

# THE OCULAR HARPSICHORD OF LOUIS-BERTRAND CASTEL

The Science and Aesthetics  
of an Eighteenth-Century *Cause Célèbre*

Maarten Franssen

## Introduction

Some inventions need never leave the drawing board and materialize in order to leave their marks on the cultural environment. The ocular harpsichord of Louis-Bertrand Castel (1688-1757), designed to produce a music of colours, certainly seems to have been such an invention. But although a number of studies have been dedicated to the instrument,<sup>1</sup> it has never been undertaken 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. The instrument has mostly been treated as the isolated invention of a crank. Only very rarely has it been recognized that, during the greater part of the eighteenth century following its announcement, the idea occupied the minds of many more people than just its inventor. An early and not very well known example is the work of the historian of literature Von Erhardt-Siebold, whose extensive study of the sudden emergence of synaesthetic imagery in early Romantic English poetry led her to surmise a wide diffusion of Castel's ideas on colour harmony. Although she had not read any of Castel's own writings, she stated: "I see the ocular harpsichord

---

<sup>1</sup> Wellek, "Farbenharmonie und Farbenklavier", Schier, *Castel*, Chouillet-Roche, "Le clavecin oculaire." Neither Schier nor Chouillet-Roche knew the articles by Wellek, although it is from his work that one learns the most about the repercussions throughout Europe of the harpsichord. Schier, on the other hand, seriously misjudged the situation. His book, although very informative on Castel's life, is of little value as regards the ocular harpsichord. Chouillet-Roche concentrates on the outfit of Castel's instrument. Needless to say, I owe source references to all three of them.

as the direct stimulus of the use of synaesthetic imagery in literature."<sup>2</sup> Such a hypothesis is, of course, extremely difficult to prove. What I intend to do in this study is rather to chart the responses to the ocular harpsichord throughout the eighteenth century, and thereby discover what support there is for another conjectural assertion of Von Erhardt-Siebold, that "the ocular harpsichord counted as an invention that one had to come to terms with, and even while it was mostly rejected, even by the Romantics, as a practical instrument, there was wide recognition of the basic ideas behind it".<sup>3</sup> First, however, it is important to consider how scientific and aesthetic arguments intermingled in Castel's own defense of his instrument and, even, whether there ever was an ocular harpsichord.

### The history of Castel's ocular harpsichord

#### *Castel's professional career*<sup>4</sup>

When Louis-Bertrand Castel announced his "invention" of the ocular harpsichord in 1725 he was by no means a unknown man. Born in Montpellier, he had entered the Jesuit Order when he was fifteen years old, and after finishing the École Saint-Stanislas in Toulouse he had taught for some time at various Jesuit colleges in the south of France. He developed a keen interest in mathematics and physics, and some of his writings on these subjects were read in Paris by Fontenelle, then secretary of the Académie Royale des Sciences, and by Tournemine, editor of the *Mémoires pour l'Histoire des Sciences et des Beaux Arts*, which was meant as a Jesuit counterpart to the Gallican *Journal des Sçavans*. Its title was universally abbreviated to *Mémoires de Trévoux* or *Journal de Trévoux*, because it was published in Trévoux, capital of the formally independent principality of Dombes, near Lyon, to avoid the royal monopoly on journals. Both Fontenelle and Tournemine persuaded the general of the Jesuit Order to have Castel sent to Paris, where he became a teacher at the Collège Louis-le-Grand in a wide range of subjects, including mathematics, mechanics, optics, pyrotechnics, "l'horlogerie" and civil and military architecture. In addition, he took place in the team of editors of the *Mémoires de Trévoux*, where he remained the sole expert in mathematics and physics from 1720 until his resignation in 1746, when the journal was ordered to embark on a more

---

<sup>2</sup> Von Erhardt-Siebold, "Synästhesien", p. 51.

<sup>3</sup> *Ibid.*, p. 44.

<sup>4</sup> Most facts about Castel's early career come from his *éloge* in the *Mémoires de Trévoux*, reprinted in *Esprits, saillies et singularités*, pp. v-xxxii. For Castel's life in general, see Schier, *Castel*.

outspoken anti-Enlightenment course by its Jesuit superiors.

It is not very clear to what extent Fontenelle really was involved in fetching Castel to Paris. Maybe he thought that Castel could come up with some new arguments against the increasingly popular Newtonian philosophy, which Fontenelle, as a follower of Cartesian physics, opposed. One of Castel's feats seems to have been that he had struggled through Newton's *Principia* and copied it word for word. Castel's highly unorthodox views on mathematics and physics, however, estranged him from the fellows of the Académie des Sciences, and he lost contact with Fontenelle after 1730. Nevertheless, Fontenelle managed to introduce Castel into the high life of Paris, especially the *salon* of Madame de Tencin, whose lover Fontenelle had been for some time. Apparently *la vie mondaine* was not lost on Castel, as he became the one to introduce Rousseau to Madame de Bezenval and Madame Dupin on his arrival in Paris in 1742. After Castel's breach with Fontenelle the role of his protector was taken over by Montesquieu, whose son was Castel's pupil at Louis-le-Grand. Partly through Montesquieu's influence Castel became a foreign member of the Royal Society in 1730 and later a member of some French provincial academies. His relationship with Montesquieu was so close that the latter sent for Castel in his dying hour, after being asked whom it was he trusted most. It gave Castel enormous satisfaction to have been able to save Montesquieu's soul.

In 1724 Castel's interest in physics had resulted in his first book, the monumental *Traité de physique sur la pesanteur universelle des corps*. It attracted much attention, especially as it was thought at that time that the cause of gravity remained the main mystery in physical science, and it was reviewed rather friendly in the *Journal des Sçavans*, although the reviewer clearly did not quite know what to make of Castel's exuberant style of writing. From this book one gets already a clear picture of Castel's scientific opinions, which he did not change for the rest of his life: he had no trouble with the doctrines of mechanism, that the physical processes in the world are just matter acting directly on matter. It was only the free will of man that formed no part of the mechanical universe (but, and that was Castel's own peculiar solution to the problem of gravity, he gave free human action an enormous physical efficacy). What he totally rejected, however, was the core of the Newtonian achievement: the direct application of mathematics to physics. He certainly acknowledged that Newton was a brilliant mathematician, but just that made him a bad physicist. It was Castel's opinion that

physics in itself is simple, natural and easy, that is, easy to understand. Its terms are known, its objects are known. We observe and prove the majority of things naturally ... Everyone is to some extent a physicist. ... Geometry, on the other hand, is all *abstract*

and *mysterious as to its objects, its methods, and even its terms*. With Newton, this order is reversed"<sup>5</sup>

This view is not wholly different from the general outlook of mechanicism, which can be said to make the ontology of everyday life into the ontology of the physical universe, but with Castel it was very outspoken and even had some religious overtones. In a review of the French edition of Nieuwentijt's book *Het regt gebruik der wereltbeschouwingen* [*The right use of contemplating the works of the Creator*] Castel remarked: "It is in the simple and naive account of nature as everyone knows it, that one has to look for demonstrations of the existence of God. Nature shows enough marvels to the eyes of all kinds of people, and there is no need to borrow ambiguous traits from *Descartes* or *Newton* to embellish the work of God."<sup>6</sup> This way of thinking, keeping as much as possible to the surface of things, pervades all Castel's writings, including his ideas on colour music.

Although Castel was the science editor for the *Mémoires de Trévoux*, his first article on the ocular harpsichord appeared in another journal, the *Mercure de France*, which was more or less the official cultural magazine of France. It also published extensively on scientific subjects, however, - a clear indication of the swiftly rising popularity of science in the eighteenth century. It published a long debate on the cause of the tides, induced by Castel's *La théorie de physique sur la pesanteur universelle*, but also a laudatory letter on the book from Joly, *avocat* to the parliament of Paris, of no less than 47 pages.<sup>7</sup> The *Mercure* always remained very friendly towards Castel, and called his 1743 critical book on Newton, for instance, "the work of a genius".<sup>8</sup> This attitude probably mirrored the personal opinion of Antoine de La Roche, its editor in chief from 1721 to 1744.

---

<sup>5</sup> Castel, *Le vrai système*, p. 6: "La Physique est de soi simple, naturelle & facile, je dis facile à entendre. On en sait les termes, on en connoît les objets. Naturellement nous observons, & nous éprouvons la plûpart des choses ... Tout le monde est un peu Physicien ... Au lieu que la *Géométrie* est tout *abstraite & mystérieuse dans son objet*, dans ses *façons*, jusque dans ses *termes*. Chez Newton, cet ordre est renversé."

<sup>6</sup> *Mémoires de Trévoux*, April 1726, pp. 607-608: "C'est dans l'histoire simple & naïve de la nature telle que tout le monde la reconnoît, qu'on doit puiser des démonstrations de l'existence de Dieu. La Nature étale assez de merveilles aux yeux de toutes sortes de gens, sans être obligé d'emprunter de *Descartes* ou de *Newton* des traits équivoques pour embellir l'ouvrage de Dieu."

<sup>7</sup> *Mercure de France*, April 1725, 669-695; May 1725, 857-876.

<sup>8</sup> *Mercure de France*, November 1743, p. 2444. The book meant is *Le vrai système de physique generale de M. Isaac Newton*.

*The first announcement of the ocular harpsichord*

It was in this context that there appeared in the *Mercure de France* of November 1725 a letter from Castel directed to the otherwise unknown Monsieur Decourt of Amiens, entitled "Clavecin pour les yeux, avec l'art de peindre les sons, et toutes sortes de pièces de musique."<sup>9</sup> In this letter, Castel set out to prove that there was an analogy between the phenomena of sound and light, and between tones and colours, such that what had up till then been performed only with sound, that is, arranging different tones in such a way that we appreciate the effect as a form of art, should be equally possible by arranging different colours, so that a whole new form of art would emerge, a music of colours.

Castel motivated the analogy between sound and light by the supposition that both were vibrational phenomena. By way of a rhetorical question he wondered whether "sound and light do not equally consist in the insensible wiggings of the sonorous and luminous bodies, and of the media that transmit them to our ears [and to our eyes]?"<sup>10</sup> And as tones are modifications of sound and colours are modifications of light, this implied an analogy between tones and colours. For arguments for this view he did not refer to one of the then current light theories of Newton, Malebranche or Descartes, but to the work of his Jesuit predecessor Athanasius Kircher, whom Castel at a later occasion called "my true, my first, and as it were my only master".<sup>11</sup> From Kircher Castel derived a number of observational analogies between sound and light: they both are reflected by plane surfaces; both can penetrate into denser media and are refracted in the process; and both can be concentrated in a focus by a hollow mirror. Moreover, the speaking trumpet or ear trumpet, Kircher's own invention, seemed the perfect analogue of the telescope. These observations sufficiently supported the hypothesis that sound and light were manifestations of the same kind of physical process.

It was already Kircher who had concluded that, if this were true, there had to be an analogy between the art forms of tone and colour. According to Kircher: "If, when a musical instruments sounds, someone would perceive the finest movements of the air, he certainly would see nothing but a painting with an extraordinary variety of colours." And again: "The colours also have their harmony, which pleases no less than music, and this analogous harmony even

---

<sup>9</sup> *Mercure de France*, November 1725, 2552-2577.

<sup>10</sup> *Ibid.*, p. 2557: "le son & la lumiere ne consistent-ils pas également dans les tremousseimens insensibles des corps sonores & lumineux, & du milieu qui les transmet jusqu'à nos oreilles?"

<sup>11</sup> *Mémoires de Trévoux*, October 1735, p. 2033: "mon véritable, mon premier, & comme mon unique Maître".

has a very strong power to excite the affects of the mind."<sup>12</sup> Castel cited these passages with delight, and added examples of his own of how painters talked about colour tones and dissonances of colours and musicians about the design of a composition and the figures of a song.

Apart from Kircher, Castel mentioned a second authority for his cherished analogy: the *Opticks* of Newton, the French translation of which he had recently reviewed for the *Mémoires de Trévoux*.<sup>13</sup> As is well known, Newton had distinguished seven distinct colours in the spectrum, i.e. red, orange, yellow, green, blue, indigo and violet, and in Proposition III of Part II of Book One he recorded his measurements of the space that each colour occupied in the spectrum. He then mentioned that these relative widths corresponded exactly with the differences in the length of a string when it sounded the successive notes of the diatonic scale. Newton, however, gave no clue whatsoever to what was to be concluded from this correspondence. Castel could not fail to notice this: "Here is all the analogy that this great geometrist has managed to find between the tones and the colours; where does this analogy lead to, where does it come from? I do not get any the wiser about it."<sup>14</sup> Nevertheless, it was clear that any colour music needed a colour-musical scale, and Castel was quick to adopt Newton's succession of colours as a scale with violet as its fundamental tone.<sup>15</sup> That Newton had explicitly rejected any physical analogy between light and sound, mainly because he thought that treating light as vibrations of a medium was incompatible with the rectilinear propagation of light, seems not to have bothered Castel.

Of course, Castel admitted that the analogy between tones and colours was not perfect. A tone is in practice a fleeting thing, while a colour is something

---

<sup>12</sup> Kircher, *Musurgia*, vol. 2, p. 240 resp. 223: "si enim quispiam subtilissimas aeris motiones, dum aliquod instrumentum musicum resonat, cerneret; certè is nihil aliud, quàm picturam aliquam insigni colorum varietate adumbratam videret"; "Est enim & coloribus sua harmonia, quae non minus quam Musica recreat atque haec harmoniarum analogia maximam in concitandis animi affectibus vim possidet".

<sup>13</sup> *Mémoires de Trévoux*, August 1723, 1428-1450.

<sup>14</sup> Castel, *Optique des couleurs*, p. 162: "Voilà toute l'analogie que ce grand Géometre a jamais trouvée entre les sons & les couleurs; à quoi va cette analogie, & d'où vient-elle? je n'en sçais rien." It has always remained something of a mystery why Newton decided on exactly these seven colours; in other parts of the *Opticks* he mentions a division into only five. In an interesting article, David Topper has argued that Newton introduced two extra colours for aesthetic reasons, to obtain a more even distribution of the colours. The analogy with the musical scale later strengthened him in this decision. See Topper, "Newton".

<sup>15</sup> *Mercure de France*, July 1726, pp. 1542-1543. Castel didn't notice that Newton compared his colours to a minor scale, whereas he himself supposed a major scale. It is interesting that Kircher already had compared the twelve tones of the chromatic scale with twelve colours, but Castel never referred to this solution. See *Musurgia*, vol. 1, p. 568. Maybe this is because Kircher's correspondences are obviously inconsistent; see Wellek, "Renaissance- und Barock-Synästhesie", pp. 549-559.

permanent. Moreover, in a musical piece the different tones merge into one whole, while in a painting the different colours stay clearly separated. But this difficulty could easily be overcome: admittedly it was impossible to make tones permanent, but colours could be made transient. Although this would diminish the perfectness of colours as such, it would increase the perfection of the works of art which were produced by the use of colours.<sup>16</sup> To achieve this, Castel proposed to take an ordinary harpsichord, but to change the mechanism so that "the pressing of the keys would bring out the colours with their combinations and their chords; in one word, with all their harmony, which would correspond exactly to that of any kind of music".<sup>17</sup>

Perhaps some sceptics would question whether it would be in any way agreeable to look at the succession of these single colours or combinations of colours. Castel, however, was convinced that we would enjoy colour music even more than we did ordinary music. For we do not particularly enjoy hearing a single tone, but we indeed enjoy the ensemble of many different tones. On the other hand, we certainly do enjoy the sight of one single colour, so how much more would we enjoy the interplay of many different colours! It is pre-eminently the continuous change of impressions that gives us the most enjoyment, according to Castel, and that is why we enjoy a piece of music more than a painting. The ocular harpsichord would, then, elevate the art of colour to the same level of enjoyment as music gives us: "The principal advantage of this new harpsichord is thus to give to the colours, apart from their harmonic order, a certain vivacity and lightness which on an immobile and inanimate canvas they never have."<sup>18</sup> But even when we discard the element of time, we could conceive of a specific painting as a complete analogue of a certain musical composition, reflecting its tonality, its harmonies and its structure and design, so that all these aspects of the composition could be contemplated at leisure:

And be convinced that these emotive spots, these main harmonic lines, these unexpected changes of tone, which at any time cause detachments, yearnings, emotions and a thousand different transitions in the soul that abandons itself to them, change nothing of their force and their energy when passing from the ears to the eyes and from music to painting, which

---

<sup>16</sup> *Mercur de France*, November 1725, pp. 2562-2565.

<sup>17</sup> *Ibid.*, p. 2568: "le mouvement des touches fasse paroître les couleurs avec leurs combinaisons & leurs accords; en un mot, avec toute leur harmonie, qui corresponde précisément à celle de toute sorte de Musique."

