1726.

In Rameau's second theoretical work, he mentions the ocular harpsichord as an extension of the same musical principles his own system is founded on. See Chapter 3: Fundamental Basics, Subtext.

3. Saurin, *Lettre critique,* 1730.

During Castel's quarrel with Fontenelle, the academician Saurin wrote an anonymous fifty-page pamphlet attacking Castel's 1729 work on mathematics, and mentions the ocular harpsichord in passing as an obvious testament to Castel's lunacy. See Chapter V.

4. Review of le Gendre, *Traité de l'opinion, Journal de Trévoux,* 1733.

In this review, the *Journal de Trévoux* notes that Le Gendre seems to think that the senses cannot supplement each other, while there is reason to believe that they do. This is because all the senses are susceptible in their own ways to a single principle of harmony:

> Ainsi l'auteur du clavecin oculaire n'a jamais pu prétendre qu'un sourd entendît proprement par les yeux, ni qu'un aveugle vît proprement par les oreilles. Tout ce qu'il a pu vouloir dire, c'est que les couleurs étant susceptibles d'harmonie et de la même harmonie que les sons, un sourd pourrait fort bien par les yeux et les couleurs jouir, non de la musique, mais du plaisir de la musique: ce plaisir ne consistant pas précisément dans le son, mais dans ne suite et un accord de divers sons. Or les couleurs sont susceptibles de la même suite et des mêmes accords harmoniques. La nouveauté rendit cela d'abord paradoxe. Aujourd'hui c'est une vérité démontrée, dont tout le monde convient. (p. 1794-5.)

5. Le Gendre, *Traité de l'opinion,* 1735

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Following the *Journal de Trévoux*'s review of his fourth volume (above), Saint Aubin responded in his second edition, summarizing Castel's proposals for the instrument, and related devices such as the auricular prism. He is highly sceptical, pointing out that Castel has left major parts of his theory unfinished. The fact that the instrument still does not exist is given as proof that it is not a universally accepted truth, in spite of what the *Journal de Trévoux* would like to claim.

6. Prévost, 'Musique des couleurs, clavecin oculaire', *Le Pour et Contre,* 1735

Prévost dedicated this issue of *Le Pour et Contre* to ridiculing Castel, the *Journal de Trévoux*, and the absurd ocular harpsichord.

7. 'Vers philosophiques', *Mercure de France,* 1735.

Written to commemorate the completion of Castel's first prototype, on the feast day of St Thomas the Apostle, this poem is an ode to faith in the face of scepticism. An explanatory note informs us that the ocular harpsichord has two mottos, in honour of its patron saint: Doubting Thomas' *Nisi videro, non credam*, 'unless I see, I will not believe'; and Jesus' response: *Beati qui non viderunt et crediderunt*, 'blessed are they that have not seen, and yet have believed'.

8. Marsy, *Pictura, carmen*, 1736.

Marsy's latin poem imagines how charming it would be if 'ocularia musica' were possible. The allusion to Castel is made explicit in a footnote in the 1753 French translation.

9. Review of Marsy, 'Poëme latin sur la peinture', *Observations sur les écrits modernes,* 1736.

This review also makes Marsy's allusion to Castel explicit, remarking, 'Ne semble-t-il pas que l'Auteur ait eu devant les yeux le clavecin oculaire du P.C. annoncé et promis depuis si longtemps?' (p. 200).

10. Banières, *Traité physique,* 1737.

Banières defends Castel against Le Gendre's implication that the instrument's nonexistence proves that it cannot work, arguing that the responsibility for producing it doesn't belong to Castel, but to workmen and mechanics. Banières expresses surprise that ocular harpsichords aren't already common. (pp. xxvi-xxvii).

11. Review of Banières, *Traité physique*, *Suite de la clef*, 1737.

This reviewer suggests that Banières ought to be more cautious with his praise, by reserving his judgement until he has seen the ocular harpsichord himself (p. 350).

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12. Review of Banières, *Traité physique, Journal des savants,* 1737.

The *Journal des savants* is also not convinced by Banières' claim that it is workmen, and not Castel, who bear the burden of producing the ocular harpsichord.

13. Algarotti, *Il Neutonianismo per le dame,* 1737.

In Algarotti's third dialogue, in the midst of a discussion of colour-sound analogy, the Marchesa is introduced to the idea of 'il cembalo de colori, e la Musica degli occhi' (p. 137). She finds the notion so absurd that she initially believes her Newtonian interlocutor is making fun of her. They come up with increasingly ludicrous ways to use the ocular harpsichord, culminating with a suggestion for a sauce harpsichord: 'Chi sa, soggiuns'ella, se noi non potremo ancora un giorno fare un pranso per via d'un cembalo, e aver la musica delle salse?' (p. 139).

14. Algarotti, *Le Newtonianisme pour les dames.* trans. Perron de Castera, 1738.

Algarotti's French translator is unamused by the passage on the ocular harpsichord, and has translated his sauce joke (above) thus: 'peut-être qu'un jour le clavecin nous donnera de quoi dîner, et que nous aurons la musique des ragouts' (p. 271). De Castera includes this disapproving footnote:

> Tout ce badinage est déplacé. Le R.P. Castel, auteur de cette invention curieuse, n'a consulté que son heureux génie, et les Observations de plusieurs grands philosophes. Kircher appelait le son le singe de la lumière. Newton l'ayant suivi a trouvé que les couleurs prismatiques occupent dans l'image colorée certains espaces réglés entre eux dans la même raison que les nombres qui expriment les intervalles des sept tons de musique. Ensuite l'illustre Père Castel portant ses recherches encore plus loin, a découvert dans cette harmonie des modes différents, c'est là-dessus qu'il a imaginé le clavecin oculaire pour dédommager par des concerts muets les personnes qui sont privées de l'usage des oreilles, ou que le bruit des instruments incommode. (p. 268).

15. 'Lettre d'un Italien à un Français, au sujet des Entretiens sur le Newtonianisme, traduits en Français par M. du Perron de Castera', *Observations sur les écrits modernes*, 1738.