<sup>18</sup> *Ibid.*, p. 2573: "Le principal avantage de ce nouveau Clavecin, est donc de donner aux couleurs, outre l'ordre harmonique, une certaine pointe de vivacité & de legereté qu'elles n'ont jamais sur une toile immobile & inanimée."

can thus rightly be called, by a better name than it has carried so far, a *mute music*.<sup>19</sup>

In a follow-up article some months later, Castel tried to establish the principles of his colour music *more geometrico*.<sup>20</sup> It was generally accepted that the vibrations of the air that constitute the different tones of music cause vibrations in our ear, and that, when different tones combine, our soul experiences pleasure if the ratios of the rates of vibrations of the different tones are simple rational numbers. For instance, in an octave the two notes vibrate with a ratio of 2:1, and in a fifth with a ratio of 3:2. Castel argued that this was how all our senses functioned. According to him it was a consequence of the philosophy of mechanicism that external objects can only cause regular or irregular vibrations or undulations in the membranes of our body. Following this line of argument, he arrived at the following "*Principal proposition*. So the pleasure and displeasure of all our senses consists in the same sort of vibrations, that is, in vibrations in harmonic proportion." Evidently, colour harmony had to be a fact, because "without it, nothing could please us, and everything would be very unpleasant to us, just as a completely dissonant music."<sup>21</sup> This meant, of course, that there could also be a music of flavours, a music of scents and a music of touches. Castel acknowledged this wholeheartedly:

1°. Take some forty scent bottles filled with different perfumes, cover them with valves, and arrange them so that the pressing of the keys open these valves: there you are for the nose. 2°. On a board arrange objects that can make different impressions on the hand, and then let the hand come down on each of them: there you are for the touch. 3°. Arrange likewise some objects that taste fine, interspersed with bitter objects. But am I talking to people who have to be told everything?<sup>22</sup>

---

<sup>19</sup> *Ibid.*, pp. 2575-2576: "Et croyez-vous que ces endroits pathétiques, ces grands traits d'harmonie, ces changemens inespérés de tons, qui causent à tous momens des suspensions, des langueurs, des émotions, & mille sortes de péripéties dans l'âme qui s'y abandonne, perdent rien de leur force & de leur énergie en passant des oreilles aux yeux, & 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*".

<sup>20</sup> *Mercure de France*, February 1726, 277-292.

<sup>21</sup> *Ibid.*, p. 286-287: "*Propos. principale*. Donc le plaisir & le déplaisir de tous nos sens consiste dans la même espèce de vibrations, c'est-à-dire, dans des vibrations & [sic] proportion harmonique. ... sans elle rien ne pourroit nous plaire, & tout nous seroit très-désagréable, autant qu'une musique toute dissonante."

<sup>22</sup> *Mercure de France*, March 1726, p. 459: "1°. Mettez de suite une quarantaine de cassolettes pleines de divers parfums, couvrez-les de soupapes, & faites ensorte que 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, & puis faites-la couler uniment sur ces corps: voilà pour le toucher. 3°. Rangez de même des corps agréables au goût, entremêlez de quelque amertume. Mais parlai-je à des gens à qui il faille tout dire?" In 1755 Polycarpe Poncelet published his book *Chimie du goût et de l'odorat*, in which he proposed a harmony of flavours along Castel's lines. His major diatonic scale was: sour, bland, sweet, bitter, sweet-and-sour, tart, hot. For scents he failed for want of a



From a modern point of view it is interesting that Castel also argued for the possibility of an "auricular prism", which would be able to separate the different notes of a musical chord, and which he fruitlessly tried to construct for some time.<sup>23</sup>

Castel's proposal of a colour music and an ocular harpsichord was greeted enthusiastically in the *Mercure de France* by a M. Rondet, who gave some concrete advice concerning the actual construction of the harpsichord. He suggested that one make as many coloured windows in the case of the instrument as it had keys and place a strong light in the case. Normally the windows would be covered by a screen, but when a key was pressed, the corresponding screen would swing over and the lighted window would become visible. If desired, all kinds of mirrors could increase the effect.<sup>24</sup> (Rondet's enthusiasm for the whole idea seems to have been so great that he was still defending the instrument in 1755.<sup>25</sup>) It is less clear how seriously Castel himself took the problem of constructing a real ocular harpsichord. In his first article he wrote that he wanted "in the style of Socrates, the demonstration to precede the proposition and the construction of the thing, ... since it is not as an artisan but as a philosopher that I set out to demonstrate you this new art."<sup>26</sup> Much later, he remarked on this original period: "It was only an idea, and I had no intention of executing it."<sup>27</sup> And indeed, just the effect of the prism seemed enough to satisfy his chromatic appetite:

One day, when the sun was shining brightly, having shut all windows of a room and having placed four or five prisms in front of some holes that I had made in the shutters, making them turn incessantly, I watched on the opposite wall a moving tapestry which, without any other concert of harmony, presented me with the most agreeable spectacle that I could remember having ever seen or heard.<sup>28</sup>

---

sufficiently refined terminology. See Chouillet-Roche, "Clavecin oculaire", p.165.

<sup>23</sup> *Ibid.*, p. 463.

<sup>24</sup> *Mercure de France*, April 1726, 650-660.

<sup>25</sup> *Ibid.*, April 1755, 160-163.

<sup>26</sup> *Ibid.*, November 1725, pp. 2554, 2561: "Je veux même, en stile de Socrate, que la démonstration précède la proposition & la construction de la chose, ... car ce n'est pas en artisan, mais en Philosophe que j'ai entrepris de vous démontrer ce nouvel art".

<sup>27</sup> *Ibid.*, July 1755, p. 147: "ce n'étoit en effet qu'une idée, & je n'avois nulle intention de l'exécuter."

<sup>28</sup> *Ibid.*, March 1726, p. 461: "Un jour ayant fermé toutes les fenêtres d'une chambre que le Soleil éclairait, & mis aux trous que j'avois faits dans les volets quatre ou cinq prismes qu'on faisoit tourner sans cesse, je vis sur la muraille opposée une tapisserie mouvante, qui sans autre concert d'harmonie, me donna le plus agreable spectacle que je me souviens d'avoir jamais vû ni entendu."

*The resumption of the project*

So it is perhaps not strange that nothing more was heard of the ocular harpsichord for ten years. Nevertheless, the instrument kept haunting Castel. When he was reading Félibien's *Entretiens sur la vie et les ouvrages des plus excellents peintres anciens et modernes* and noticed the author's complaint that the theory of painting lagged far behind the theory of music, and his remark that the painter Poussin had also thought about "l'art harmonique des couleurs", he decided to elaborate his invention. There was also the fact, however, that he had increasing doubts on the Newtonian colour scale. It seemed implausible that violet could play the role of fundamental tone, since this colour was in practice always produced by mixing red and blue. Therefore he set out in 1734 to perform a number of systematic experiments on colours, with the assistance of a painter friend. He published his conclusions from these experiments in a 321-page article in the *Mémoires de Trévoux*, in the form of a letter to Montesquieu, who had urged him to make his new ideas public.<sup>29</sup>

Castel's starting point was to take the analogy between the tone scale and the colour scale as literal as possible. Between the two tones that together form an octave, there is a continuum of possible vibration rates, but we discern only a limited number of distinct tones, that is, we interpret any arbitrary tone as one of the twelve notes of the chromatic scale. According to Castel, our observation of colours is subject to the same rule; although all colours continuously merge into each other, we discern only a limited number of distinct colours. Then, if the Newtonian colour scale violet-indigo-blue-green-yellow-orange-red were the true analogue of the diatonic scale, the transition blue-green would correspond to the smallest possible interval E-F, which would imply that we do not discern a separate colour between blue and green. And this, according to Castel, is simply false; between blue and green is celadon. (Observe that Castel here made the mistake of taking the Newtonian colours for the scale in C major, although Newton had compared them with the scale in D minor.) This way of comparing the internal relations of the colours with the tone intervals was the clue to the construction of the true chromatic colour scale. Because red, yellow and blue would surely be part of this scale, it sufficed to determine how many distinct colours there were between red and yellow, between red and blue, and between yellow and blue.

Miraculously, there turned out to be exactly twelve distinct colours: blue-

---

<sup>29</sup> "Nouvelles expériences d'optique et d'acoustique," *Mémoires de Trévoux*, August 1735, 1444-1482; August 1735, 2me partie, 1619-1666; September 1735, 1807-1839; October 1735, 2018-2053; November 1735, 2335-2372; December 1735, 2642-2768.

celadon-green-olive-yellow-fallow-nacarat-red-carmine-violet-agate-violaceous, representing a direct analogue of the chromatic scale in music.<sup>30</sup> Castel's next step meant a departure from music, however. Instead of permitting every colour to be the possible root tone of a major or minor scale, he wanted an absolute colour-tonic, and argued that this place was occupied by blue, the *basse fondamentale* of nature, because we see all colours in nature against the background of the blue sky.<sup>31</sup> To make the departure from music seem less radical, however, Castel argued that in music there is also an absolute tonic, fixed by the range of the human voice, and this tonic was the standard C. Again miraculously, making blue the absolute key-colour resulted in the most perfect analogy possible: the three most important notes in the scale - tonic, dominant or fifth, and third - were now... blue, red and yellow. It was known that all colours could indeed be produced by mixing blue, red and yellow. And was not red indeed the dominant colour of nature, and had not the note G "something of the warrior, of anger, something bloody, something flamboyant"?<sup>32</sup> And was not, on the other hand, the interval F-B the most difficult to sing, and the corresponding colour interval fallow-violaceous a combination of "colours that are very undetermined and difficult to grasp"?<sup>33</sup>

Even this perfection did not yet satisfy Castel. Five years later, in his *Optique des couleurs*, he combined this colour scale with the chiaroscuro to solve the problems of different octaves. Just as all tones are posited between the silence below the lowest tone and the silence above the highest tone, so all colours are between the two "colourless colours" black and white. By adding the chiaroscuro, we can think of the colours as moving from black to white, in the sequence of the colour scale, such that when we have completed one octave the octave colour is one "chiaroscuro unit" lighter than the prime. By a similar process as had been used to discover the number of distinct colours in the scale, Castel established that there were exactly twelve full octaves of different chiaroscuro shades between black and white. This meant that the ocular harpsichord needed a keyboard of 144 or 145 keys. But the introduction of chiaroscuro also served another purpose for Castel: as blue is always the darkest colour of any three equally dark red, yellow and blue, according to Castel, and as the darkest blue is darker still than the darkest red or the darkest yellow, we can be extra sure that

---

<sup>30</sup> The French names used by Castel are *bleu-céladon-verd-olive-jaune-fauve-nacarat-rouge-cramoisi-violet-agathe-violant*. For *violant* Castel sometimes put *gris-bleu*.

<sup>31</sup> *Mémoires de Trévoux*, August 1735, 2me partie, p. 1663.

<sup>32</sup> *Ibid.*, September 1735, p. 1830: "quelque chose de guerrier, de colere, de sanglant, de flamboyant".

<sup>33</sup> *Ibid.*, August 1735, pp. 1474-1475: "des couleurs fort indécises & fort difficiles à attraper, aussi difficiles que le *fa si* triton dissonant est difficile à sentir & à entonner."

blue is the absolute fundamental tone of the colour scale.

Obviously, this solution to the scale problem of colour harmony meant a complete breach with the Newtonian theory of equivalent primary colours. As Castel was quick to admit, "if the system of Mr Newton is true, mine will be turned on its head, there is no ocular music, harmony or harpsichord: and everything I have said so far is nothing but a beautiful chimaera".<sup>34</sup> Up till then, Castel's criticisms of Newtonian optics, as he voiced them for instance in his review of Newton's book in the *Mémoires de Trévoux*<sup>35</sup>, were in line with his rejection of the mathematization of nature. He scorned, for instance, Newton's introduction of the term "refrangibility", as a concept that explained nothing. After 1735, however, he was forced to reject Newton's experimental results as well. The solution to this problem presented itself in 1739, when a letter directed to him was published in the *Mémoires de Trévoux* which suggested where Newton had gone wrong. In fact, it happens to be identical to the later critique of Goethe. Newton had not looked well enough at his spectrum, argued this anonymous amateur physicist. The green in the spectrum is only visible at some distance from the prism; when you observe the outcoming rays directly behind the prism, the middle of the spectrum is not green but white. His suggestion was that the colours only arise at the edge of the white ray when it passes through the prism: in the shorter passage arise red and yellow, in the longer passage blue and violet. The yellow from the upper end and the blue from the lower end converge, and so produce green at some distance from the prism.<sup>36</sup>

Castel enthusiastically declared this solution to be the obvious and right one.<sup>37</sup> If no suspicious questions were asked about the violet (it was just the result of the overflow of some red), the result was that the prism did in fact only produce the three desired main colours blue, red and yellow. A load had been taken off Castel's mind:

---

<sup>34</sup> *Ibid.*, October 1735, p. 2033: "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: & tout ce que j'en ai dit jusqu'ici n'est qu'une belle chimere".

<sup>35</sup> *Ibid.*, August 1723, 1428-1450.

<sup>36</sup> The letter was reprinted in Castel's *Optique des couleurs*, pp. 353-369. The whole proposal is completely identical with Goethe's later one. The cause of all this confusion is, of course, that if one makes the beam of white light that enters the prism too wide, or if one fails to make an incoming diverging beam converge by interposing a lense (as Newton was careful to do), there will be an overlap of different spectra beyond the prism, causing white in the middle and leaving prismatic colours only at the edges. Note also that Newton himself had already pointed out that, for instance, primitive green light, or rather "greenmaking" rays, is something different from the mixture of primitive blue and yellow causing the sensation of green, and that a prism can always tell the one from the other. See the *Opticks*, Book One, Part II, Propositions IV and VIII.

<sup>37</sup> See Castel's reaction to the anonymous writer in *Optique des couleurs*, pp. 370-446.

... the great Newton, how could he have been so deeply wrong, and with that apparatus and that fuss that impresses the wise and keeps the universe in admiration and as it were enslaved by its brilliant spectrum of seven colours, no more, no less? ... I had challenged the prism and its fantastic spectrum. ... I regarded it with terror, as if it were a reef signaled by the wreckage of a famous ship, followed by a thousand ships that had come to share its disaster, while collecting its debris.<sup>38</sup>

In his later book on Newtonian physics in general, Castel tried to give a theoretical foundation to his critique of Newton's optics.<sup>39</sup> He presented some objections against the emission theory of light (he had never discussed it before). For instance, it could not explain how objects could have a blue colour; if the surface of an object absorbs the larger and heavier red light-particles, it will surely also absorb the smaller blue light-particles, instead of reflecting them. Referring to Malebranche's theory, in which light is a sequence of pulses, or a vibration, in a special medium, the aether, Castel argued that both white and coloured light are vibrational phenomena. White light is a single, longitudinal vibration, and coloured light results when a second transverse vibration is added to the vibration of white light. In such a model, where coloured light is a modification of white light, it is conceivable that the light that passes through a prism gets coloured only at the edges; in the middle of the beam the transverse vibrations annihilate each other, while they can survive at the edges.<sup>40</sup>

#### *Castel's attempts to actually build an ocular harpsichord*

In neither the "Nouvelles expériences" nor the *Optique des couleurs* did Castel seriously discuss the actual construction of an ocular harpsichord. In his 1735 article he ended with an enormously elaborate extension of his earlier proof *more geometrico* of the possibility of colour music, building it into a complete "logique du goût" with eight principal propositions and 73 theorems, and finally lost himself in a delirious enumeration of all possible kinds of colour enjoyment. Nevertheless, from some occasional remarks it becomes clear that Castel had

---

<sup>38</sup> *Ibid.*, pp. 373-374, 376-377: "le grand Newton, pourquoi & comment a-t-il pû s'y tromper solennellement, & avec cet appareil & ce fracas qui impose aux sages, & tient tout l'univers dans l'admiration & presque dans l'esclavage de son *spectre* essentiellement brillant de 7 couleurs, ni plus ni moins? ... Je me defiois du prisme & de son spectre fantastique. ... Je le regardois avec terreur, comme un écueil signalé par le naufrage d'un vaisseaux fameux, suivi de mille vaisseaux, qui venoient à l'envi partager son désastre, en recueillant ses débris."

<sup>39</sup> Castel, *Le vrai système*, pp. 421-500.

<sup>40</sup> *Ibid.*, pp. 501-507. Malebranche had included the first version of his theory in the 1700 edition of his *De la recherche de la vérité*, but presented a slightly but significantly changed version in the 1712 edition, to make it compatible with Newton's prism experiments. See Hakfoort, *Optica*, pp. 60-63. Castel apparently had read only the 1700 version.

worked, reluctantly, to construct at least a model for the harpsichord. Addressing Montesquieu, he wrote: "I was forced to make the first model, which you have seen." It was completed in 1734, on 21 December,

the fête of Saint Thomas, to whom I have dedicated it, under the motto *nisi videro, non credam*. ... The sound movement consists in striking a tone during a certain time, and then silencing it to strike a second tone, and then a third tone, etc. The colour movement consists in making appear and disappear, by placing the fingers on the keyboard, a colour, any colour, and any series of colours sought for. This has been thought out, done, and will soon be perfect. There have been a thousand witnesses."<sup>41</sup>

This description does not give us much information on the exact mechanism that Castel had in mind, except that he now wanted it to be an ordinary and an ocular instrument in one.

The history of Castel's ocular harpsichord after 1735 has to be painstakingly reconstructed from different sources.<sup>42</sup> From them a picture emerges of a man gradually worn out completely by his own invention, although he kept believing in it to the last. In 1739 a letter was published in Hamburg by the composer Georg Philipp Telemann, in which he sang praises of Castel's invention, which he had admired while on a visit to Paris. In his letter Telemann gave a relatively precise description, suggesting that the instrument was complete:

To have it sound a tone, one touches a key with a finger and presses it, and thereby a valve is opened that produces the chosen tone. ... At the same time, when the key opens the valve to produce the tone, Father Castel has fitted silken threads or iron wires or wooden levers, which by push or pull uncover a coloured box, or a ditto panel, or a painting, or a painted lantern, such that at the same moment when a tone is heard, a colour is seen.<sup>43</sup>

---

<sup>41</sup> *Mémoires de Trévoux*, pp. 2645, 2722-2723: "il m'en a fallu faire le premier modele que vous avez vû ... jour mémorable de Saint Thomas Apôtre, à qui je l'ai consacré, sous le devise *nisi videro, non credam*. ... Le mouvement des sons consiste, à faire entendre un son pendant un instant plus ou moins long, & puis à le faire taire pour laisser entendre un nouveau son; & après celui-là un troisième, &c. Le mouvement des couleurs consiste à faire paroître & disparoître, au gré des doigts posés sur un clavier, une couleur, & telle suite de couleur qu'on veut. Or cela est trouvé, fait & bien-tôt parfait. Il y en a mille témoins."

<sup>42</sup> And not all sources are equally reliable. The story in the anonymous English leaflet *Explanation of the ocular harpsichord* from 1757, for instance (cf. Schier, *Castel*, p. 183), although its author claims to have been a close associate of Castel, is completely wrong in asserting that Castel did not work on the harpsichord at all between 1734 and 1754.

<sup>43</sup> Telemann, *Beschreibung*, p. 264-265: "Um einen Klang hören zulassen leget man die Finger auf die Claviertaste, man tricket sie nieder, und indem sie sich vorn hinein sencket, oder hinten aufhebet, öffnet sie ein Ventil, das den beehrten Klang mittheilet. ... Zu gleicher Zeit, wenn die Taste, um einen Klang zu haben, das Ventil aufmachet, hat der P. Castel seidene Schnüre, oder eiserne Dräer, oder höltzerne Abstracten angebracht, die durch ziehen oder stoßen ein färbigtes Kästgen, oder einen dergleichen Fächer, oder eine Schilderey, oder eine helle bemahlte Laterne, entdecken, also daß, indem man einen Klang höret, zugleich eine Farbe gesehen wird."

Basically, it has all the features of the 1734 model. All the various alternatives that Telemann mentioned for his one instrument nevertheless make clear that Castel was still considering different possibilities, to be applied in a definitive version of the instrument. A letter from Castel to Montesquieu written in 1739, published in the *Mémoires de Trévoux*, is evidence that Castel was indeed experimenting with lanterns: "You have seen my lanterns, tuned by colour degrees and light [chiaroscuro?] degrees. ... With lanterns wonderful effects can be produced using glasses, horn, nettings, taffetas, oiled or rather varnished sheets of paper, especially when the lanterns are made as mobile as mine are."<sup>44</sup>

Still in the same year the *Mercure de France* published a poem by a certain Mr. Descazeaux, "Stances sur le merveilleux Clavecin Oculaire", containing such lines as: "What rapid course of shades! What accord in their differences! For my charmed eyes what a voice!"<sup>45</sup> As four years had passed since Castel had last published on the harpsichord, it is implausible that Descazeaux would have sent his poem to the *Mercure* if he had not recently seen it, be it only a model, and been impressed by it.

Again some years later, in July 1741, Georg Wolfgang Krafft, a member of the Imperial Academy of St Petersburg, received a letter from Paris, informing him of Castel's theory. The correspondent mentioned that Castel was busy building his harpsichord and had promised its completion before the end of 1740. The design seemed to be suffering further changes, as it was reported that the original plan was to show coloured strips, but that Castel had replaced them by a painting containing coloured crystals, realizing the instrument "in modo theatri comici".<sup>46</sup> The report from Paris, for that matter, induced Krafft to dedicate an official meeting of the academy to Castel's colour music, where he did away with the whole idea, as will be shown in the next section.

Castel clearly did not hold to his promise for the end of 1740, but his optimism held ground. In 1745 the Englishman Alban Butler, visiting Paris in the retinue of his employer, the earl of Shrewsbury, saw the "famous instrument" in Castel's workshop, and his account makes evident that Castel was still far from his goal: "This instrument is not finished, and gives only three colours." Butler added circumspectly: "The father pretends to entertain hopes of making it

---

<sup>44</sup> *Mémoires de Trévoux*, August 1739, pp. 1676, 1677-1678: "Vous avez vû mes Lanternes diapasonnées par les degrés des couleurs & de lumières ... Par mes Lanternes sur-tout on peut faire des merveilles avec des verres, des cornes, des gazes, des taffetas, des papiers mêmes huilés ou plutôt vernis: sur-tout si l'on donnoit à ces Lanternes la mobilité qu'ont les miennes."

<sup>45</sup> *Mercure de France*, April 1739, pp. 768-769: "Quel rapide cours de nuances! / Quel accord dans leurs différences! / Pour mes yeux charmés quelle voix!"

<sup>46</sup> Wellek, "Farbenharmonie und Farbenklavier", p. 358.

complete."<sup>47</sup> In entertaining these hopes Castel even tried to make up with the members of the Académie des Sciences, with whom he had embroiled himself some twenty years earlier. As he wrote to Montesquieu in 1748:

I wanted to appease them concerning ... my harpsichord, that I am making for real without money, without workers, without leisure, but which I am making anyway *piano, sano*. (It is quite true, this harpsichord; ... the preliminaries have already convinced some unbelievers; I will defy them all without much ado three or four months from now; not only is it possible, this harpsichord, but easy as well).

In a PS he added: "I will not leave my room any more until I have perfected my harpsichord."<sup>48</sup> In this letter we find the first mention of an obvious problem: money.

The last phase of Castel's desperate attempts to complete the harpsichord is recorded in his manuscript "Historical and demonstrative journal of the practical execution of the ocular harpsichord", perhaps meant to be published just as the "Nouvelles expériences" had been published in 1735. The "Journal" is written as a series of letters to the Comte de Maillebois, who had been his pupil at Louis-le-Grand and to whom he had finally run for rescue in 1751. The "Journal" can be dated to 1752. It shows a Castel who is now at the end of his wits; in the drafts there are up to eleven new starts of his account of the history of his invention, and intermittently he varies the story of his triumphs and complaints with fragments of poetry. Some passages breath an atmosphere of utter failure:

The nature of things is diminished, agitated, inadequate. The whole game of the universe, just as that of the rainbow and of music, is in a minor key, ... in violet, in black, or in semi-black. All of nature, all our arts, all our organs, all our senses, all our faculties are in mourning for their initial perfection. Everything is doomed in our hands and around us, everything is in discord and in dissonance.<sup>49</sup>

---

<sup>47</sup> Butler, *Travels*, p. 65. Butler's cryptical description of the harpsichord says that "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".

<sup>48</sup> Montesquieu, *Oeuvres*, vol. 3, pp. 1157, 1158: "j'ai voulu les amadouer vis-à-vis ... de mon clavecin, que je fais dans le vrai sans argent, sans ouvriers, sans loisir, mais que je fais pourtant *piano, sano*. (Il est bien vrai, ce clavecin; ... mes seuls apprêts ont déjà convaincu quelques incrédules; je les défie tous sans façon dans trois ou quatre mois d'ici; non seulement il est possible, ce clavecin, mais désormais facile); ... Je ne sors plus de ma chambre depuis que je fais tout bon mon clavecin."

<sup>49</sup> Brussels, Royal Library Albert I, manuscript collection nr. 15746, f. 53: "La nature des choses est diminuée, affoiblie, enervée, infirmée. Tout le jeu de l'univers comme celui de l'arc en ciel et de la Musique est monté dans le mineur ... en violet, en noir, ou demi-noir. Toute la nature, tous nos arts, tous nos organes, tous nos sens, toutes nos facultés portent le deuil de leur première perfection. Tout est maudit entre nos mains et autour de nous, tout est en discorde et en dissonance."



Apparently Maillebois had offered to pay for the manufacture of the harpsichord. Castel had received some financial assistance earlier: according to the anonymous leaflet *Explanation of the ocular harpsichord* the duke of Huescar, the Spanish ambassador, had offered him 1000 crowns in 1735, but somewhat later Castel "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".<sup>50</sup> The same source says that Maillebois furnished 2000 *écus*, or 85 *louis d'or*, for the instrument.<sup>51</sup> According to the "Journal", Castel had told Maillebois he needed 100 *louis d'or*. In a desperate begging-letter to the wife of Maillebois, a draft of which has been preserved with the "Journal", Castel wrote that he had indeed received some of the promised sum, but that it added up to no more than 20 of the needed 100 *louis*. It took him some time to come to the point, but finally he admitted: "Let me tell you quite frankly. I need 15 *louis* immediately to avoid going bankrupt for my harpsichord, that is to say, for my honour, and perhaps for [the honour of] M. le Comte."<sup>52</sup> If the sum of 85 *louis d'or* is indeed what Maillebois spent, the instrument cost in 1751-1752 alone several year's wages of a skilled worker in Paris.

What becomes most clear from the "Journal" was that Castel felt he had fallen into a trap, and filled with rancour he blamed his readers, his "public", for this: "After this time [1735] my feet indeed slipped from underneath me: I was led to believe that I wanted to make, and little by little that I was making the harpsichord. ... The public has taken it too seriously."<sup>53</sup> All that was left of Castel was an old man sitting between the remnants of his models, none of which was capable of coming anywhere near what he had had in mind for the performance of his instrument; there was nothing left for him but to "adjust and readjust the debris of my harpsichord to the taste of the public".<sup>54</sup> From a report he gives of a demonstration it becomes clear how completely his

---

<sup>50</sup> *Explanation*, pp. 7, 10.

<sup>51</sup> In fact, the gift is ascribed to the Marquis de Maillebois, Marshall of France and father of the Comte de Maillebois, "some years after" 1735 (*Explanation*, p. 7). My suspicion is that this is a mistake, mixing up father and son, as there is no reference at all in the "Journal" to anything Maillebois' father might have done for the harpsichord. To be sure, Castel had discussed matters from the art of war with the Marquis de Maillebois.

<sup>52</sup> Brussels, Royal Library Albert I, manuscript collection nr. 20754, f. 28r-29r: "Laissés moi vous le dire franchement. il me faudroit tout a l'heure 15 Louis pour ne pas faire banqueroute a mon clavecin, c'est a dire a mon honneur, et peut etre a m<sup>f</sup>. le comte."

<sup>53</sup> *Ibid.*, ff. 22r resp. 37v: "Aprés ce tems il est vrai que le pied me glissa: on me fit accroire que je voulois faire et peu a peu que je faisois le clavecin. ... le Public au bout a fait trop d'honneur á mon affaire. il l'a pris trop au serieuse".

<sup>54</sup> *Ibid.*, f. 19v: "j'ajuste et je rajuste desormais les debris de mon clavecin au gout public."

confidence had left him:

... before proceeding on the grand scale, I wanted to make an experiment, a test piece, a model which would demonstrate in a moment the entire potential of the harmonic play of colours. I arranged everything for this demonstration, and in order to seriously satisfy the audience I had prepared transparent sheets and candles, colours and light, screens and valves, even drums and rattles with hammers in the style of Pythagoras, ... and I went on to perform this terrible experiment, terrible for me who would suffer all the embarrassment of it.

In these circumstances, a few sceptical remarks from the audience were enough to make Castel lose control of himself:

After these barely but audible words I was seized by a kind of picturesque enthusiasm, and throwing my pencil in the face of the horse that did not labour according to my wishes [sic], I exclaimed *No, I am not going to do it, this fatal experiment, because I declare it done; I am not going to finish the harpsichord, because it is finished, and thus demonstrated to be feasible, since it only needs perfecting.* Well, in this way I addressed the 80 or 100 people present to see and judge, all mature and enlightened people, the majority of them not knowing what to think of it.

Castel only dared to show this audience the things he was still proud of, the models and textiles that had resulted from his colour experiments in the 1730s but "were lying worthless, covered with dust and cobwebs, rusting en falling apart, and disheartening me, not daring to believe that they could be presented to gentlemen, intelligent people but not acquainted with the actual fabrication of the organ or harpsichord."<sup>55</sup> Clearly, since 1735-1740 no progress at all had been achieved.

Nevertheless, Castel managed to organize a last dignified colour concert, reporting to the *Mercure de France* that the ocular harpsichord had performed for fifty people, who demanded four encores, on the day of its patron saint,

---

<sup>55</sup> *Ibid.*, ff. 37v-38v: "avant que d'y proceder tout a fait en grand, je voulois faire une experience, un essai, un modele qui démontreroit en peu de tems et d'un coup d'oeil l'entiere possibilité du jeu harmonieux des couleurs. je m'arrangeois en effect pour cette Demonstration, et j'avois tout au serieux et au bon du Public préparé des transparents et des Bougies, des couleurs et des lustres, des Paravents et des soupapes, des tambours meme et des cresselles avec des ma[r]teaux a la façon de Pythagore, ... et j'allois proceder a cette terrible Experience, terrible pour moi qui devois en avoir tout l'embarras. ... A ces mots a demi et trop entendus, saisi moi meme d'une sorte d'enthousiasme pittoresque, et jettant le Pinceaux au nés du cheval qui ne renifloit bien son ecume a mon gré *non je ne le ferai point*, ai je dit, *cette experience fatale, car je la declare faite; non je ne ferai point le clavecin, car il est fait, et par consequent démontré possible a faire, puisque ce n'est qu'a refaire et parfaire.* Or j'ai dit cela a 80 ou 100 personnes assemblées pour voir et juger, tous gens murs et éclairés, la plupart ne sachant jusques la qu'en penser. ... elles restent la en non valeur dans des tas de poussiere, d'araignées, de rouille, de delablement, de decouragement de ma part, n'osant pas croire avant vous [=Maillebois] que cela meritait d'etre présenté a d'honnetes gens, a des gens d'esprit non au fait de la facture specifique de l'orgue ou du clavecin."

Saint Thomas, and even for 200 applauding people on the 1st of January 1755.<sup>56</sup> Again Castel gave no technical details, but the *Explanation of the ocular harpsichord* also contains a report on this performance, and there the instrument is said to have included coloured glass windows, illuminated from within by a hundred wax candles. However, as Castel was said to have exclaimed after the show "that this was not even a *sketch*, a *beginning* of it, so far was it from being *perfect*,"<sup>57</sup> it probably still involved only a model. It was the harpsichord's swan song, as Castel died two years later.