This letter is about what a terrible job De Castera has done translating Algarotti's work. Among a numbered list of offenses, the writer finds that De Castera has made Algarotti's sauce harpsichord unfunny and nonsensical, commenting, ''Dîner suivant les proportions d'un clavecin pour le goût, et trouver dans le clavecin du quoi dîner, ne paraît pas être la même chose.'

16. Review of *Le Newtonianisme pour les dames, Réflexions sur les ouvrages de littérature,* 1739.

This review also discusses Algarotti's sauce harpsichord joke, also arguing that the problem with the joke lies with De Castera's clumsy translation. It provides a literal translation of the passage in question, and comments: 'Cette expression où

[de Castera] trouve une énorme pesanteur, est bien plus riante et plus claire que la sienne' (p. 210).

17. Review of *Le Newtonianisme pour les dames*, *Le Pour et Contre,* 1738.

Le Pour et Contre concludes its review of Algarotti's work by describing Castel's ocular harpsichord as a 'témoignage non suspect' of Newtonian colour-sound analogy.

18. Voltaire, *Éléments de la philosophie de Newton*, 1738.

In the first edition, Voltaire includes a chapter about colour-sound analogy, in which he praises Castel for his invention, but speculates that the ocular harpsichord is likely doomed to be unpleasant, and that in any case it has yet to be produced. See Chapter IV.

19. Voltaire, 'Lettre à Monsieur Rameau,' 1738.

Written during Castel's quarrel with Rameau, this polemical text is dedicated to destroying Castel's reputation, and ridiculing him as a vindictive madman, whose attacks aren't worth Rameau's time. See Chapter IV.

20. Mairan, 'Discours sur la propagation du son dans les différents tons qui le modifient', *Histoire de l'Académie royale des sciences*, 1739.

On 4 May 1737, Mairan presented this paper disproving colour-sound analogy to the *Académie des sciences*. He never mentions Castel or the ocular harpsichord; a conspicuous omission, as the subject was made fashionable by the ocular harpsichord (see, for examples, the five entries that follow).

21. Descazeaux, 'Stances sur le merveilleux clavecin oculaire', *Mercure de France*, 1739.

Descazeaux's ode praises Castel as a 'nouvel Alcide' who has released humanity from its fetters by inventing the ocular harpsichord.

22. Telemann, *Beschreibung der Castellischen Augenorgel,* 1739.

When German composer Telemann visited Paris, he visited Castel at Louis-le-Grand and wrote this pamphlet describing the ocular harpsichord and Castel's theories for German readers.

23. Telemann, 'Description de l'orgue ou clavecin oculaire du P. Castel, *Le Pour et Contre,* 1739.

Telemann's pamphlet was quickly translated into French and published in *Le Pour et Contre,* prefaced with remarks by Prévost which acknowledged and softened his earlier dismissal of the instrument. Castel then appended this translation to his 1740 work, *L'Optique des Couleurs*. See Chapter II.

24. Arnaud, 'Epître à Monsieur H[elvétius]', *Nouveaux Amusements du cœur et de l'esprit*, 1739.

One line of this poem reads, 'tu soumets les couleurs à l'empire des tons' (p. 321). The footnote to this line reminds readers of Castel's system, commenting that everyone is waiting for the ocular harpsichord, but that it has still not been produced.

25. Granet, review of *L'Optique des couleurs, Réflexions sur les ouvrages de literature*, 1740.

In this glowing review, Granet praises Castel's combination of philosophical skill and *bel esprit*, and savours the 'delicious sensation' of reading his work. Granet writes that though some 'petits esprits' have attempted to make fun of the ocular harpsichord, the truly philosophical reader will be both stunned and charmed, and already understands why it has made Castel so famous.

26. Review of *L'Optique des couleurs*, *Journal des savants,* 1740.

The ever-circumspect *Journal des savant*'s review straightforwardly summarizes Castel's arguments and conclusions, noting Castel's claims that the ocular harpsichord will be 'quelque chose de savant et de fort agréable à l'esprit' without any editorial reaction. The last paragraph implies that Castel's attack on Newton's system is unjustified, instructing readers to decide for themselves.

27. Review of *L'Optique des couleurs*, *Journal de Trévoux,* 1740.

The *Journal de Trévoux*'s review does not mention the ocular harpsichord; this omission is conspicuous. Perhaps this review is by Castel, and the choice to ignore the instrument was his, or perhaps Castel's Jesuit colleagues had begun to feel embarrassed by it. In any case, this summary focuses on celebrating *L'Optique*'s polemical anti-Newtonianism, and on the *cabinet des couleurs* as a tool for painters and dyers.

28. Review of *L'Optique des couleurs, Bibliothèque française,* 1740.

This pleasant review gingerly refrains from passing judgement on the book or on the ocular harpsichord, summarizing Castel's arguments, and repeating comments in the 'approbation' to the effect that 'c'est un livre qui répond à la réputation de son auteur'.

29. Le Gendre, *Traité historique et critique de l'opinion,* 1741.

In the second edition of his fifth volume, Le Gendre explains Castel's colour system, drawing out the moments where he disagrees with Newton, and noting that Castel 'destroys' Newton's colours. (p. 304). He is sceptical of Castel's ideas on harmony, and of the harpsichords for other senses. He observes that colour

music could only be capable of performing sonatas, and imagines it as 'une musique parfaitement expressive, un assemblage de beaux tableaux'. (p. 347).

30. Boureau-Deslandes, 'Lettre de M. …. sur *L'Optique des Couleurs'*. *Observations sur les écrits modernes*, 1741.

Boureau-Deslandes' anonymous review of Castel's *Optique* also doesn't mention the ocular harpsichord, because he confines himself to 'general remarks' in order to expose Castel as a 'charlatan' who uses an informal style to disguise the fact that his work is full of 'des idées entièrement décousues'.

31. Boureau-Deslandes, *Pigmalion, ou la statue animée avec l'Optique des Moeurs, opposée à l'Optique des Couleurs,* 1742.

Boureau-Deslandes' anonymous volume comprises two libertine tales that satirise Castel and his ideas. The first, *Pigmalion*, quotes Castel's *Mathématique universel* in a footnote to a risqué passage. The second, *l'Optique des mœurs*, is an explicit send-up of Castel's *Optique des couleurs*, and repeatedly refers to him and to the ocular harpsichord. In it, two Arab doctors arrive in Venice, where they proceed to cure the Venetians of various physical and moral maladies through the use of optical instruments.