The author of Castel's *éloge* in the *Mémoires de Trévoux* bluntly stated that Castel had fruitlessly spend the best part of his life trying to build the ocular harpsichord. There was no denying that in the theory of colours Castel had made "important discoveries from which the arts could profit," but the instrument which he indeed had succeeded in constructing had "neither fulfilled the project of its author, nor satisfied the expectation of the public".<sup>58</sup>

#### *Other harpsichord builders*

However, there are still some descriptions of the ocular harpsichord to be found after Castel's death, although they differ widely. In Savérien's *Histoire des progrès de l'esprit humain dans les sciences exactes et dans les arts qui en dépendent*, published in 1766, it says that the instrument "consists of a table on which is put up a kind of theatre complete with decorations. In front of the theatre is a keyboard, whose keys are connected with the decorations. When a key is pressed, no sound is heard but a colour is seen, in such a way that chords of colours are formed just like chords of notes."<sup>59</sup>

In 1769 the painter Lemierre, in his didactic poem *La peinture*, gave this versified description of the ocular harpsichord, built by "the industrious Castel, who today is not known any more":

He [Castel] places on a buffet the silvery instrument,  
Where the ingenious art of a mobile hand  
Questions the ebony and harmonic ivory;

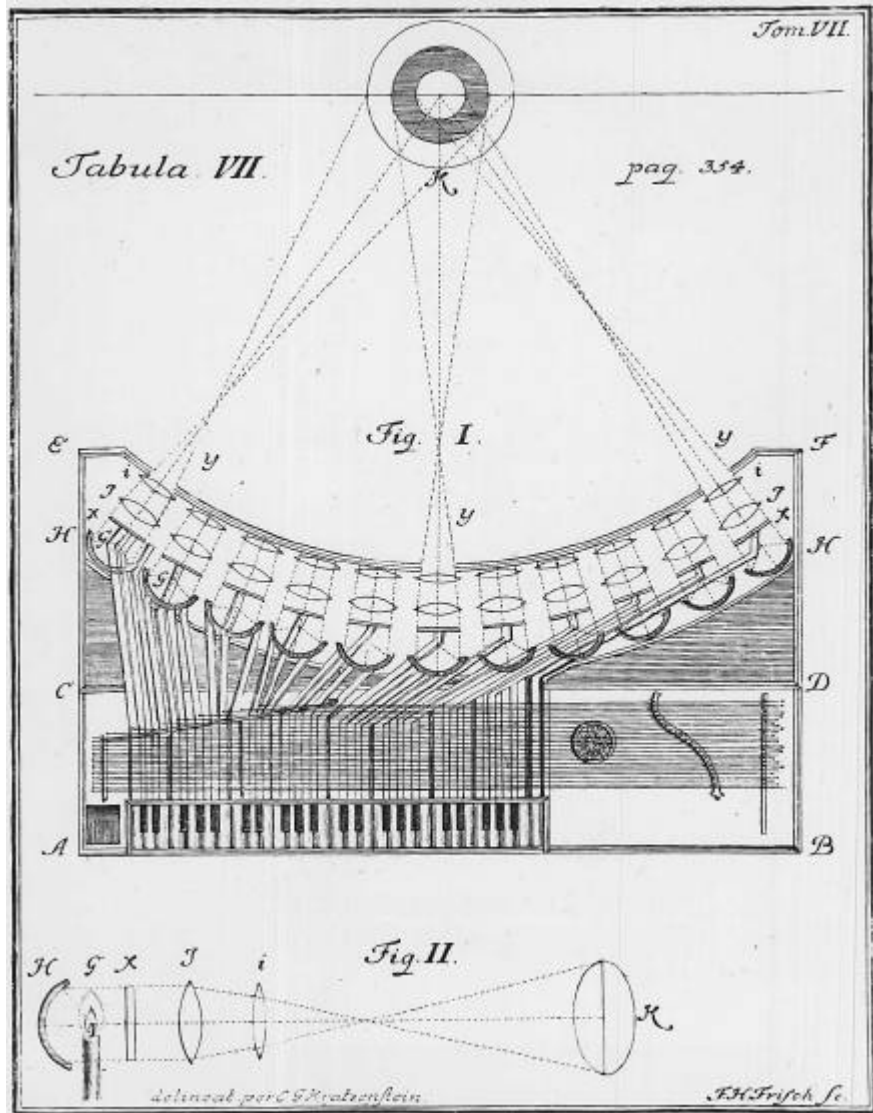
---

<sup>56</sup> *Mercur de France*, July 1755, pp. 144-145.

<sup>57</sup> *Explanation*, p. 13.

<sup>58</sup> Cited in *Esprit, saillies et singularités*, p. xx: "des découvertes importantes dont les arts pourroient profiter ... n'a ni rempli le devis de l'auteur, ni satisfait l'attente du public".

<sup>59</sup> Savérien, *Histoire*, p. 275: "C'est un instrument formé par une table sur laquelle est élevée une espèce de théâtre avec ses décorations. Sur le devant de cette table est un clavier, dont les touches répondent à ces décorations. Lorsqu'on touche sur le clavier, on n'entend pas des sons, mais on voit des couleurs; de sorte qu'on fait des accords de couleurs comme des accords de sons."



**Figure 1** – Johann Gottlob Krüger’s design for an ocular harpsichord. From the *Miscellanea Berolinensia*, 1743. (Courtesy Amsterdam University Library.)

At the end of each key a long elastic cord  
 Answers to the ribbons, folded one over another,  
 And as the hand, by varying the notes  
 Knows how to compose the sounds coming from the strings,  
 High above each strip opens up, unfolds,  
 And purple, green, orange and blue,  
 Return to the eye their movement and their play.<sup>60</sup>

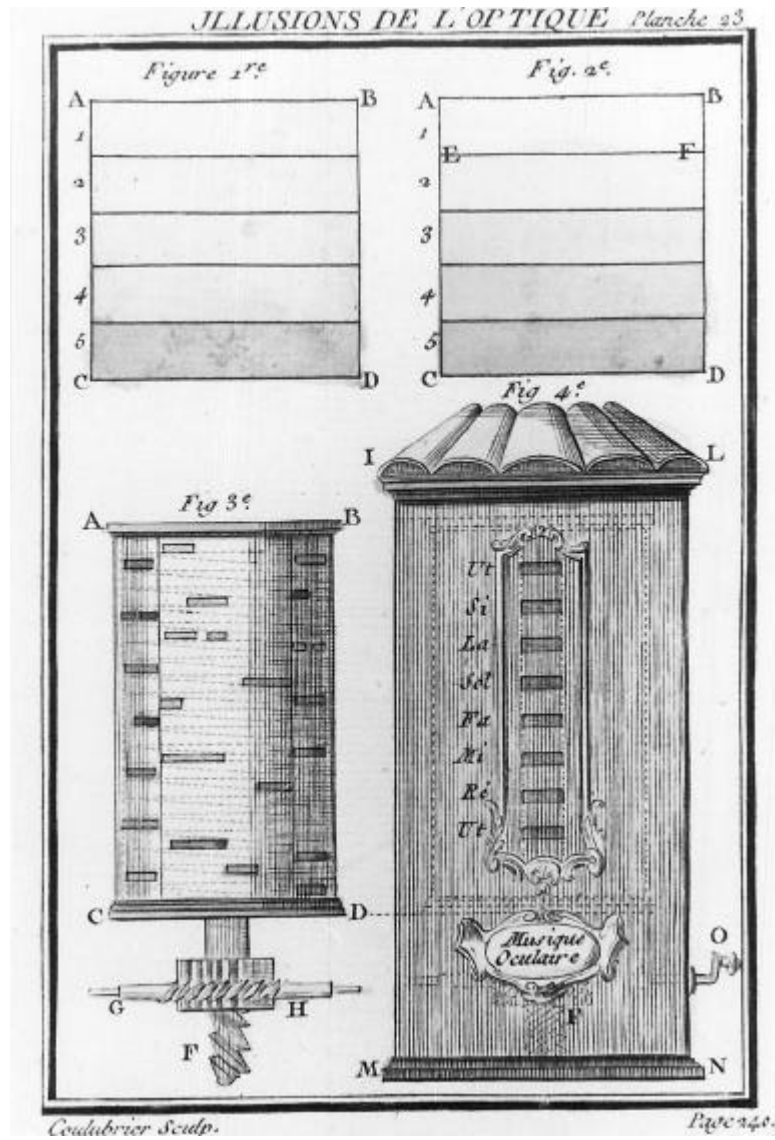
Both descriptions suggest that Savérien and Lemierre actually saw the instrument they described, but we can only guess where and when they did. Nevertheless both descriptions can be connected with other ones: Savérien's reminds one of the letter in which Krafft was informed that Castel wanted to realize his instrument "in modo theatri comici"; Lemierre's emphasis on the part of the ribbons will be encountered again with Diderot.

Around the same time, in a book containing all kinds of "recreations" based on scientific experiments to amuse your family and friends (possibly the first example of this genre) the author, a certain Guyot, referring to Castel's *Optique des couleurs*, presented his own simplified version of an ocular instrument. It consisted of a cardboard cylinder, with a candle inside, placed in a square box having eight rectangular openings cut out in the front, corresponding to the eight notes of the diatonic scale, including the octave. The cylinder could be rotated by hand in such a way that it spiralled upwards at the same time. For a certain tune the cylinder could be provided with matching holes covered with coloured paper, such that, if the cylinder was turned round in measure with the melody, the right colours would be showing through the rectangular openings. The complete thing could even be purchased from Guyot himself; it was the most expensive item in the book. Guyot admitted that it was very simple compared with what Castel had looked for, but according to him the pleasure the instrument might be capable of would never be worth the costs. In fact, the experience with this simple model convinced Guyot "that it is far from the truth that the various chords and alternations of colours make any such impression as he [Castel] thought they did, and that there is no perceptible analogy between colours and sound".<sup>61</sup> This small experiment was the last performance of

---

<sup>60</sup> Lemierre, *Peinture*, p. 70: "Il élève en buffet l'instrument argentin / Où l'art ingénieux d'une mobile main / Interroge l'ébène et l'yvoire harmonique; / Au bout de chaque touche un long fil élastique / Répond à des rubans l'un sur l'autre pliés, / Et selon que la main par des tons variés / Sait diriger les sons que la corde renvoie, / Plus haut chaque tissu s'entrouve, se déploie, / Et du pourpre, du verd, de l'orange, du bleu, / Fait retentir à l'oeil le passage & le jeu."

<sup>61</sup> Guyot, *Récréations*, vol. 3, recreation nr. 52, pp. 234-240: "qu'il s'en faut de beaucoup que ces différens changemens & accords de couleurs fassent une impression telle qu'il se l'est imaginé; qu'il n'y a aucune analogie sensible entre les couleurs & le son". For Guyot the whole idea was destroyed by the simple counterexample that two colours mix to a new colour, but that two notes do not mix to a new note but to a chord. This repeated Mairan's earlier argument, to be discussed in the next section, and in a sense also Krüger's, discussed on the next page.



**Figure 2** – Guyot’s toy version of the ocular harpsichord. From his *Nouvelles récréations physiques et mathématiques*, Paris 1769-1770. (Courtesy Utrecht University Library.)

Guyot’s book was translated into English, German and Dutch. In France it was reprinted in 1786 and 1799.

Castel's harpsichord in France.

Shortly before Castel's death, however, the ocular harpsichord had been introduced into England by an unknown associate of Castel. In 1757 this man published a leaflet, entitled *Explanation of the ocular harpsichord*, in which he recorded some of the history of the instrument and also his own solution to the problem.<sup>62</sup> The description he gives of his instrument is quite detailed: it consisted of a rectangular box of about 170 by 100 by 60 cm, placed on top of a normal harpsichord. In the front it had fifty elliptic windows of transparent enamel, which were lit from behind by some 500 candles. When a key was pressed, the window with the corresponding colour would glow up, but how this was achieved the author did not say, although he did indicate that even the difference in propagation velocity between light and sound had been taken into account! The author, however, had taken one crucial step away from Castel's theory, in adopting Newton's "minor scale", connecting the colour violet with the note D. But did this author succeed where Castel had failed? There is much reason to doubt it. The copy of the *Explanation* in the British Library has a written comment of its original owner, saying: "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 the instrument, for nothing was then performed nor afterwards, as ever I heard, neither did I ever know why."<sup>63</sup>

More daring was an adaption of Castel's project which had been proposed already quite early in Germany. In 1743 Johann Gottlob Krüger, a professor at the university of Halle, published a paper entitled "On a new kind of music, enjoyed by the eyes,"<sup>64</sup> in which he severely criticized Castel's views on colour music. For Castel's ocular harpsichord, as Krüger knew it showing, at the pressing of a key, a strip of coloured silk lit from behind by candles, could imitate the melodic aspect of music but not the harmonic aspect. There was no convincing analogue of a chord. This is not to say that Krüger rejected the idea of colour music in itself; according to him it was clear "that our mind, in judging the pleasure or displeasure of the things that reach our eyes, follows the same laws and rules that are followed in distinguishing musical consonance from dissonance".<sup>65</sup> This fact, however, could not be explained by any physical

---

<sup>62</sup> *Explanation*, pp. 17-22. The leaflet was reviewed in the *Mémoires de Trévoux*, January 1759, 342-357.

<sup>63</sup> British Library, shelf nr. 1041.h.4.(1.)

<sup>64</sup> Krüger, "De novo musicis".

<sup>65</sup> *Idem*, p. 352: "animum nostrum in diiudicanda obiectorum, quae oculum afficiunt, suavitate & molestia, easdem observare leges, easdemque regulas, quibus in distinguendis consonantiis a dissonantiis musicis uti consuevimus".

analogy between light and sound; it was simply a psychological phenomenon. This meant that there was no rationale for Castel's colour scale, nor was there any, for that matter, for Newton's casually presented analogy. Castel's scale could easily be proven to be defective: the combination of red and orange is not unpleasant, but the corresponding interval B-C is dissonant; similarly red and violet make a pleasant pair, whereas the major seventh D-C is dissonant; on the other hand red jars with green, while the corresponding interval G-C is a fourth and not dissonant.

Acknowledging the possibility of colour music, Krüger set out to design an ocular harpsichord that would solve the problem of the missing chords, "an instrument radically different from Castel's, but in all respects fitter to make the eyes delight in colours".<sup>66</sup> He began by adopting an arbitrary colour scale, red-orange-yellow-green-blue-purple-violet, matching the scale in C major, which amounted more or less to reversing the Newtonian spectral colours. Then he arranged a number of candles, each placed in the focus of a hollow mirror, in the form of a half-circle; the beams of light coming from the candles were each focused by a lens, such that all the beams projected into one point, the middle of the full circle, where a screen was set up. Each key of the instrument was not only triggering an ordinary harpsichord mechanism but was attached as well to a lever that normally screened off one of the beams, but when moved by pressing the key, pushed a circular window of coloured glass into the beam, resulting in the projection of a coloured circle onto the screen. The diameters of the windows decreased as the corresponding tones got lower, enabling the simultaneous projection of different coloured circles to visualize a colour chord, showing the root of the chord as a primary colour along the circumference of the projected circle and an array of increasingly superimposed colours towards the centre.

Although Krüger added a blueprint of the instrument to his article, there is no indication that anyone ever tried to build it. He did, however, refer to it in the second and third edition of his *Naturlehre*, presenting it as completely his own invention and not even mentioning Castel as the originator of the whole idea:

Anyone observing the beautiful colours that arise in the prism is easily led to the insight that it might be possible to delight the eye by the alternation and blending of the seven colours just as much as the ear by the seven tones. I have sketched such a

---

<sup>66</sup> *Ibid.*, p. 353: "machinam a Castelliana diversissimam, quae omnino ad delectandos coloribus oculos aptior esse videtur".



machine, ... which is not unworthy of the name of ocular harpsichord.<sup>67</sup>

As Krüger wholeheartedly defended Newton's theory of optics in his *Naturlehre*, he might, especially in Germany, have been partly responsible for the fact that in the latter half of the eighteenth century the idea of colour harmony was often thought to have been advocated by Newton himself.

### Initial reception: scientific scepticism and artistic affinity

#### *Scientific scepticism*

Castel's defence of his colour music was detailed enough to invite serious criticism. There was hardly any of it, however, after its first announcement in 1725. Only one comment appeared in print, written by an anonymous "Philosophe Gascon", who accused Castel of confounding "two things which all philosophers distinguish, and which are indeed as apart as mind and body; you confound the sensations that the soul experiences with the occasional causes of these sensations".<sup>68</sup> Even if light and sound were both vibrational phenomena, the anatomical differences between eye and ear were sure to destroy any commensurability of optical and acoustical sensations. Castel never really answered this line of criticism, which would be voiced by later writers as well; apart from his mechanistic argument that all senses can only transmit the impulses they receive from outside into the sensorium, his simple conviction that colours delight the soul counted sufficiently against it.

It was only in 1735, after the publication of Castel's "Nouvelles expériences d'optique et d'acoustique", that the ocular harpsichord fully entered the public arena. In the following five or ten years Castel must have been at the height of

---

<sup>67</sup> Krüger, *Naturlehre*, 2nd ed., vol. 1, p. 627; 3rd ed., vol. 1, pp. 684-685: "Wer die schönen Farben, welche durch das Prisma entstehen, betrachtet, den kan man leicht auf den Einfall bringen, daß es wohl eben so möglich sey, das Auge durch Abwechselung und Vermischung der sieben Farben, als das Ohr durch die sieben Tone zu vergnügen. Ich habe daher eine solche Maschine angegeben, ... welche des Namens eines Farbenclavecymbels nicht unwürdig ist." The last part of the sentence, calling the instrument an ocular harpsichord, was only added in the third edition. There were later posthumous editions up till 1777. In 1748 Krüger published a description of his instrument in German, which did not contain anything new, except that it showed that Krüger could be equally enthusiastic about colour music as Castel. What is interesting, however, is that Krüger stated that he had previously worked as an organ builder. See Krüger, "Anmerkungen".