32. Krafft, *Sermone in solemni academiae scientiarum imperialis,* 1742.

Cited by Schier (p. 173), this is apparently a printed copy of Krafft's address to the Saint Petersburg Academy of Sciences on 29 April 1742, which discussed the ocular harpsichord.

33. Krafft, *Sermone, etc, Journal de Trévoux,* 1743.

This article gives an account and translation of Krafft's address to the Saint Petersburg Academy, interspersed with editorial commentary and reactions.

34. Diderot, *Les bijoux indiscrets*, 1748.

In the chapter, 'Songes', on dreams and their causes, the characters discuss the possibility of dreaming while awake; Mangogul asks Bloculocus if he thinks Castel was dreaming in this manner when he began his 'orgue à couleurs'. When Diderot edited *Les bijoux indiscrets* around 1769, he added another reference to Castel in chapter 19, which describes an island society in which women use the ocular harpsichord to assemble harmonious outfits, with absurd results—this chapter was first published in Naigeon's 1798 *Œuvres complètes*, vol 10.

35. Diderot, 'Clavecin oculaire', *Encyclopédie,* 1751.

Diderot's *Encylopédie* article on the ocular harpsichord outlines the basic idea of an ocular harpsichord, except that he describes an instrument that plays colours instead of sounds, rather than both simultaneously. This is likely because Diderot saw Castel's first prototype, which was silent. He also describes it as using a single strip of colours, though his language is uncertain, and he doesn't specify

what the strip is made of: 'Il semble que les couleurs d'un clavecin oculaire devraient être places sur une seule bande étroite, vertical, et parallèle à la hauteur du corps du musicien' (III, p. 512). The article's concluding line remarks that the manufacture of the instrument is so extraordinary, 'qu'il n'y a que le public peu éclairé qui puisse se plaindre qu'il se fasse toujours, et qu'il ne s'achève point.'

36. Hogarth, *The Analysis of Beauty,* 1753.

This reference to the ocular harpsichord is a rejected passage in Hogarth's manuscript, and so wasn't published, but I include it here to demonstrate how far awareness of the ocular harpsichord had spread by the early 1750s. Hogarth describes the ocular harpsichord, and transitions to a joke about gustatory harpsichords (probably first made by Prévost in 1735), in order to wrap up with a joke about Handel, poking fun at his taste for over-the-top mass entertainment by imagining how pleased he would be to compose for such an instrument. (This passage is also quoted in Chrissochoidis, and included in the Yale University Press edition.)

37. Diderot, *Lettre sur les sourds et muets*, 1751.

Diderot and his deaf–mute friend visit Castel in his rooms at Louis-le-Grand, to see the famous ocular harpsichord. Instead of teaching him to understand what music is, Castel's colour music convinces Diderot's friend that Castel is also deaf and mute, and has invented his instrument in order to communicate.

38. Krüger, 'De novo musices, quo oculi delectantus, genere', *Miscellanea Berolinensia,* 1743.

According to Franssen, this 1741 paper by a professor at the University of Halle criticised Castel's colour scale as baseless, replaced it with his own system, and then gave plans to build his own ocular harpsichord, complete with blueprints.

39. Butler, *Travels Through France and Italy and part of Austrian, French, and Dutch Netherlands: during the years 1745 and 1746.*

Alban Butler travelled to Paris while in the retinue of the Earl of Shrewsbury, and visited Louis-le-Grand, where he met Castel and saw his 'famous instrument' (p. 65). Butler describes the prototype, notes that it 'is not finished, and gives only three colours.' Butler writes that Castel says he's going to finish it, but is sceptical: 'I scarce believe he will, at least not in haste.'

40. Montagnat, *Eclaircissements […] sur la […] mécanisme de la voix de l'homme,* 1746.

In a footnote, Montagnat (a medical doctor) calls for Castel and Vaucauson to invent a 'pneumatic harpsichord' to resolve the question of whether or not a mechanism could imitate the subtleties of human and animal voices (p. 99).

41. Review of Montagnat, 'Lettre à M.L.D.F.', *Journal de Trévoux*, 1746.

Reviewing two of Montagnat's letters (including the one above) the *Journal de Trévoux* quotes his call for Castel or Vaucauson to build a pneumatic harpsichord. They conclude their article by announcing that Castel had already proposed this project to Vaucauson, six or seven years before, having got the idea from a Swiss author whose name they have now all forgotten. They write that Castel's plan was for an instrument that would not only articulate specific sounds, but be capable of speech, as well. (p. 2169-70).

42. Batteux, *Les Beaux-arts réduits à un même principe,* 1747.

Concluding his third chapter on meaning in music and dance, without citing Castel or Voltaire, Batteux repeats comments from Voltaire's *Éléments,* describing a 'clavecin chromatique, qui offrirait des couleurs et des passages, pour amuser peut-être les yeux, et ennuyer sûrement l'esprit' (p. 286).

43. Condillac, *Traité des systèmes,* 1749.

Condillac doesn't name Castel, but he clearly has him in mind when he begins his argument against the idea that, 'on peut exécuter des airs avec des couleurs, comme avec des sons' (p. 47). He writes that although one can certainly make semantic analogies between all the senses, it doesn't follow that one ought to be able to make 'airs' as well. Condillac argues that using the same logic and strict definition of harmony, one could establish a planetary music on the basis that there are seven planets as well as seven notes; further, that one could apply the rigid arithmetic of geometry to predict the number of satellites around each star and planet, as well as to determine the size of the inhabitants on other aliens (pp. 46-55). This passage probably inspired Voltaire's joke at Castel's expense in *Micromégas* (no. 45), as well as a number of other passages and ideas in the *conte*.

44. Gautier d'Agoty, *Chroa-génésie*, 1749.

Gautier d'Agoty quotes Castel's *L'Optique des couleurs* at length, claiming that Castel is the most talented philosopher at understanding the nature of colours that he has come across (p. 62). Gautier was a central figure in the invention of colour printing, and is especially invested in Castel's identification of yellow, red, and blue as the fundamental colours.

45. Gautier d'Agoty, *Observations sur l'histoire naturelle, sur la physique, et sur la peinture,* 1752.

Gautier d'Agoty's first observation on painting is a chapter devoted to, 'Observations sur la musique des couleurs, inventée par le père Castel', and 'l'orgue des couleurs' (I, pp. 76-92). A granular discussion of colour-sound analogy, its history and its mechanics, the chapter extensively quotes Mairan's paper arguing against the notion (no. 20).

46. Voltaire, *Le Micromégas,* 1752.

Appendix II

Voltaire makes a short joke about Castel's analogical reasoning in the third chapter, likely inspired by Condillac (above). See Chapter IV.

47. Le Camus, *Médicine de l'esprit,* 1753.

Le Camus writes that there are probably seven 'goûts primitifs' that could be used to make a taste scale. 'Il serait possible d'avoir dans les saveurs une harmonie plus réelle encore, que celle que pourrait former le clavecin des couleurs.' (II, p. 83).

48. *Idée du siècle littéraire présent, réduit à six vrais Auteurs,* 1754.

This anonymous pamphlet (attributed to Pierre-Louis d'Aquin de Chateau-Lyon, or to Jean Blanchet) satirizes six modern writers: Gresset, Crébillon, Trublet, Fontenelle, Montesquieu, and a final 'auteur à deviner', who Jean-Olivier Richard has identified as an unmistakable caricature of Castel. Castel is admired for his vast erudition, and skewered for his 'orgueil infini' and circuitous, indulgent style. As there can be no direct mention of the ocular harpsichord without ruining the guessing game, the author mentions colour music as one of many reasons that the public should be ashamed of itself for having so esteemed him. This passage is worth quoting at length, for its viciousness, and because of the extreme rarity of the source text:

> Comme j'ai supposé à cet Auteur un orgueil infini, et une érudition vaste, il est naturel qu'il écrive sur les Mathématiques en général pour étaler l'étendue de sa science, qu'il lutte contre les plus grands Philosophes pour usurper sur eux l'empire de la réputation, qu'il se jette dans les systèmes, et qu'il ose faire un Monde. Si cet Ecrivain se trouve revêtu d'un caractère sacré, s'il est lié à un corps illustre qui est une Académie immense dont les Membres sont semés dans tout l'Univers; si de leur aveu il imprime pendant 30 ans de longs panégyriques de ses talents, il est vraisemblable qu'on croira qu'il y a beaucoup de vrai dans ce qu'il avance, et qu'on concevra de lui une très-haute idée: dès-lors sa réputation sera bien au-dessus de son mérite.
>
> Si cet Auteur se permet des prolixités de style qui fassent dire que le Commentaire est toujours à côté du Texte, s'il s'abandonne à d'éternelles digressions, s'il veut prouver à toute l'Europe que les yeux sont des oreilles, que c'est par celles-ci qu'on voit, & par ceux-là qu'on entend: s'il soutient opiniâtrement qu'il est le centre de l'Univers, & que ses moindres mouvements excitent d'affreuses tempêtes aux extrémités de l'Afrique, de l'Asie, & de l'Amérique : alors le Public ouvrira les yeux sur des paradoxes & des défauts que l'estime avait cachés, il rougira d'avoir admiré: & la renommée de cet Auteur sera bien au-dessous de ses talents. (pp. 22-3).

49. Frézier, 'Remarques sur quelques livres nouveaux concernant la beauté et le bon goût de l'Architecture', *Mercure de France*, 1754.

Frézier (a Jesuit) writes, 'je n'admets pas que celle-ci qui est rendue agréable par les sons, dont les longueurs des cordes qui les forment sont en raison harmonique, produise le même effet à nos yeux, comme l'a cru l'inventeur du clavecin oculaire' (p. 17). What pleases one sense is not necessarily a pleasure for the others, and in his experience with architecture, harmonic proportion is not the definitive source of beauty in a building.

50. 'Réponse du P. Laugier, jésuite, aux remarques de M. Frézier', *Mercure de France*, 1754.

Laugier agrees with Frézier's observation that perfect harmonic proportion is impossible in architecture. He adds:

Je présume avec lui que le plaisir de la vue n'a aucun rapport avec celui de l'ouïe, et que l'idée d'un clavecin oculaire ne peut trouver place que dans une imaginations féconde en singularités, mais peu amie du vrai et du solide' (pp. 37-8).

51. 'Lettre de M. Rondet', *Mercure de France,* 1755.

Rondet springs to Castel's defence against P. Laugier's comments (above), reminding him that Castel introduced them in the early 1740s, and that 'vous me parliez même avec extase de l'invention du clavecin oculaire'. Repudiating Laugier for his comments about Castel's imagination, Rondet claims that the instrument has won over the most opinionated sceptics, and that: 'Elle a produit un cours de physique qui se dicte publiquement à Paris et ailleurs, elle a réuni les suffrages de plusieurs illustres de toutes les nations; de M. de Voltaire entre autres, lui qui loue si peu.' The reference to praise from Voltaire (no. 18) is rather amusing, as he had by this point removed this praise from subsequent editions; see Chapter III.

52. Mendelssohn, *Briefe über die Empfindungen*, 1755.

In the eleventh of Mendelssohn's letters, Palemon grants that colour music, performed on a 'Farbenclaviere' (p. 119), may be possible on some theoretical and physiological terms, but doubts that it would have any imitative or representative power; any resulting pleasure would therefore be limited.

53. Poncelet, *Chimie du goût et de l'odorat,* 1755.

Poncelet's introduction discusses 'le fameux clavecin de couleurs' as one of the greatest achievements of the era's 'imagination badine' (p. xxii). He attributes the instrument's continued non-existence to technical mistakes, but notes that painting already achieves the same sensations as music. He then invokes Vaucauson's famous automaton:

Le clavecin des couleurs était donc tout trouvé, ce n'est que par un défaut d'attention qu'on essaye de le présenter sous une forme nouvelle, et la mécanique que l'on voulait employer à cet effet, ne pouvait servir tout au plus qu'à animer un peintre automate qui eut colorié de jolis tableaux, comme on a vu un fluteur automate jouer de jolis airs (p. xxiv).