<sup>68</sup> *Mercure de France*, May 1726, p. 933: "vous confondez deux choses que tous les Philosophes distinguent, & qui sont effectivement aussi distinguées, que l'esprit l'est du corps; vous confondez les sensations que l'ame éprouve avec les causes occasionnelles de ces sensations".

his fame; even the Prince de Conti paid him a visit at his workshop,<sup>69</sup> and his 1743 book on Newton's physics was a beautifully printed and expensive work. A clear indication of how Castel's reputation fared in these years can be found in two letters in the *Mercure de France* from 1754/1755. In one of them, Rondet, defender of Castel to the last, described the attitude of a certain Father Laugier in Castel's period of glory:

You even spoke to me in raptures about the invention of the ocular harpsichord, and about the striking way in which its author had demonstrated the theory, undoubtedly after the letters that the Reverend Father had addressed to the illustrious Président de Montesquieu in the *Mercures* [sic] of 1735. He had conquered the public, and even the most obstinate were convinced.<sup>70</sup>

But when, after twenty years, the harpsichord's music was still in the future, Laugier had changed his mind entirely, and he stated himself to be of the opinion "that the pleasure of sight has no connection at all with the pleasure of hearing, and that the idea of an *ocular harpsichord* could only arise in an imagination fertile of oddities but hardly a friend of the true and the solid".<sup>71</sup>

However, leaving aside what the general public may have thought about it in 1735, there were quite a number of sceptical responses. Castel's "Nouvelles expériences" were immediately reviewed by the abbé Prévost in his journal *Le Pour et Contre*, and he rather sceptically remarked that

if one strips from the theory all its ingenious researches and traits of the imagination with which the author has carefully adorned it, it only states that the colours, just like all other objects of sight and of the other senses, are linked by natural grounds of agreement and incompatibility, which cause that the connection and assemblage of these objects pleases us or shocks us. On this the larger part of the arts and the sciences is based, and the principle stretches as far as the *art de la cuisine*, ...

But even granted this much, would Castel's application of the principle fulfil its promise of giving pleasure? Prévost did not believe it would, since a movement "so slight and still so sudden as has to be supposed in an ocular harpsichord or in any other instrument that answers to the ideas of Father Castel, will annoy and trouble the sight, to such a degree that this pretended music will instantly

---

<sup>69</sup> Brussels, Royal Library, ms. coll. nr. 15746, f. 13r-13v.

<sup>70</sup> *Mercure de France*, April 1755, pp. 160-161: "Vous me parliez même avec extase de l'invention du clavecin oculaire, & de la maniere frappante dont l'auteur en avoit démontré la théorie, sans doute après les lettres que ce R.P. avoit écrites à l'illustre Président de Montesquieu, dans les *Mercures* de 1735. Il avoit gagné le public, & les plus opiniâtres étoient convaincus."

<sup>71</sup> *Ibid.*, October 1754, pp. 37-38: "que le plaisir de la vûe n'a aucun rapport avec celui de l'ouïe, & que l'idée d'un *clavecin oculaire* ne peut trouver place que dans une imagination féconde en singularités, mais peu amie du vrai & du solide."

become unbearable."<sup>72</sup>

This scepticism was shared by Voltaire. While preparing his famous book on the Newtonian world view, *Éléments de la philosophie de Newton*, Castel's ideas on colours were pointed out to him, and although he only exchanged some letters with Castel and never saw any instrument, he did enter the ocular harpsichord in his book, linking it with Newton's analogy between the widths of the various colours in the spectrum and the differences in string length for the notes of the minor scale. He fully accepted the analogy between tones and colours, and even thought it gave "reason to suspect that all things in nature have their hidden *rappports*, which perhaps some day will be discovered".<sup>73</sup> The harpsichord itself, however, could not convince him:

It is no doubt to be wished that this invention will not, like so many others, be an ingenious and useless effort; the rapid passage of various colours before the eyes may perhaps not fail to shock, dazzle and exhaust the sight; perhaps our eyes want some rest to be able to enjoy the agreement of the colours. It is not enough to propose us a pleasure, nature must have given us the capability to admit this pleasure: it is up to experience only to judge this invention.<sup>74</sup>

Voltaire's initial benevolence, to be sure, could not for long withstand his malicious character. It seems that Voltaire had not appreciated Castel's review

---

<sup>72</sup> *Le Pour et Contre* 7 (1735), pp. 14 resp. 19: "si on la dépouilloit de toutes les recherches ingénieuses, & de tous les traits d'imagination dont l'Auteur a pris soin de l'orner, elle signifieroit seulement qu'entre les couleurs comme entre tous les objets de la vûë & des autres sens, il y a des fondemens naturels de convenance ou d'incompatibilité, qui font que la liaison & l'assemblage de ces objets nous plaît ou nous choque. 'est là-dessus qu'est fondée la plus grande partie des Arts & des Sciences, & ce principe s'étend jusqu'à l'*Art de la Cuisine*"; "aussi léger & aussi prompt qu'il faut les concevoir dans un Clavecin oculaire ou dans tout autre Instrument qui réponde aux idées du R.P. Castel, la gêne & trouble la vûë, jusqu'à rendre en un moment cette prétendue Musique insupportable." In 1739, however, Le Fèvre de Saint-Marc, who edited the journal in that year, published in *Le Pour et Contre* the integral translation of Telemann's *Beschreibung der Augenorgel*, commenting: "On a d'abord traité l'idée de chimérique, mais on commence à croire aujourd'hui qu'il n'est pas impossible de la réaliser." (Vol. 18, p. 313.)

<sup>73</sup> Voltaire, *Éléments*, p. 184: "donne lieu de soupçonner, que toutes les choses de la Nature ont des rapports cachés, que peut-être on découvrira quelque jour."

<sup>74</sup> *Ibid.*, p. 185: "Il est à souhaiter sans doute, que cette invention ne soit pas, comme tant d'autres, un effort ingénieux & inutile: ce passage rapide de plusieurs couleurs devant les yeux semble peut-être devoir étonner, éblouir, & fatiguer la vûë; 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 capable de recevoir ce plaisir: c'est à l'expérience seule à justifier cette invention." It will come as no surprise that the harpsichord did not survive the many reprints of the *Éléments* for long. In 1741 Voltaire added the comment: "Au reste, cette idée n'a point encore été exécutée, et l'Auteur ne suivoit pas les découvertes de Newton." Starting from 1748 (the Dresden edition of the *Oeuvres*), the whole reference to the instrument was skipped. It just said: "A l'égard de l'analogie entre les sept couleurs primitives et les sept tons de la musique, c'est une découverte qui n'est pas encore assez approfondie, ce qui ne peut encore mener à rien." See Part II, Ch. 13 of any edition.

of the *Éléments* in the *Mémoires de Trévoux*. Poor Castel must have thought himself very polite indeed, copiously praising Voltaire's philosophical competence and not criticizing Newton's views for fear of giving the impression of criticizing the famous author himself. Voltaire, however, was mainly annoyed by Castel's remark that he, in writing on Newton's physics, "had switched from the frivolous to the solid", complaining that the writing of the *Éléments* had cost him only six months, while writing the *Henriade* had cost him six years.<sup>75</sup> He took revenge by publishing an anonymous *Lettre à Mr. Rameau*, taking a stand in a old and tedious quarrel between Castel and the composer Rameau. In this letter he ridiculed all of Castel's views, but most of all the ocular harpsichord:

It paints minuets and nice sarabandes. All the deaf of Paris are invited to the concert that he promises them for twelve years. ... With what goodness and obligingness towards humanity does he deign to demonstrate ... with lemmas, theorems and scholia, 1°. That people love pleasures. 2°. That the art of painting is a pleasure. 3°. That yellow is different from red, and hundreds of other thorny questions of this kind.<sup>76</sup>

The most penetrating critique, however, came from the Académie des Sciences. In 1737 Dortous de Mairan, to become the successor of Fontenelle as secretary of the Académie three years later, read a paper before the academy discussing the analogy between tones and colours, in which he listed a number of grave difficulties, many of which we in fact would still think valid today. Although he based himself solely on Newton's prism experiments and did not once mention Castel's harpsichord, witnessing the contempt Castel was still held in by the academicians, it can only have been the stir Castel's ideas had caused which motivated Mairan's extensive discussion. His arguments, however, according to Mairan, did not depend on the truth or falsity of Newton's theory of optics or of any such theory; indeed he himself was not a Newtonian.<sup>77</sup>

To start, it was of course accepted that the pleasure or displeasure of musical chords depends on the ratios of the rate of vibration of the constituent notes, the pleasure increasing as this ratio gets simpler. However, there was no

---

<sup>75</sup> Voltaire to d'Olivet, 20 October 1738, in Voltaire's *Correspondence*, vol. 7, p. 14. It seems not to have been just Voltaire's touchiness but a more general feeling; Desfontaines informed the poet Rousseau in August 1738: "All philosophers and geometers stumble ... over the corpse of the poor Newtonian; Father Castel has severely ridiculed him these days in the *J. de Trévoux*." Idem, p. 322. I failed to get this impression from the review.

<sup>76</sup> In Voltaire, *Correspondence*, vol. 7, pp. 477-480: "Il peint des Menuets, de belles Sarabandes. Tous les Sourds de Paris sont invités au Concert qu'il leur annonce depuis douze ans; ... Avec quelle bonté, quelle condescendance pour le genre humain, daigne-t-il démontrer ... par Lemmes, Théorèmes, Scholies, 1°. Que les hommes aiment le plaisir. 2° Que la Peinture est un plaisir. 3° Que le jaune est different du rouge, & cent autres questions épineuses de cette nature."

<sup>77</sup> See for Mairan's optical theory Hakfoort, *Optica*, pp. 43-48.

indication at all that the rates of vibration of the various colours had any such simple ratios. The only indication of what the physical properties of the different colour rays were, be it their vibration rate or any other property that determined the impact of the ray on, for instance, our eye, was their refractibility, which was the only thing in which they could be said to differ. Mairan then assumed that for each ray the ratio of the angles of incidence and refraction was the right measure of this physical property, let's say its rate of vibration. But the maximal ratio of the different values of this property, for the colours red and violet, was 77:78, as Newton had so laboriously measured. The conclusion had to be that no pleasure could be expected of colour harmonies.<sup>78</sup>

Second, as had been remarked earlier by the "Philosophe Gascon", the organs of hearing and sight were so different in their anatomy, the one hard and dry, the other soft and humid, that it was inconceivable that the impressions they transmitted to the soul were commensurable. In fact, the pleasure we feel with simple frequency ratios of tones can be seen to be grounded in the anatomy of the ear: "The immediate organ of hearing is in fact, so to say, a real musical instrument, ...: it is a kind of harpsichord, [containing] an infinity of strings, which by their different lengths and their different tensions are capable of taking care of the relations and the vibrations of all possible tones."<sup>79</sup> For the eye there was no indication of a similar mechanism. Then there were other problems, such as the fact that two colours mix to a new colour, while two tones mix to a chord, something quite different from a single tone; the fact that we enjoy the slowly fading of one colour into another but loathe the tuning of a string such that one tone changes into another; and finally the fact that colours are absolute, whereas with tones only the intervals are absolute, and any tone can be the root of any interval.<sup>80</sup>

To summarize, Mairan stated:

There is no relation between these sensations [of hearing and sight] but in their intensity or magnitude; no other relation, neither as to their nature nor as to the idea we have of them. If there would be the least such a relation, it would not be impossible to give someone born blind but not mute some idea of what colour and painting are, and

---

<sup>78</sup> Mairan, "Discours", pp. 29-30.

<sup>79</sup> *Ibid.*, pp. 37-38 resp. 10: "L'organe immédiat de l'ouïe est en effet, on le peut dire, un véritable Instrument de Musique, ... c'est une sorte de Clavecin, [contenant] une infinité de cordes, qui par leurs différentes longueurs, & par leurs différentes tensions, sont en état de fournir aux rapports, & aux vibrations de tous les tons possibles."

<sup>80</sup> *Ibid.*, pp. 39-42.

conversely a mute who is not blind some idea of tones and music.<sup>81</sup>

Interestingly enough, some years later Diderot would turn Mairan's argument on its head, and conclude from his own observation that Castel's harpsichord had been able to give a blind man some idea of what colour was, that there was something to the harmony of the senses.

The French academy stood not alone in its fierce critique. In 1742 the Imperial Academy of St Petersburg dedicated a similar session to Castel's ideas, after having been informed about them from Paris. There the physiologist Weitbrecht repeated the objection that the anatomical differences between eye and ear discredited any analogy between optical and acoustical sensations. The mathematician Krafft was even more radical, and argued that the existence of colour harmony and colour music depended completely on the question whether or not light was indeed a vibration of the aether. He himself thought this to be a false theory, which not only made Castel's views meaningless, but Newton's analogy just as well.<sup>82</sup>

Although Castel had founded his colour harmony on the hypothesis that light was a vibrational phenomenon, the majority of scientists in the second quarter of the eighteenth century subscribed to Newton's emission theory. There were, of course, occasional defenders of Newton to whom the idea of colour harmony nevertheless appealed, not in the least because they thought they could find indications for it in Newton's own *Opticks*; Voltaire and Krüger are two examples. This situation changed in 1746, when Euler published a new vibration theory of light which was much more sophisticated than earlier ones, and one may rightly wonder whether adherents of this theory were more sympathetic to Castel's views. Euler himself certainly seems to have accepted the idea of colour harmony, as is shown by the reference to it in his *Lettres à une Princesse d'Allemagne*. In describing the refraction of white light into the spectral colours by a prism, he counted six colours, red-orange-yellow-green-blue-violet, although he admitted that actually the spectrum is a continuum of fading colour shades, causing the number of colours one discerns to depend on the number of available names and on the quality of one's retina. Indeed, some people said

---

<sup>81</sup> *Ibid.*, pp. 35-36: "Il n'y a de relation entre ces sentiments, que par l'intensité ou la grandeur; nulle relation d'ailleurs, ni dans leur nature, ni dans l'idée qui nous les représente. S'il y en avoit le moins du monde, il ne seroit pas impossible de donner à un Aveugle né, qui n'est pas sourd, quelque idée des couleurs & de la peinture, & réciproquement à un Sourd qui n'est pas aveugle, quelque idée des Sons & de la Musique."

<sup>82</sup> See Schier, *Castel*, pp. 172-175 and Castel's own review of the transactions of the session, in the *Mémoires de Trévoux*, May 1743, 817-842. Castel muttered that the Russians were simply not informed well enough to judge; he was of the opinion that in his writings most of these objections had already been dealt with.

they could see a slight purple before the red. Next he introduced, out of the blue, a comparison between these colours and the musical scale in C major, "because the colours can be equally well expressed in numbers as the tones are". As the fundamental tone, however, he took purple and not red (which was a second above the root) since

by raising the violet enough, one arrives at a new purple, just like in rising along with the tones one gets from B to C which is an octave higher than the original C. And since in music this note is given the same name because of their resemblance, it is the same with the colours, which, after having risen by the interval of an octave, receive the same names, or rather, two colours, just like two tones, one of which has exactly twice the number of vibrations as the other, are taken to be the same colour and carry the same name.<sup>83</sup>

Although no-one had succeeded in actually measuring the rates of vibrations of the various spectral colours, Euler thus not only supposed the rate for violet to be nearly twice as great as the rate for red, but believed as well, and in this he was wholly original, that there existed higher and lower octaves of the same colours.<sup>84</sup>

It was on this principle, Euler said, that Castel had imagined a kind of music of colours and had devised his ocular harpsichord, which he presumed the princess "had heard talked about on several occasions". It seems Euler in a way "rationally reconstructed" Castel's ideas within his own theory, discarding completely Castel's own chromatic scale. This did not, however, affect his appreciation of the performance of the harpsichord itself, since he doubted whether "showing various pieces of cloth dyed in different colours would be very agreeable". According to Euler it was painting "that to the eyes is the same thing as music is to the ears".<sup>85</sup> Nevertheless, later German authors on natural philosophy who accepted Euler's theory rather than Newton's tended to bring in

---

<sup>83</sup> Cited in Euler, *Lettres*, vol. 11, p. 74 (Letter 31): "puisque les couleurs aussi bien que les sons se peuvent exprimer en nombres"; "haussant davantage le violet, on revient à un nouveau pourpre, tout comme en montant dans les sons, on parvient au delà de B au son c, qui est un octave au-dessus de C. Et comme dans la musique on donne à ce ton le même nom à cause de leur ressemblance, il en est de même dans les couleurs, qui après avoir monté par l'intervalle d'une octave, recouvrent les mêmes noms: ou bien deux couleurs, comme deux tons dont le nombre de vibrations de l'une est précisément le double de l'autre, passent pour la même couleur, et ont le même nom."

<sup>84</sup> See Hakfoort, *Optica*, pp. 90-113, on Euler's theory. Of course the frequency of blue light is in fact roughly twice as great as the frequency of red light, but this is purely coincidental.

<sup>85</sup> *Idem*: "Pour moi je pense que c'est plutôt la peinture, qui est par rapport aux yeux la même chose que la Musique aux oreilles; et je doute fort qu'une représentation de plusieurs morceaux de draps teints de diverses couleurs, puisse être fort agréable." If he had not already learned about Castel's harpsichord, he would have from a letter by Krafft, discussing the St Petersburg Academy session of 1742. See A.P. Juškevič & E. Winter, ed., *Die Berliner und die Petersburger Akademie der Wissenschaften im Briefwechsel Leonhard Eulers*, Berlin [Ost], 1959-1976, vol. 3, pp. 137-138.

Castel's ocular music, while Newtonians mostly ignored him. An example of such an Eulerian is Boeckmann; in his *Naturlehre* from 1775 he mentioned how Euler connected the different colours with different rates of vibrations of the aether, and continued: "From this the famous geometer derives the further comparison of the colours with the tones, and adopts his *colour octaves* and his *colour chords*. Then a *colour music* cannot fail, which must be to the eye what the harmony of tones is to the ear. To this belongs the *ocular harpsichord* of Father Castel."<sup>86</sup> Similarly, Erxleben mentioned the analogy between tones and colours in 1772 in his *Anfangsgründe der Naturlehre*, although he rejected the existence of any colours beyond the red or the violet, and he summarized: "There was also the invention of a *colour music*, in which the eye would be pleased by a similar multiplicity of colours as the ear is by the multiplicity of tones in a piece of music; however, it was not a success."<sup>87</sup>

#### *Artistic affinity*

Contrasting sharply with the negative responses from science was the reaction of theoreticians of art. In 1668 the painter Dufresnoy had started a tradition of didactic poetry on the art of painting with his *De arte graphica*, translated into French prose the same year by Roger de Piles. As Castel had already learned from Félibien, it was not uncommon to adopt the concept of harmony in painting as well, but it was only used in a rather general and non-committing way. The most far-reaching statement is to be found with the same Roger de Piles, who in his *Idée du peintre parfait* pronounced that "there is harmony and dissonance between the various colours and shades in the same way as there is in a musical composition", but for him the harmony in music was not just the harmony of the different tones but also of the different instruments, and in his last book on painting he applied the term harmony specifically to the "*tout-ensemble*", and for comparisons of colours spoke only in a general way of their accord and opposition or their amity and antipathy.<sup>88</sup>

---

<sup>86</sup> Boeckmann, *Naturlehre*, p. 322: "Hieraus leitet dieser berühmte Geometer die weitere Vergleichung der Farben mit den Tönen her, und nimmt seine *Farben-Octaven* und *Farben-Accorde* an. Es kann also auch nicht an einer *Farben-Musik* fehlen, die dem Auge das seyn soll, was die Harmonie der Töne dem Ohr ist. Hieher gehöret das *Farben-Clavicymbel* des Vater Castells."

<sup>87</sup> Erxleben, *Anfangsgründe*, p. 315: "Man hat auch ein *Farbenmusik* erfunden, wobey das Auge durch eben eine solche Mannichfaltigkeit von Farben ergötzt werden sollte, wie das Ohr bey einer Musik durch Mannichfaltigkeit der Töne; sie hat aber ihr Glück nicht machen können." The editor Lichtenberg added as references Mendelssohn and Krüger.

<sup>88</sup> Piles, *Idée*, p. 40; *Cours*, pp. 334-342: "Il y a une harmonie & une dissonance dans les especes de Couleurs, comme il y en a dans les tons de lumière, de même que dans une Composition de Musique". The *Idée* is very commonly but mistakenly ascribed to Félibien; it is in fact the separately reprinted first book of Piles' *Abregé de la vie des peintres*, originally published in 1699.



This terminology suddenly sharpened after 1735. In 1736 the abbé Marsy published his *Pictura*, a didactic poem inspired by Dufresnoy. Marsy advised the aspiring painter to

avoid intermingling inimical and incompatible colours; because, although we recommend varying the coloration, nevertheless there has to be an accord and a harmony among the colour tones, just as in a concert the art of the musician consists in according ill-matched notes and combining the dissonances of many voices. Is it but an pleasant reverie? Or might it be possible, at least to suit a poetic imagination, to combine the colour tones as we do sounds; to join them into a sort of concert, a kind of mute symphony, a sort of instrument without pipes, harmonious though lacking sound, that surprises and delights the eyes; in short, an ocular music that charms the senses of the spectators?<sup>89</sup>

The mention of accord and harmony prevailed in later works in this genre, although not always as extensively as with Marsy. In 1760 Watelet published his poem *L'art de peindre*; as a friend of d'Alembert (he wrote the article "Grace" for the *Encyclopédie*), he probably regarded the ocular harpsichord with scepticism, but it did not restrain him from using phrases like "the harmonious accord of the different shades" and "vary the harmony of his colouring", and pronounce that painting and music "both have their tones, their chords, their nuances, and these common terms mark their resemblances".<sup>90</sup> Nine years later, however, the already mentioned Lemierre fully revived Castel in a similar didactic poem when he sang of the rainbow,

Where by happy chords, the colour that glitters  
Has a tone it follows and a tone that follows it,  
Where by the effect of an invisible and supreme art  
This hue is no more and still seems the same,  
Where, displaying everywhere its imperceptible *rappports*,  
The contrast of tones appears only at both edges;  
In the meadows of the sky ocular harmony

---

<sup>89</sup> Cited from the French prose translation, in Watelet, *L'art de peindre*, pp. 283-285: "Gardez-vous bien de mêler ensemble des couleurs ennemis & incompatibles: car quoique nous recommandions de varier le coloris, il faut néanmoins qu'il y ait de l'accord & de l'harmonie dans les tons des couleurs; de même dans un concert, l'art du Musicien sçait accorder des disparates, & marier ensemble les dissonances de plusieurs voix. N'est-ce qu'une agréable rêverie? Ou seroit-il donc possible, du moins au gré d'une imagination poétique, de combiner, comme on fait les sons, les modules & les tons des couleurs; d'en former une espece de concert, une sorte de simphonie muëtte, une maniere d'instrument organisé sans tuyaux, & harmonieux sans rendre de sons, qui surprît & enchantât les yeux; enfin une Musique Oculaire qui charmât les sens des Spectateurs?" In this edition from 1760 there is a note at the end saying: "Allusion au Clavecin oculaire du célèbre Pere Castel, Jésuite."

<sup>90</sup> Watelet, *L'art de peindre*, pp. 22 resp. 29: "Des effets nuancés l'accord harmonieux"; "Peut de son coloris varier l'harmonie."

Shows you the genius of the concert of colours.<sup>91</sup>

It was not only these French painter-theorists who were attracted to the reinforcement of the analogy between music and painting by the concept of colour harmony. In England the painter William Hogarth originally mentioned the ocular harpsichord in the manuscript of his famous *The analysis of beauty*, but deleted the reference before publication. From the small passage it is hardly possible to judge what he made of it, although he recognized that the idea only made sense if it is taken for granted "that colours and sound [are] of the same nature and that like dispositions of them both would answer the same purpose, i.e., that a jig in notes would be literally a jig in colours".<sup>92</sup>

The observed adoption of the Castellian terminology of colour harmony in painting was not much more than the amplification of a manner of speaking which was already familiar. Moreover, these painters took Castel's complicated analogy as only an analogy between the already existing arts of painting and music. It did not have a lasting effect on the use of the concept of harmony in painting. In 1762 Christian Ludwig von Hagedorn placed the judgment of colours by harmony in opposition to the mechanical mixing of simple colours, stating that "the beautiful colours in itself do not make a colorist", and he applied the concept of harmony primarily with "the whole", just as Roger de Piles had done at the beginning of the century.<sup>93</sup>

On the other hand, there is one man standing apart in demonstrating a much more substantial affinity with Castel's ideas, namely Denis Diderot. The first evidence of an acquaintance of Diderot with Castel dates from 1751, when Diderot sought Castel's help in warding off the attacks of the Jesuits on the first volumes of the *Encyclopédie*. Already some years earlier there is an aside in one of Diderot's novels hinting that he knew Castel opposed the recently ordained crusade of the Jesuits against the unfolding Enlightenment.<sup>94</sup> So it

---

<sup>91</sup> Lemierre, *La peinture*, p. 71: "Où par d'heureux accords cette couleur qui luit / Tient du ton qu'elle quitte & du ton qui la suit, / Où par l'effet d'un art invisible & suprême / Cette teinte n'est plus & semble encore la même, / Où laissant voir par tout d'insensible rapports / Le contraste des tons ne paroît qu'aux deux bords, / Aux campagnes du ciel oculaire harmonie, / Du concert des couleurs te montre le génie." The 1770 edition has in the footnotes parallel passages from Watelet, including the phrases that were quoted above.

<sup>92</sup> Hogarth, *Analysis*, p. 176. Like Prévost before him, his first association was to fantasize a concert of flavours. How Hogarth came to hear about the harpsichord is not clear. Castel was certainly known in England in the 1740s; see Von Erhardt-Siebold, "Inventions", p. 354 n. 2.

<sup>93</sup> Hagedorn, *Betrachtungen*, pp. 688-689 & 710-711. Hagedorn mentioned having studied Félibien, Marsy and Watelet (p. 64); he had also read Krüger's *Naturlehre* (p. 711).

<sup>94</sup> See Diderot to Castel, March 1751, in *Correspondance*, vol. 1, pp. 115-116. The allusion to Castel is in *Les bijoux indiscrets* (1748): "C'était un bon homme qui mettait de l'esprit à tout, et que les autres brames [Brahmins] noirs, ses confrères, firent mourir de chagrin." See *Oeuvres complètes*, vol. 4, p. 203.

probably was in the late 1740s that Diderot paid a visit to Castel's workshop, as many others had done before him. The description of this visit Diderot included in his *Lettre sur les sourds et muets*, published in 1751. Diderot, however, had prepared himself better than the others, in bringing with him a deaf-mute: "I imagined that if there was anyone on earth who was to receive any pleasure from ocular music, and anyone who could judge it impartially, it was a deaf-mute by birth."<sup>95</sup>

As is clear from his account, the reaction of the deaf-mute pleased Diderot and perhaps it played a part in winning him over to Castel's views. It was obvious, said Diderot, that there was no way of explaining to the deaf-mute

anything about the nature and the marvelous properties of the harpsichord; since he had no idea of sound, what he understood of the ocular instrument assuredly had no relation to music, and the purpose of this machine was to him as incomprehensible as the use that we make of our speech organs. Then what did he think? And what basis was there for the admiration to which he succumbed when he saw the gamut of Father Castel? ... My deaf imagined that this inventor of genius was equally deaf and mute; that he used his harpsichord to communicate with other people; that each colour shade on the keyboard had the value of one of the letters of the alphabet; and that by way of the keys and the agility of his fingers, he combined these letters and formed words, phrases, indeed a whole conversation in colours.

Now, suddenly, the deaf-mute believed himself to comprehend what music was: "He gathered that music was a special way of communicating thought, and that the instruments, the fiddles, the violins, the trumpets, were, in our hands, another type of speech organ." Diderot thought this very clever of the deaf-mute: "If he had perhaps not exactly chanced upon what [music] was, he had almost chanced upon what it should be."<sup>96</sup>

Given this appreciation, one would surely expect Diderot to say something

---

<sup>95</sup> Diderot, *Oeuvres complètes*, vol. 1. pp. 356-357: "J'imaginai que s'il y avait un être au monde qui dût prendre quelque plaisir à la musique oculaire, et qui pût en juger sans prévention, c'était un sourd et muet de naissance."

<sup>96</sup> *Idem*, pp. 357-358: "qu'il n'était pas possible de lui rien communiquer sur la nature et les propriétés merveilleuses du clavecin; que n'ayant aucune idée du son, celles qu'il prenait de l'instrument oculaire n'étaient assurément pas relatives à la musique, et que la destination de cette machine lui était tout aussi incompréhensible que l'usage que nous faisons des organes de la parole. Que pensait-il donc? et quel était le fondement de l'admiration dans laquelle il tomba, à l'aspect des éventails du Père Castel? ... Mon sourd s'imagina que ce génie inventeur était sourd et muet aussi; que son clavecin lui servait à converser avec les autres hommes; que chaque nuance avait sur le clavier la valeur d'une des lettres de l'alphabet; et qu'à l'aide des touches et de l'agilité des doigts, il combinait ces lettres, en formait des mots, des phrases; enfin, tout un discours en couleurs. ... Il crut que la musique était une façon particulière de communiquer la pensée, et que les instruments, les vielles, les violons, les trompettes étaient, entre nos mains, d'autre organes de la paroles. ... S'il ne rencontra pas exactement ce que c'était, il rencontra presque ce que ce devrait être."

about the ocular harpsichord in the recently initiated *Encyclopédie*. Indeed he gave it an article of its own in the third volume, published in 1753, under the heading "Clavecin oculaire (Musiq. et Opt.)". He described the instrument as "designed to give the soul through the eyes the same agreeable sensations of melody and harmony of colours as the sensations of melody and harmony of sounds it receives by the ordinary harpsichord through the ear", and he readily followed Castel to the extremes of the analogy:

... if one takes a nice rudimentary piece of auricular music, for instance the one of Mr. d'Alembert, and the word *colour* is everywhere substituted for the word *tone*, one will have the complete elements of ocular music, coloured songs of several voices, a fundamental bass, a thorough bass, chords of all kinds, even by supposition and suspension, a rule of connection, harmonic inversions, etc.

He light-heartedly sidestepped the by now repeatedly raised difficulties:

The objections which have been put forward against the ocular music and instrument are so obvious that it is useless to report them: we only venture to assure that they are perfectly, I will not say destroyed, but at least countered by the responses drawn from the comparison of the two musics, leaving now only experience to decide the question.<sup>97</sup>

However, Diderot did discuss one particular problem, resembling the one that Voltaire had mentioned: the subjective jumps from one colour of the scale to the next are much greater than the corresponding jumps from one musical tone to the next. This meant that there had to be found

some expedient to link the colours and rend them continuous to the eye; if not, the eye will, in very vivacious airs, not knowing what colour interval will come next, have no clue to where to expect the next tone, and will, out of a battery of colours, only seize some sparse tones, or will have to torment itself so much to seize all notes that it will be dazzled

---

<sup>97</sup> *Encyclopédie*, vol. 3, pp. 511-512: "destiné à donner à l'ame par les yeux les mêmes sensations agréables de mélodie & d'harmonie de couleurs, que celles de mélodie & d'harmonie de sons que le clavecin ordinaire lui communique par l'oreille"; "si l'on prend un bon rudiment de Musique auriculaire, tel que celui de M. d'Alembert, & qu'on substitue par-tout le mot *couleur* au mot *son*, on aura des élémens complets de musique oculaire, des chants colorés à plusieurs parties, une basse fondamentale, une basse continue, des chiffres, des accords de tout espece, même par supposition & par suspension, une loi de liaison, des renversemens d'harmonie, &c"; "Les objections qu'on a faites contre la musique & l'instrument oculaires se présentent si naturellement, qu'il est inutile de les rapporter: nous osons seulement assûrer qu'elles sont si parfaitement, sinon détruites, au moins balancées par les réponses tirées de la comparaison des deux musiques, qu'il n'y a plus que l'expérience qui puisse décider la question." The authorship of Diderot was indicated by an asterisk. The article was left unchanged in the 1771-1776 quarto reprint of the *Encyclopédie*, in the octavo reprints of Neuchâtel, 1777-1779, and Lausanne, 1778-1782, and even in Felice's adaptation of the *Encyclopédie*, the *Dictionnaire universelle* of 1770-1780.

in no time; and then goodbye to melody and harmony.

Diderot was convinced that "to solve this problem, one needs only a very small part of the sagacity which the invention of the harpsichord supposes".<sup>98</sup> Indeed, Castel had remarked repeatedly that all that was needed was the resignation that one inevitably had to become used to colour music gradually. Had the French public not encountered similar difficulties in accepting Italian music?