Poncelet concludes by discussing how much easier it would be to build a flavour harpsichord, instead.

54. Rameau, *Erreurs sur la musique dans l'Encyclopédie,* 1755

Appendix II

Writing in the midst of the *querelle des Bouffons*, Rameau comments that if Castel had relied exclusively on harmony to make his argument for colour music, then he would have had as many supporters as he had readers (pp. 46-7).

55. D'Alembert, *Avertissement des éditeurs,* Encyclopédie VI, 1756.

Replying to Rameau (above), D'Alembert scornfully refers to the ocular harpsichord. See Chapter III.8.

56. Rameau, *Réponse de M. Rameau à MM. les éditeurs de l'Encyclopédie sur leur dernier Avertissement*, 1756

Rameau responds to D'Alembert's comments; see Chapter III.8.

57. Berthier, 'Éloge historique du P. Castel', *Journal de Trévoux*, 1757.

The *Journal de Trévoux*'s obituary for Castel, penned by its editor and Castel's erstwhile nemesis, Berthier, gives the history of the ocular harpsichord, noting that it made Castel very famous, and that the best part of his days were spent attempting to build it, and without success. See Chapter I.

58. Fréron, 'Mort Du P. Castel,' *Année littéraire,* 1757.

Fréron's brief obituary for Castel, 'si connu par son clavecin oculaire qui l'a occupé une grande partie de sa vie et qu'il n'a jamais pu exécuter', makes a few comments on the character and style of his work, and gives some basic biographical details. 'On doit le regarder', he writes, 'comme un des hommes de ce siècle qui a eu le plus de vues et le plus d'écarts. C'est une perte pour la République des Lettres et pour mes feuilles.'

59. *Explanation of the Ocular Harpsichord*, 1757.

This pamphlet in the British Library's collection has two parts. The first gives the history of the anonymous author's friendship with Castel, and includes an English translation of a personal letter from Castel to the author. The second part describes the author's own attempt to build the ocular harpsichord –this pamphlet was produced to accompany a public exhibition of the instrument. See Chapter II.

60. Review of *Explanation of the Ocular Harpsichord*, 1759.

The *Journal de Trévoux* took the *Explanation* as an opportunity to give its own straightforward history of the instrument. It quotes Voltaire's comments on the *Eléments* (without attribution) and speculates that the author of the Explanation (who is unknown to it) is a native French speaker, and one of Castel's former students. See Chapter II.9.

61. Pernéty, *Dictionnaire portratif de peinture, sculpture, et gravure*, 1757.

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In his chapter on harmony, Pernéty writes Castel's 'système du clavecin oculaire' was derived from an idea about the harmony of colours that M. de la Chambre had before him, as shown in his *Traité des couleurs de l'Iris*. The idea of this phenomenon, 'était un peu trop bizarre, pour faire fortune.'. (p. 358).

62. Le Cat, 'Éloge du P. Castel, jésuite', *Précis analytique des travaux de l'Académie royale de Rouen, 1761-1770.*

This is a truncated version of Le Cat's full *éloge,* delivered in 1761. It gives a brief biography of Castel, and a summary of his full accomplishments, and the circumstances of his death. Le Cat explains the general idea of the ocular harpsichord, and writes that Mairan's 1739 paper (no. 19) had quashed the public's general enthusiasm for the idea.

63. Laborde, 'Lettre aux auteurs de ces mémoires sur un phénomène électrique', *Journal de Trévoux*, 1759.

Laborde was a Jesuit who came up with a plan for an electric harpsichord. In his opening paragraph, he notes: 'On a longtemps parlé d'un clavecin oculaire, et l'on n'est jamais parvenu à le voir. Mais celui dont j'ai l'honneur de vous parler, est un vrai clavecin acoustique, qu'on peut entendre et qui a déjà été entendu.' He later observes that when you play the ocular harpsichord in the dark, it becomes ocular and acoustic, 'puisque les yeux y sont agréablement surpris par des étincelles brillantes qui éclatent à chaque son, et qui ressemblent à des petites étoiles errantes' (p. 1837). This was followed by a second letter, and then a book that reprinted both letters.

64. Review of Laborde, 'Le clavecin électrique', *L'Avant-coureur*, 1760.

This brief review begins: 'On a beaucoup plaisanté sur le clavecin de couleurs du P. Castel, et ces plaisanteries qui étaient fondées, pourraient nuire à l'ouvrage que nous annonçons, et faire présumer que le clavecin électrique du P. de la Borde n'est pas plus réel que celui de son confrère; on aurait tort, ce n'est pas ici une invention imaginaire'.

65. Euler, 'Lettre XXXI', in *Lettres à une Princesse d'Allemagne*, 1770.

Letter thirty-one, dated 27 July 1760, discusses refraction and colour. Euler explains that one can compare the spectrum to an octave, and that this is what Castel's system is based upon. 'Il a fait un clavecin, dont chaque touche, étant touchée, représente un morceau teint d'une certaine couleur, et il prétend que ce clavecin, étant bien joué, pourrait représenter un spectacle très agréable aux yeux. Il le nomme clavecin oculaire, et V.A. en aura déjà quelques fois entendu parler' (p. 134). The princess was only fifteen, so it is notable that Euler assumes that she will have heard about the instrument several times before. Euler concludes his letter by saying that he thinks that painting already achieves this effect, and that he doesn't think this colour music would be agreeable.

66. Paulian, 'Castel, Louis-Bertrand', *Dictionnaire de physique*, 1761.

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Paulian's encyclopaedia entry on Castel is full of praise. At the end he discusses some enjoyable personal correspondence that he had with Castel towards the end of his life. He gives biographical information and discusses Castel's personality, style, and achievements. Of his works, Paulian observes that they contained too much that was good for people to speak badly of them, and too much that was false for people to speak well of them. The ocular harpsichord, 'est regardé avec raison comme le chef d'œuvre du P. Castel', but Castel wasn't rich enough to realise his beautiful system. Paulian hopes it will be possible to build it in the future.

67. *Esprit, saillies, et singularités du P. Castel,* ed. La Porte, 1763.