Although Diderot had visited Castel's workshop and seen a model harpsichord demonstrated, he did not say anything on the technical realization of the instrument. Neither did he promise a drawing of it in the *Recueil des planches*, as he did for other inventions described in the same volume (for instance a curious mechanical calendar mentioned under "Chronologique, machine"). He only admitted that "the fabrication of this instrument is so extraordinary that only a little enlightened public will complain that it is constantly made and never finished", and that it needed a "rare engineer" to do it.<sup>99</sup>

Apart from the ocular harpsichord, Diderot was also impressed by the coloured ribbons that Castel had made in the course of his colour experiments during the years 1734-1740. By taking silken threads dyed in the twelve colours of the chromatic scale and twining them into yarn in different combinations, he had manufactured ribbons that showed a certain colour passing by imperceptible changes through all the chiaroscuro shades from almost black to almost white, or others showing a complete octave in which all the different colours imperceptibly changed into the next one until the root colour was regained.<sup>100</sup> When the first volume of the *Encyclopédie* appeared Diderot wrote to Jaucourt: "Here is our *Encyclopédie*. In it I have rendered homage to Father Castel at several occasions; and I will seize the opportunity to do so again in the following volumes."<sup>101</sup> One of these occasions was the article "Animal", in the introduction of which Diderot mentioned Castel's ribbons as a metaphor for the "great

---

<sup>98</sup> *Idem*: "il faudroit trouver quelque expédient qui liât les couleurs, & les rendît continue pour l'oeil; sinon, dans les airs d'un mouvement extrêmement vif, l'oeil ne sachant quelle intervalle de couleurs on va faire, ignorera, après avoir vû un ton où il doit se porter pour apercevoir le ton suivant, ne saisira dans une batterie de couleurs que quelque notes éparses de tout un air coloré, ou se tourmentera si fort pour les saisir toutes, qu'il en aura bien-tôt la brelue; & adieu la mélodie & l'harmonie. ... pour la resoudre, il ne faut que la plus petite partie de la sagacité que l'invention du *clavecin oculaire* suppose."

<sup>99</sup> *Idem*: "La facture de cet instrument est si extraordinaire, qu'il n'y a que le public peu éclairé qui puisse se plaindre qu'il se fasse toujours & qu'il ne s'acheve point."

<sup>100</sup> See "Nouvelles expériences", *Mémoires de Trévoux*, October 1735, pp. 2047-2048, and *Optique des couleurs*, pp. 176-196.

<sup>101</sup> In Diderot, *Correspondance*, vol. 1, p. 131: "Voilà notre Encyclopédie qui paroît. J'y ai fait une mention honorable du Père Castel en plusieurs endroits; et j'en saisirai l'occasion d'en [dans?] les volumes suivants."

chain of being". He introduced them to the same purpose in his *Rêve de d'Alembert*: "All beings circulate one inside the other, and so do all species... all is in perpetual flux... Every animal is more or less human; every mineral is more or less plant; every plant is more or less animal. There is nothing definite in nature... The ribbon of Father Castel... Yes, Father Castel, it is your ribbon and nothing else."<sup>102</sup>

For Diderot these ribbons were somehow the core of the ocular harpsichord, as becomes clear from a rather romantic letter written to either Sophie Volland or Madame de Maux, comparing his feelings towards living in Paris and in the countryside with the difference between music and colour:

Do you know anything of the ocular harpsichord of Father Castel? Imagine small coloured ribbons that unfold as the fingers walk along the poignant keys of a pianoforte. Well, my friend, this instrument, it is me in the city and in the countryside. In the city, all the coloured ribbons unfold, and the poignant keys are silent. In the countryside, on the other hand (and from my comparison one can easily see that I am not there now), the coloured ribbons stay in their envelope and the harmonious and sombre keys of the instrument make themselves heard and the heart of my friend shivers with them.<sup>103</sup>

### **Colour harmony and the changing aesthetics of the later eighteenth century**

Diderot can be regarded as a key figure in the reception of the ocular harpsichord, in the sense that he did not simply accept, or reject, the concept of colour harmony and colour music as a scientific fact or by a mere artistic appeal, as most of the people discussed earlier had. Diderot's aesthetics was founded in the whole of internal relations of the work of art, that could be classified and studied scientifically instead of being obediently adopted from Antiquity or

---

<sup>102</sup> Cited in *Oeuvres philosophiques*, p. 311: "Tous les êtres circulent les uns dans les autres, par conséquent toutes les espèces... tout est en un flux perpétuel... 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." The triptych *Entretien entre d'Alembert et Diderot - Le rêve de d'Alembert - Suite de l'entretien* was written in 1769, but not published until 1830.

<sup>103</sup> Letter dated November 1769, in *Correspondance*, vol. 9, pp. 209-210: "Avez-vous quelque notion du clavecin oculaire du Père Castel? Imaginez des petits rubans colorés qui se déploient à mesure que les doigts se promènent sur les touches pathétiques d'un piano forte. Eh bien, mon amie, cet instrument, c'est moi à la ville et à la campagne. A la ville, tous les petits rubans colorés se déploient, et les touches pathétiques sont muettes. A la campagne au contraire (et l'on voit bien à ma comparaison que je n'y suis pas) les petits rubans colorés restent dans leur étui, et les touches harmonieuses et sombres de l'instrument se font entendre et le coeur de mon amie en tressaillit." The passage is taken from the fragments that Naigeon copied out of the letters Diderot sent to Sophie Volland and to Madame de Maux, after which he destroyed the originals. Although the editors of the correspondence assume the letter that contains the cited passage was addressed to Madame de Maux, there is in this case really no way of telling.

remaning hidden behind a *je ne sais quoi*. In his article "Beau" in the *Encyclopédie* Diderot wrote:

If, thus, nothing more enters in the concept of the *beautiful* ... than the notions of order, *rappports*, proportion, arrangement, symmetry, agreement, and disagreement, then, since these notions do not stem from any other source than do the notions of existence, number, length, size, depth, and an infinity of others that are not contested, one can, it seems to me, use the first set of notions in defining the *beautiful* without being accused of substituting one term for another and turning in a vicious circle.<sup>104</sup>

This would not have sounded completely alien to Castel, who had started defending his colour music on the supposed fact that all pleasure is derived from harmonic proportion of, and who in his later "logique du goût" (or even "système physico-moral du goût") had called music "a simple agreement", be it one appreciated by the highest level of the mind, making it a pleasure of the understanding, the only pleasure humans do not share with animals.<sup>105</sup>

It is, indeed, very interesting to examine the changing grounds for the appreciation of the idea of colour music as, in the course of the eighteenth century, the theories of aesthetics changed. The dominating view in the first decades of the eighteenth century was the ancient idea that all art should imitate nature; it was the "principle" to which the Batteux reduced art in 1746 in *Les beaux arts réduits à un même principe*. For a long time it was held that the main change during the later eighteenth century and into the Romantic period was a replacement of imitation as the main criterion by expression. This was argued in 1958 by Abrams in his *The mirror and the lamp*: during the greater part of the eighteenth century art was supposed to be a mirror which reflected nature to the audience, whereas in the Romantic conception art would be a lamp out of which streamed the light of the artist illuminating his audience.

This view has recently been criticized in two books by Neubauer and by Barry.<sup>106</sup> Neubauer in particular shows how the idea of expression as a main characteristic of art was already defended by many people during the larger part of the eighteenth century, and both argue that the most important change in aesthetics at the end of the century was not a change from imitation to expression but from a representational to a non-representational conception of art.

---

<sup>104</sup> Cited in Diderot, *Oeuvres esthétiques*, p. 417: "S'il n'entre donc dans la notion de beau ... que les notions d'ordre, de rapports, de proportion, d'arrangement, de symétrie, de convenance, de disconvenance; ces notions ne découlant pas d'une autre source que celles d'existence, de nombre, de longueur, largeur, profondeur, et une infinités sur lesquelles on ne conteste point, on peut, ce me semble, employer les premières dans une définition du beau, sans être accusé de substituer un terme à la place d'un autre, et de tourner dans un cercle vicieux."

<sup>105</sup> *Mémoires de Trévoux*, November 1735, pp. 2342-2359.

<sup>106</sup> Neubauer, *Emancipation*; Barry, *Language*.

Imitation and expression have in common that both are representational, in the sense that both take the work of art to have an encoded meaning, put in by the artist, that might be either a reference to the world outside, as in the case of imitation, or to the inner world of the artist, as in the case of expression. To enjoy a work of art was to grasp its meaning. At the end of the eighteenth century, however, people started to look upon art not as transmitting an encoded meaning, but as a structured whole which would, by triggering the imagination of the audience, evoke various associations of sensations and emotions, without these being necessarily put in first by the artist or without it being able to say that they were understood truthfully. Whereas Neubauer defends this view of the aesthetic revolution towards the end of the eighteenth century primarily for the case of music, Barry argues that a similar change pervaded English poetry, changing from conveying messages to word play, and that it perhaps was considered even in painting, by the Englishman Alexander Cozens.

Clearly, music was very important in this aesthetic revolution, since it had always been dominated at least in practice, regardless of what theorists would claim for the ultimate meaning of music, by considerations of form and structure. The arguments by which Castel defended his colour music had no connection with the aesthetics of imitation; they suggested a complete parallel to formal, instrumental music (although he complicated this by his introduction of painting as a large scale analogue). In fact, it had been the composer Rameau, whom Neubauer mentions as an important figure during the eighteenth century in keeping alive the view that music is nothing but a formally structured whole, without an encoded explicit meaning, - who had urged Castel to publish his first announcement of the ocular harpsichord. According to Castel, the idea had not surprised Rameau at all.<sup>107</sup> Other composers did not react differently. In his *Beschreibung der Augenorgel* Telemann reported the many objections that were voiced against Castel's harpsichord, but he was not impressed by them. As he stated:

The tones please only through a clear distinctness, through agreement and analogy. The colours are just as varied as the tones, and have certain agreements. The eye can join them together, develop their analogies and experience their order and disorder. This experience causes the delight and stimulus in all things, and the real delight of music consists in perceiving such differences immediately or repeatedly during a short time. This excites the soul, keeps it happy, and prevents it from falling into an inane monotony. In short: there is no doubt that this play of colours will please. For music is nothing but a pleasure.<sup>108</sup>

---

<sup>107</sup> *Mémoires de Trévoux*, August 1735, p. 1640.

<sup>108</sup> Telemann, *Beschreibung*, p. 266: "Die Klänge gefallen nur durch eine deutliche Verschiedenheit, durch die Uebereinstimmung und Vergleichung; Die Farben sind so mannigfaltig, als die Klänge, und haben gewisse Uebereinstimmungen. Das Auge kan sie zusammenfügen, ihre Vergleichungen entwickeln und ihre Ordnung und Unordnung empfinden. Diß Empfinden verursacht das Vergnügen und Anreitzen in allen Dingen, und das eigentliche Vergnügen der Musik bestehet in dem, solchen Unterschied augenblicklich, und nach und nach



Another author, closely related to the musical world of Castel's age, who discussed Castel's harpsichord was Francesco Algarotti. Voltaire had much admired his book *Il Newtonianismo per le dame* from 1737, written in the form of a conversation between a teacher and his inquisitive pupil, a marquise, and it was quickly translated into French and into many other languages as well. Remarkably enough, considering the title of the book, in the part dealing with optics Algarotti defended the vibration theory of Malebranche, in the form Malebranche finally gave it to reconcile it with Newton's prism experiments. The marquise accepted this theory, as she said because "the fraternity between sound and light appeals to me", upon which her teacher answered: "I had expected, Madame, that this fraternity would please you, and I am convinced that the ocular harpsichord and its ocular music, which are going to present you a new brilliance, will be successful with you." What follow are a lot of jokes, but it remains doubtful whether Algarotti wholly rejected the idea as such.<sup>109</sup>

The adoption of colour music as an art fully equal to music, interpreted as a wholly formal art, later was the choice of Immanuel Kant in his *Kritik der Urteilskraft*. Kant ordered the arts into three hierarchical pairs. First came rhetoric and poetry, both relating the *Verstand* or understanding with the imagination. Next came sculpture and painting, connected with the *Sinnesanschauung* or sensory apperception and leaving the imagination a much more modest role to play. Last came music and *Farbenkunst*, both acting purely on the level of the sensations and not involving anything more than different degrees of tension of the sense organs. Kant, in accordance with his acceptance of Euler's vibration theory of light in 1755, connected the sensations of each art with the velocity of the vibrations of the respective media. As he supposed the existence of both tone and colour scales, his *Farbenkunst* cannot have been

---

in kurtzer Zeit mehrmals, zu bemercken. Diß erwecket die Seele, erhält sie beständig munter, und verhindert, daß sie nicht auf einen albernen Gleichlaut verfällt. Kurtz: Es ist unstreitig, daß dieß Farbenspiel ergetzen wird. Denn Musik ist nichts anders, als eine Ergetzlichkeit."

<sup>109</sup> Algarotti, *Newtonianisme*, p. 222: "la fraternité du Son & de la Lumière me touche"; "J'ai bien jugé, Madame, que cette fraternité vous plairoit, & je ne desespère pas que le Clavecin des couleurs, & la Musique des yeux qui vont lui donner un lustre nouveau, ne fasse fortune auprès de vous." Interestingly, the first extension the marquise thinks of is a "musique des ragoûts", as did Prévost and Hogarth. At a certain moment, when Algarotti became too frivolous, the translator defended Castel in a footnote! In the fully revised final edition of 1752 all references to Malebranche had disappeared, but Castel's harpsichord was still there. The only joke left - if it was a joke - was the statement that "on such an instrument the eyes enjoy arias by Pergolesi and Rameau; and thanks to it it will be possible to have copied on cloth some lines sung by Caffariello." (Chapter 6 of any later edition.)

anything else but Castel's colour music, but there is no explicit reference indicating the source of his knowledge of it. This is the more astonishing as Kant is the only theorist to have accepted the idea of colour music without any comment at all.<sup>110</sup>

In Kant's ordering of the arts music is not thought to convey any meaning; it is only able to work on the senses according to its structure, and there was apparently no reason for Kant to deny the same effect to a similarly structured colour music. However, for many people experience told differently. During the second half of the eighteenth century it was increasingly emphasized that music had a stronger effect on us, was in a sense more inescapable, than any of the other arts, and few people did agree with Castel that colours could compete with sounds in this respect. Already Mairan ended his enumeration of objections against colour music with the observation that

the impressions of pleasure and displeasure that the soul receives out of the presence and the various arrangements of colours are almost nothing compared to the impressions caused by sounds. ... Sounds are sometimes able to excite or to calm the passions in an almost purely mechanical way by their arrangement and their movements. But sight, the most delicate and at the same time, if you please, the most peaceful of all our senses, mechanically and by means of colours procures us only infinitely weak impressions.<sup>111</sup>

Diderot had wrestled with the same observation concerning his own aesthetics. As explained in his *Lettre sur les sourds et muets*, in any art the internal relations on which he placed so much emphasis were nevertheless to be used to convey ideas, be they imitative or expressive. In the *Additions*, written some months later, he tried to answer the objection of Madame de La Chaux that nearly everyone enjoys instrumental music, but that this music cannot be said to convey any ideas. Diderot started by repeating the standard response that these musical pieces "gratify your ears exactly like the rainbow delights your eyes, by a pure and simple pleasure of sensation". Genuine artistic delight depended on the presence of imitation or expression, which was why we find the stars painted on a canvas more beautiful than the real stars in a clear night sky. However, Diderot immediately seemed to realize the inadequacy of this answer:

Painting shows the object itself, poetry describes it, music creates hardly an idea of it; it has no resources but the intervals and lengths of its tones. And what analogy do such pencils

---

<sup>110</sup> Kant, *Urteilkraft*, Section 51. For Kant and Euler, see Hakfoort, *Optica*, p. 118.

<sup>111</sup> Mairan, "Discours", pp. 43-44: "les impressions de plaisir ou de peine que l'Ame reçoit par la présence & par le divers assemblage des couleurs, ne sont presque rien en comparaison des impressions causées par les Sons. ... Les sons par leur assemblage, & par leurs mouvements, vont cependant quelquefois jusqu'à exciter, ou à calmer les passions, & cela par une voye presque toute mécanique. Mais la vûe, le plus délicat, & en même temps, s'il m'est permis de le dire, le plus paisible de tous nos sens, ne nous procure mécaniquement, & par le moyen des couleurs, que des impressions infiniment foibles".

have with spring, darkness, solitude, etc., and with the majority of objects? How is it possible that out of three arts imitating nature, the most arbitrary and the least precise speaks the most forcefully to our soul?