La Porte's compilation of Castel's works plucked passages from other works and glued them together to form chapters on a variety of subjects, general and specific. The introduction is formed from Berthier's *éloge* (no. 56). The ocular harpsichord is explained in a section composed of four chapters, 'Clavecin pour les yeux', 'Des couleurs', 'Comparaison du son et des couleurs', and 'Clavecin pour les sens'. This book led to a lively and searching discussion of Castel's style and œuvre in the press, see the three entries that follow for examples.

68. Fréron, 'Lettre III: Esprit Du P. Castel,' *L'Année littéraire,* 1763.

This review of La Porte's compilation quotes M. Arnaud's poetic line (no. 24) and describes the ocular harpsichord as one of the great projects of Castel's life. Later on, he admits that Castel was never able to follow through on his vision:

> Il faut avouer que l'exécution du clavecin oculaire n'a pu répondre au plan qu'en avait conçu le célèbre Jésuite. Cependant on accordera que ce système suppose une infinité de connaissances et beaucoup d'esprit dans son inventeur; ces sortes de spéculations étendent les vues humaines, enrichissent l'Histoire de la Philosophie, et servent à perfectionner les Arts (p. 52).

69. Review of, *Esprit, saillies, et singularités, Journal encyclopédique*, 1763.

This review of La Porte's *Esprit* mentions colour music very briefly, to illustrate a comparison between the Abbé de Saint Pierre, and Castel:

> Chez lui des idées très solides, des principes lumineux servaient de base à des systèmes étonnants par leur extrême singularité. L'Abbé de Saint Pierre avait formé le plan d'une ville qui serait destinée au rendez-vous des Pacificateurs des Puissances de l'Europe, et qui devait être dépositaire de la balance chimérique du pouvoir respectif des souverains; et le P. Castel travaillait à faire de la Musique en couleurs (p. 86).

70. Bachaumont, *Mémoires secrets*, 1762.

Bachaumont has very little to say about this 'ouvrage assez peu important', which he mistakenly believes to paraphrase Castel's ideas, rather than excerpting his works. He notes that much of the volume is about the ocular

harpsichord, 'c'était en effet la plus importante singularité du personnage, fou d'ailleurs' (p. 150).

71. Ladvocat, 'Castel, Louis-Bertrand', *Dictionnaire historique-portatif*, 1764.

Most of Ladvocat's encyclopaedia entry on Castel is taken from Berthier's *éloge*, but he has his own opinion on the ocular harpsichord, which is that it took a simple comparison too far. Castel was never able to build it in spite of several attempts and lots of money, but was never able to follow through on his design: 'Le Père Castel mit tout en œuvre pour accréditer son clavecin pour les yeux, mais ce clavecin fabriqué à plusieurs reprises et même à grand frais, n'a ni rempli le dessein de l'Auteur, ni l'attente du public; il donna cependant lieu à plusieurs observations importantes.'

72. Savérien, *Histoire des progrès de l'esprit humain*, 1766.

In his chapter on optics, Savérien discusses Castel and the ocular harpsichord at some length, as an example of Castel taking his imaginative whims way too far. After explaining Castel's colour system, Savérien writes, 'Tout cela est avancé fort légèrement et sans preuves' (p. 268). He also describes Castel's colour cabinet. Strangely, his description of the ocular harpsichord is very specific, and unlike any other I've seen; see Chapter VI.1.

73. Lacombe de Prezel, 'Castel, Louis Bertrand', *Dictionnaire des portraits historiques, anecdotes, et traits remarquables des hommes illustres*, 1768.

Lacombe de Prezel's entry on Castel has very little biographical detail, quite a few anecdotes, and an interesting analysis of Castel's ideas and style. He discusses the ocular harpsichord but thinks that colour music is doomed to be almost unbearable. He is willing to make an exception for 'un air de couleurs', and sends the reader to Diderot's *Encyclopédie* article. He concludes that Castel's ocular harpsichord 'était une belle chimère qui flattait son imagination'.

74. Herder, 'Erstes Waldchen', *Kritische Wälder*, 1769.

According to Franssen, Herder's brief remark suggests, 'the possibility of a painted harpsichord by combing colours with line forms, as had been discussed by Mendelssohn' (p. 60, n. 123).

75. Le Camus, *Medicine de l'esprit,* 1769.

In his second edition, Le Camus added an extended footnote quoting Poncelet's comments in *Chimie du gout* (no. 52) accusing him of stealing his idea, and brazenly plagiarizing his work (II, pp. 127-8.)

76. Le Mierre, *La Peinture*, 1769.

In his second *chant*, Le Mierre begins a general discussion of colour-sound analogy before building to his stanza on 'l'ingénieux Castel de ce jour qu'on

ignore' (p. 38). Most of the passage celebrates the beauty of Castel's colour music, but it also includes a very precise description of the physical instrument:

Il élève en buffet l'instrument argentin
Où l'art ingénieux d'une mobile main
Interroge l'ébène et l'ivoire harmonique;
Au bout de chaque touche un long fil élastique
Répond à des rubans l'un sur l'autre pliés,
Et selon la main par des tons variés
Sait diriger les sons que la corde renvoie
Plus haut chaque tissu s'entrouvre, se déploie
Et du pourpre, du vert, de l'orangé, du bleu
Fait retentir à l'œil le passage et le jeu.

77. Diderot, review of *La Peinture*, *Corréspondence littéraire*, 1770.

Diderot mocks Le Mierre's 'apologie du clavecin oculaire du père Castel, jésuite', and its excessively precise description of the instrument: 'Voilà le galimatias que commence et qui ne finira pas sitôt.' Diderot sarcastically suggests that a model could be built by following Le Mierre's verses, if the idea was worth the trouble. Around the same time, Diderot also referred to Castel and his ribbon in *Le rêve de d'Alembert,* but this wasn't published in the eighteenth century.

78. Guyot, *Nouvelles récréations*, 1770.

Castel, Guyot writes, 'a prétendu trouver une analogie parfaite entre les couleurs et les sons'; he gives Castel's colour scale and refers the reader to *L'Optique des couleurs.* Noting that Castel never managed to produce his instrument, Guyot explains how to make a little device of his own invention that will prove that there is no such analogy. It one foot and a half tall, and has eight little windows that represent the octave. Inside, there is a cylinder with coloured windows made of tracing paper – once you put a candle inside of it, it works sort of like a music box, with a little handle to wind it on the side. Guyot includes a colour illustration (III, pp. 234-40). See Chapter VI.1.

79. Erxleben, *Anfangsgründe der Naturlehre*, 1772.

In the course of rejecting colour-tone analogy, this text briefly mentions the invention of colour music and notes that it was unsuccessful (p. 315). Cited from Franssen, p. 46.

80. Poncelet, *Nouvelle chimie du goût et de l'odorat*, 1774.

When Poncelet updated and republished his *Chimie du goût* (no. 52) two decades later, he included a footnote responding to Le Camus' accusations of plagiary (no. 74). He complains that he had not previously read Le Camus' work (no. 46), or even heard of him. He says that the only person who deserves credit for the notion is Castel, because anybody who had heard of the ocular harpsichord could have come up with it: 'L'idée singulière de son clavecin des couleurs m'a seule fait naitre l'idée d'un orgue savoureux, et cette idée me parait si naturelle, qu'elle

pourrait venir à vingt et cent personnes successivement sans se l'être communiquée' (p. xxvi). On the next page, he engages in an effective show of one-upmanship by actually providing an illustrated flavor scale. See Chapter VI.1.

81. Boeckmann, *Naturlehre,* 1775.

In a discussion of Euler, Boeckmann endorses the idea of colour music, and refers to Castel's ocular harpsichord (p. 322). Cited from Franssen, p. 46.

82. Denis, *Einleitung die bücherkunde*, 1778.

See below, no. 88.

83. Rousseau, *Essai sur l'origine des langues*, 1781.

In Chap. XVI, 'Fausse analogie entre les couleurs et les sons', Rousseau writes :

J'ai vu ce fameux clavecin sur lequel on prétendait faire de la musique avec des couleurs; c'était bien mal connaître les opérations de la nature, de ne pas vois que l'effet des couleurs est dans leur permanence, et celui des sons dans leur succession.

84. Montmignon, 'Têtes parlantes, inventées & exécutées par M. l'Abbé Mical', *Systême de prononciation figurée*, 1785.

Montmignon discusses an automaton invented by the abbé Mical: two mechanical heads that have a pleasant conversation in praise of the king. He suggests adapting this 'machine parlante' to make a 'clavecin vocal' (p. 135), capable of playing syllables and words. This machine can also be developed into, 'un clavecin oculaire: instrument composé d'après les principes du système d'une écriture notée, et dont l'exécution pourrait être utile aux sourds, et aux sourds et muets' (p. 137). He proposes a way to build such an instrument, and includes a table explaining how to organize the keyboard. There is no direct reference to Castel, but the parallels between the ideas and the language used to describe them are clear – later, he explains how to use colour in this instrument, as well:

Le clavecin oculaire peut être un véritable clavecin de couleurs, il ne s'agirait que de colorer les touches, et de distribuer sur le clavier, les tons des couleurs principales et leurs nuances dégradées; de manière que le nombre des couleurs égalât le nombre des sons voyelles et des sons articulés (p. 140).

85. Chabanon, *Observations sur la musique*, 1779.

Chabanon discusses Castel's 'clavecin coloré, c'est-à-dire, qui devait produire aux yeux des accords de couleurs en même temps qu'il produisent l'harmonie des sons' (p. 6). He paraphrases Castel's reasoning, and concludes that Castel clearly has no sensitivity to music whatsoever, because the ear perceives 'rapports' between successive sounds, and the eye has no such sensitivity. Castel was 'une dupe d'une invention ridicule, et d'une absurde chimère' (pp. 7-8).

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86. Le Camus, *Le Génie de l'architecture*, 1780.

In a digression on the harmonies between sounds and colours, Le Camus explains Castel's idea, and expresses regret that it was 'neglected' at the time. Le Camus also seems to be under the impression that Castel succeeded in building the definitive instrument:

Aussi, par un calcul le mieux conçu et le plus ingénieux, avait-il construit un instrument qui donnait un concert de couleurs, en même-temps qu'il en formait un par les sons. Les couleurs se succédaient harmoniquement, et frappaient les yeux avec la même magie et autant d'agrément pour l'homme instruit, que les sons combinés par le plus habile musicien peuvent flatter les oreilles. Ce chef-d'œuvre a éprouvé le sort des meilleurs projets; il a été jugé sans être connu […] Regrettons qu'on ait négligé la découverte du Père Castel, qui peut-être en aurait produit de plus intéressantes; ce serait au moins un plaisir de plus' (pp. 9-11).

87. Brisson, 'Clavecin oculaire', *Dictionnaire raisonné de physique*, 1781.

Brisson's entry on the ocular harpsichord is a copy of Diderot's *Encyclopédie* article (no. 34) – much of the entries before and after it are also taken from the *Encyclopédie*.

88. 'Quatrième extrait de Michael Denis, *Enleitung in die Bücherkunde*', *L'Esprit des journaux*, 1780

In this translated excerpt of his German book, on the subject of Jesuit science, Denis writes:

Les Jésuites Scheiner dans son *Oculus* ou *fundamentum opticum*, Fabri dans sa *Synopsis optica*, Grimaldi dans son ouvrage *De lumine et coloribus,* ont fourni de bons mémoires pour les progrès de l'optique; et Castel a porté la comparaison de Newton entre les sept couleurs et les sept tons, jusqu'à construire un clavecin oculaire. (p. 193)

89. Herder, 'Ob Malerei oder Tonkunst eine grössere Wirkung gewähre?', 1785

Herder's 'Music' laments that civilization has stifled the art of music, giving the ocular harpsichord as a prime example. Cited from Franssen, p. 61.

90. Rousseau, *Confessions*, VII, 1785.

There are several remarks and anecdotes about Castel in volume VII; Rousseau introduces him as 'le P. Castel, jésuite, auteur du clavecin oculaire'. See Chapter V.9.

91. Darwin, *The Loves of the Plants,* 1791.

The third interlude of Erasmus Darwin's poem discusses the 'sister arts' of painting and music. After discussing Newton's colour scale, the poet continues:

From this curious coincidence, it has been proposed to produce a luminous music, consisting of successions or combinations of colours, analogous to a tune in respect to the proportions above mentioned. This might be performed by a strong light, made by means of Mr. Argand's lamps, passing through coloured glasses, and falling on a defined part of a wall, with moveable blinds before them, which might communicate with the keys of a harpsichord; and thus produce at the same time visible and audible music in unison with each other. The execution of this idea is said by Mr. Guyot to have been attempted by Father Cassel [sic], without much success (p. 136).

92. Duchesne, 'Clavecin oculaire', *Dictionnaire de l'industrie,* 1795.

'Tout le monde', this article begins, 'a entendu parler du clavecin oculaire du père Castel' (p. 369). After describing Castel's ideas and colour scale, he discusses the device developed by Guyot: 'mais ni le clavecin oculaire, ni la serinette des couleurs ne produisent l'effet que se l'était imaginé le père Castel.' First of all, he argues, the pleasure of colours doesn't derive from the reflection or refraction of light: 'ce n'est par la seule présence et la situation des individus, que les couleurs nous font apercevoir' (p. 370). Secondly, sounds do not mix to form other sounds, like colours do. 'Enfin le peu de satisfaction qu'a produite jusqu'à présent une telle pièce de mécanique, ne pourrait mériter les frais qu'elle occasionne, qu'autant qu'un physicien, voulant étendre cette idée, chercherait à la perfectionner, et à en faire une application plus intéressante.'

Appendix III

A Brief Account of Castel and the *Journal de Trévoux*

Castel was born in Montpellier in 1688, the son of a well-to-do surgeon. He was sent to the Jesuit school in Toulouse to be educated, joined the order, and then began teaching at a number of their provincial *collèges*. In 1720 he was transferred to the Jesuits' most famous school, Louis-le-Grand, in Paris. There, he taught mathematics, physics, mechanics, and military theory, and worked on the *Journal de Trévoux*, which published most of Castel's articles. Established in 1700, this journal was produced by an editorial board of Jesuits at Louis-le-Grand, and published at a printing press on the estate of its protector, the Duc de Maine, in Trévoux. Its first issue was published in 1701, and at the end of the same year Tournemine was brought from Rouen to act as the 'agent', or editor-in-chief.[1]

According to Castel's *éloge* in the *Journal de Trévoux,* Fontenelle had somehow got hold of several of Castel's essays, which he showed to Tournemine, who responded by requesting his transfer to Paris so that he could work at the journal.[2] This story is unverifiable, but it is tempting to believe it: Tournemine had reached the end of his 'agence' at this point, and perhaps he saw Castel as a polemical voice who would honour his vision, and protect it from Jesuit censorship.[3] Upon Castel's arrival, he was included on a team that was assembled under the direction of Thoubeau, who intended to reform the journal's editorial

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[1] For the history of the *Journal de Trévoux*, see: Carlos Sommervogel, *Table méthodique des Mémoires de Trévoux (1701-1775),* 3 vols (Paris: Auguste Durand, 1864); Gustave Dumas, *Histoire du Journal de Trévoux depuis 1701 jusqu'en 1762* (Paris: Boirin et Cie, 1936); Jean M Faux, 'La Fondation et les premiers rédacteurs des *Mémoires de Trévoux* (1701-1739) d'après quelques documents inédits', *Archivum historicum Societatis Iesu* , no. 23 (1954), 131-151; Alfred Desautels, *Les Mémoires de Trévoux et le Mouvement des idées au XVIIIe siècle, 1701-1734* (Rome: Institutum Historicum, 1956); Jean Sgard and Michel Gilot, 'Le renouvellement des Mémoires de Trévoux en 1734', *Dix-huitième siècle*, no. 8 (1976), 205-214; and *Dictionnaire des journaux: 1600-1789,* ed. Jean Sgard, 2 vols (Oxford: Voltaire Foundation, 1991) <http://dictionnaire-journaux.gazettes18e.fr>

[2] Donald S Schier, *Louis-Bertrand Castel, Anti-Newtonian Scientist* (Cedar Rapids, Iowa: The Torch Press, 1941), p. 4.

[3] Desautels, p. 51.

process. Nevertheless, the *Journal de Trévoux* was plagued by quarrels, printing errors, and delays, and proved too controversial for the liking of its Jesuit superiors. Castel's voice was a consistent source of friction. He was frequently in conflict with members of the *Académie des sciences*, and he sought to counterbalance the enemies he made in Paris with alliances elsewhere, joining the Royal Society in 1731, the academies of Bordeaux and Lyon in 1746, and the academy of Rouen in 1748.[4] The journal's head 'agent' was replaced in 1724, 1733, 1737, and in 1743, when Castel submitted a report to his superiors on the 'crise interne du journal', in which he outlined the crisis of leadership it was experiencing, and recommended that a collegial committee be established to oversee it.[5] Instead, in 1745, Berthier was installed as the new 'agent', and Castel was removed from his position.[6] Embittered by this episode and frustrated that his superiors were censoring his works,[7] Castel continued to write and publish what he could, living in his rooms at Louis-le-Grand, and died in 1757. In 1763, a selection of his work was compiled by the Abbé de la Porte and published under the title, *Esprits, saillies, et singularités du Père Castel*.[8]

[4] Schier, pp. 20-22; pp. 43-6.
[5] Jean Sgard and Françoise Weil, 'Les Anecdotes inédites des Mémoires de Trévoux', *Dix-huitième siècle*, no. 8 (1976), 193-204
[6] See part one of, John N Pappas, *Berthier's Journal de Trévoux and the Philosophes* (Oxford: SVEC, 1957)
[7] In 1749 and 1750, Castel was corresponding with an ally, Père Cayron, who advised Castel on how to navigate the order's politics, and promised to speak to Jesuits in Toulouse on his behalf. Castel was evidently trying to work around his superiors in Paris, seeking to obtain permission to publish directly from Rome. *Documents communiqués au père Castel*, Brussels, Bibliothèque royale de Belgique, Ms. 15751-15754. pp.34^{r}-36^{v}.
[8] Louis-Bertrand Castel, *Esprit, saillies et singularités du P. Castel,* ed. Joseph de la Porte. (Amsterdam-Paris: Vincent, 1763).

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