As a rare exception in eighteenth-century literary style, the question mark did not conclude a rhetorical question. One of his suggested answers clearly pointed to the later developments as described by Neubauer and Barry: "Would it be that [music], by showing the objects to a lesser degree, leaves more room for our imagination ...?"<sup>112</sup>

Pointing out the exceptional ability of music to touch the human soul became a frequently used argument against Castel's colour music after 1750. One of its critics who used this argument was Rousseau. We can infer from a small remark in one of Castel's books that Rousseau had visited his workshop in 1742 or 1743 and apparently had seen music in the instrument.<sup>113</sup> Nevertheless, in his *Essai sur l'origine des langues* Rousseau confirmed to have seen "this famous harpsichord, on which it is pretended a music of colours can be played", but in the meantime he had developed many serious arguments against it, putting blatantly:

There are no absurdities that physical observations have not given rise to considering the fine arts. In the analysis of sound the same relations have been discovered as were found by the analysis of light. Immediately this analogy has been seized upon, completely disregarding experience and reason. The *esprit de système* has confounded everything, and as one did not know how to paint for the ears, one has taken it into its head to sing to the eyes.<sup>114</sup>

Rousseau not only called to mind the anatomical differences between eye and ear, but he pronounced the general difference between music and any art of colour, which Castel had thought open to manipulation, to be of the essence of

---

<sup>112</sup> All citations from *Additions pour servir d'éclaircissement à quelques endroits de la Lettre sur les sourds et muets*, in Diderot, *Oeuvres complètes*, vol. 1, pp. 407-409: "ne flattent votre oreille que comme l'arc-en-ciel plaît à vos yeux, d'un plaisir de sensation pur et simple"; "La peinture montre l'objet même, la poésie le décrit, la musique en excite à peine une idée; elle n'a de ressource que dans les intervalles et la durée des sons. Et quelle analogie y a-t-il entre cette espèce de crayons et le printemps, les ténèbres, la solitude, etc., et la plupart des objets? Comment se fait-il donc que des trois arts imitateurs de la nature, celui dont l'expression est la plus arbitraire et la moins précise parle le plus fortement à l'âme? Serait-ce que, montrant moins les objets, il laisse plus de carrière à notre imagination ...?"

<sup>113</sup> Castel, *L'homme moral*, p. 194, stating that "M. R[ousseau] ait cru autrefois voir de la Musique dans mon Clavessin oculaire."

<sup>114</sup> Rousseau, *Essai*, p. 169: "Il n'y a sortes d'absurdités auxquelles les observations physiques n'aient donné lieu dans la considération des beaux-arts. On a trouvé dans l'analyse du son les mêmes rapports que dans celle de la lumière. Aussi-tôt on a saisi vivement cette analogie sans s'embarrasser de l'expérience et de la raison. L'esprit de système a tout confondu, et faute de savoir peindre aux oreilles on s'est avisé de chanter aux yeux. J'ai vû ce fameux clavecin sur lequel on prétendoit faire de la musique avec des couleurs". The *Essai* was probably written between 1755 and 1761, but only published in 1781, after Rousseau's death.

these arts: music consisted of the succession of tones in time, while colours had to be adjacent in space. Moreover, there was the difficulty of the absolute character of colours, compared to the relative nature of tones; this was an indication of the fact that "painting is closer to nature, while music is more of a human art". It was this last feature, that music was the essential human art, that made it the superior art:

It is one of the great advantages of the musician that he can paint things that cannot be heard, whereas it is impossible for a painter to represent things that cannot be seen, and the most miraculous achievement of this art which deals only with movement is that it can create even the image of rest. Sleep, the dead of night, solitude and even silence form part of the scenes of music. ... Let all of nature be asleep, the one who contemplates her does not sleep, and the art of the musician consists in substituting for the insensible image of the object that of the movements which its presence excites in the heart of the contemplator. Not only will he whip up the waves of the sea, stir the flames of a fire, make small brooks stream, the rain pour down and the mountain torrents rise, but he will also paint the horror of a dreadful desert, the somber walls of a subterranean prison, calm down the storm, render the air tranquil and serene, and make the orchestra spread a new freshness over the landscape.<sup>115</sup>

Just like Diderot, Rousseau had not yet parted with imitation and expression.

In this the French musical theorist Chabanon was much more radical. He rejected the whole criterion of imitation for music, which he defined as "the art of making the tones succeed one another, conforming to regulated movements and adopting degrees of appreciable intonation, rendering the sequence of these tones agreeable to the ear".<sup>116</sup> His notion of imitation included the expression of emotions, but that this plays no role in music he demonstrated by the fact that people often sing sad songs while they are happy. Chabanon's conception of music, then, was a pure sensualism; unlike Rousseau, he extended the enjoyment

---

<sup>115</sup> Idem, pp. 175-176: "On voit par là que la peinture est plus près de la nature et que la musique tient plus à l'art humain. ... C'est un des grands avantages du musicien de pouvoir peindre les choses qu'on ne sauroit entendre, tandis qu'il est impossible au Peintre de représenter celles qu'on ne sauroit voir, et le plus grand prodige d'un art qui n'agit que par le mouvement est d'en pouvoir former jusqu'à l'image du repos. Le sommeil, le calme de la nuit, la solitude, et le silence même entrent dans les tableaux de la musique. ... Que toute la nature soit endormie, celui qui la contemple ne dort pas, et l'art du musicien consiste à substituer à l'image insensible de l'objet celle des mouvemens que sa présence excite dans le coeur du contemplateur. Non seulement il agitera la mer, animera les flames d'un incendie, fera couler les ruisseaux, tomber la pluye et grossir les torrens; mais il peindra l'horreur d'un désert affreux, rembrunira les murs d'une prison souterraine, calmera la tempête, rendra l'air tranquille et serein, et répandra de l'orchestre une fraîcheur nouvelle sur les bocages." Rousseau published this passage in his *Dictionnaire de musique* (1768), in the article "Imitation".

<sup>116</sup> Chabanon, *Observations*, p. 14: "L'Art de faire succéder les sons l'un à l'autre, conformément à des mouvemens réglés, & suivant des degrés d'intonations appréciables, qui rendent l'enchaînement de ces sons agréable à l'oreille."

of music to animals.<sup>117</sup> For Chabanon, music stood so much apart from the other arts that for this reason alone he judged Castel's colour music to be nonsense, calling the ocular harpsichord a "ridiculous invention" and an "absurd chimaera". The essence of melody consisted in the succession in time of the tones, and it was the ear that caught the internal connection of a melody; there was no indication at all that the eye could similarly appreciate a succession of colours.<sup>118</sup>

Notwithstanding the opposing views of Rousseau and Chabanon regarding imitation, there is, of course, a striking difference in the way Rousseau and Chabanon looked at music, compared with the view of Rameau and Telemann. For the latter music was basically chords, i.e. harmony, while for the former it was above all song, i.e. melody. As Chabanon remarked: "The whole essence of music is thus contained in the single word *song* or *melody*."<sup>119</sup> Rousseau compared the melody of a musical piece with the design of a painting and the chords with its colours, but he thought the harmonic part to be just a form prescribed by nature, while the melody of the music and the design of the painting made their products into works of art. If there was nothing more to painting and to music than combining colours and sounds in ways agreeable to the eye and to the ear, then both would have to count as natural sciences and not as arts. "It is imitation alone which elevates them to that rank. And what is it that makes painting an imitative art? It is the design. What is it that makes music another one? It is the melody."<sup>120</sup>

In Germany there was a similar development of an increasing emphasis on music as a privileged language of the soul. In 1755 Moses Mendelssohn, a typical Enlightenment theorist, seemed happy with the universality of harmony when he discussed the music of colours in his *Briefe über die Empfindungen*. Mendelssohn accorded that for the eye "a kind of harmony is reserved that is perhaps linked to no lesser delight than the harmony of tones is". He attributed the concept solely to Newton:

It is you, great *Newton*, to whom humanity owes this discovery [of colour harmony], and you will be famous for it for many centuries. One has not yet succeeded in elevating this colour harmony to its true level and transform it into the mother of as many delights as the

---

<sup>117</sup> Idem, pp. 17-23.

<sup>118</sup> Idem, pp. 6-8: "invention ridicule"; "absurde chimère".

<sup>119</sup> Idem, p. 15: "Toute l'essence de la Musique est donc renfermée dans ce seul mot *chant* ou *mélodie*."

<sup>120</sup> Rousseau, *Essai*, p. 153: "C'est l'imitation seule qui les élève à ce rang. Or qu'est ce qui fait de la peinture un art d'imitation? C'est le dessein. Qu'est-ce qui de la musique en fait un autre? C'est la mélodie."

harmony of tones. The ocular harpsichords seem to promise more than they in fact are able to achieve.<sup>121</sup>

Mendelssohn tested colour music against the three sources for pleasure he distinguished: "unity in multiplicity, or beauty; the concord of the multiple, or intellectual perfection; and the improved state of the condition of our body, or sensual delight". He admitted that colour music would give pleasure of the third kind, and probably also of the first kind, although there was the problem of chords. Because of the fixedness of colours in space, Mendelssohn denied the possibility of colour chords similar to musical chords, but perhaps different colours could be joined to specific forms and then united. Without a solution along these lines, "either the disharmony [of the various colours] or the singularity of the forms will inevitably disturb the delight which is held out to us, if I may say so, by the euphonious colours." But this still left pleasure of the second kind, through intellectual perfection, that is, the imitation of human actions and emotions: "Can a colour melody give us this delight? The emotions are naturally expressed by certain tones, and therefore they can be re-enacted in our minds by the imitation of these tones. But what emotion has the least relation with a colour?"<sup>122</sup>

Mendelssohn's book seems to have been the source from which the foremost German theorist of aesthetics, Herder, became acquainted with the idea of colour music.<sup>123</sup> The ocular harpsichord was a continuous presence in Herder's

---

<sup>121</sup> Cited in Mendelssohn, *Schriften*, vol. 2, p. 55: "für jeden Sinn ist eine Art von Harmonie bestimmt, die vielleicht mit nicht weniger Entzückung verknüpft ist, als die Harmonie der Töne. ... Dir, grosser *Newton!* hat das menschliche Geschlecht für diese Entdeckung verbunden sein sollen, und so viele Jahrhunderte mussten dir auch diesen unsterblichen Ruhm vorbehalten. Man ist aber noch so glücklich nicht gewesen, diese Harmonie der Farben auf ihre wahre Stufe zu erheben, und zu der Mutter so vieler Ergötzlichkeiten zu machen, als die Harmonie der Töne. Die Farbenklaviere scheinen mehr zu versprechen, als sie in der That leisten." From the later added *Anmerkungen* it appears that he had read Krüger's article, which explains why he spoke of harpsichords: he meant both Castel's and Krüger's. He did mention Castel as "the first one to have sought to actually perform a colour melody" (p. 86).

<sup>122</sup> Idem, pp. 54, 56: "das Einerlei im Mannigfaltigen oder die Schönheit, die Einhelligkeit des Mannigfaltigen oder die verständliche Vollkommenheit, und endlich der verbesserte Zustand unserer Leibesbeschaffenheit oder die Sinnliche Lust"; "so muss entweder die Disharmonie, oder das Einerlei der Figuren nothwendig die Lust stören, mit welcher uns, wenn ich so reden darf, die wohl lautenden Farben zu erfreuen versprechen"; "Kann uns eine Farbenmelodie mit diesem segnen? Die Leidenschaften werden natürlicherweise durch gewisse Töne ausgedrückt, daher können sie durch die Nachahmung der Töne in unser Gedächtniss zurückgebracht werden. Welche Leidenschaft aber hat die mindeste Verwandtschaft mit einer Farbe?" Inspired by the "line of beauty" from Hogarth's *Analysis of beauty*, Mendelssohn's proposal to combine specific colours with specific forms can be interpreted as suggesting a form of abstract painting not unlike Kandinsky's.

<sup>123</sup> In the *Erstes Wäldchen* of the *Kritische Wälder*, Herder mentioned the possibility of a painted ocular harpsichord by combing colours with line forms, as had been discussed by Mendelssohn. See *Werke*, vol. 3, p. 139.

writings. His first mention of it was in 1765, his last in 1803. He not so much rejected the instrument as thought it already proven a failure, and referred to it in that way in arguments that very much resemble Rousseau's. Like Rousseau, he thought the juxtaposition of colours in space to be the essential aspect of pleasures for the eye and the succession of tones in time essential to the ear. If painting would try to use colours in a succession through time, "the essence of the art and all its effects would be lost. To this the ocular harpsichord gives testimony."<sup>124</sup> Like Rousseau, he rejected an art, be it an ordinary music or a colour music, that consisted only of harmonies, and he distrusted instrumental music. In his essay "Ob Malerei oder Tonkunst eine grössere Wirkung gewähre?", he made Music complain that

the so-called educated world has become old and gray, and wants now partly to build with notes and juggle with them on a tightrope, instead of enjoying them. They construct really enormous harmonious buildings, that fastly rise towards heaven and reason, as they cannot enter anymore into the sanctuary of the heart. ... This is just as foreign to my art, as when someone took it into his mind to invent an ocular harpsichord, only to be astonished that this puppetry did not delight as an ordinary harpsichord does.<sup>125</sup>

Herder particularly cherished ideas similar to Rousseau's concerning the special power of music to affect the heart. The eye was to him "the coldest, most philosophical of the senses".<sup>126</sup> He thought the ear to occupy a middling position between feeling (including touch, taste and smell) and "cold and detached" sight: "The former penetrates too deeply in us, ... the latter stays too cool for us. [But] the tone of hearing enters so intimately into our soul, ... Who would be able to watch an ocular harpsichord perform without being dazzled instantly? Whereas we can sustain listening much longer and can bear to listen

---

<sup>124</sup> *Kritische Wälder: Erstes Wäldchen* (1769), in *Werke*, vol. 3, p. 136: "sonst gehet das Wesen und alle Wirkung der Kunst verlohren. Hierüber ist das Farbenklavier zeuge."

<sup>125</sup> In *Werke*, vol. 15, p. 235: "diese so genannte gebildete Welt ist alt und grau geworden, und will zum Theil jetzt statt Töne zu geniessen, mit Töne bauen oder Seiltanzen und spielen. Sie bauen auch wirklich Wunderhohe harmonische Gebäude, die rasch zum Himmel, zum Verstande hinauf streben, da sie ins Heiligthum, zum Herzen nicht mehr kommen können. ... Meiner Kunst ist dies so fremde, als da jemand auf den Gedanken kam, ein Farbenklavier zu erfinden, und sich wunderte, daß der Kinder-Jahrmart kein Vergnügen, wie das Klavier der Töne machte." The essay was published in 1785.

<sup>126</sup> *Kritische Wälder: Viertes Wäldchen*, in *Werke*, vol. 4, p. 77: "der kälteste, philosophische der Sinne". The *Viertes Wäldchen* was written in 1769 but only published in 1846. Herder was much impressed by the English physician Chesselden's account, published in 1728, of the experiences of a boy who, by a new form of surgery, had been enabled to use his sight for the first time in his life. Herder reinterpreted the experiences of the boy as expressing primarily a feeling of disenchantment. See idem, p. 82.

in almost any circumstances."<sup>127</sup> This hierarchy of the senses gave music by far the most affective power of all arts:

How often has the tone of a song, the simple movement of some heavenly notes, elevated a man from the deepest abyss of sorrow into heaven! How often does a simple melody cause tender, wistful tears to flow, cause people to suddenly find themselves with old feelings or places from childhood or in the unknown meadows of a blissful paradise, and how often does it completely resemble the magic tones of the original world, only more delicate. ... Music has the magic wand of the essential action on the human heart within its immediate reach.<sup>128</sup>

Strangely enough, at the end of his life, when Herder became more interested in natural science and he became acquainted with Euler's aether theory of light and fell under the spell of the idea of an all-pervading aether, he was inclined to accept the analogy of tone and colour scales (adopting the Newtonian colours), taking it to be, however, a question of an individual, not a universal psychology:

Why could the colour scale not be compared with the tone scale? ... The range of both scales of such different senses seems miraculously the same in its relations, although irrationally ordered. The structure of our eye and ear, or rather of our seeing and hearing nerves, has to be analogous, which is not implausible, ... It would also explain why each person likes certain tones, certain colours more than other ones; they are the ratio of the scales in which *his* organs finds pleasure, in that both scales order themselves most easily starting from this ratio. ... But one cannot fix both scales by *our* harpsichord. Other nations have divided and divide the scales differently; they liked other intervals and other colours.

This late conversion to the analogy notwithstanding, the distinction between the eye as the entrance to reason and the ear as the entrance to the soul was left intact. As Mendelssohn had argued before him, Herder made the action of light reach no further than inducing vibrations in the optical nerve and giving us, also by its warmth, a feeling of purely sensory pleasure. Sound affected "the organ whose function is to arouse emotions": "In harmony with the vibrating and sounding object, there rings in us a spiritual harpsichord and resounds with it. The tones are measured out to it, accounted to it, harmonically, melodically; an

---

<sup>127</sup> *Abhandlung über den Ursprung der Sprache* (1772), in *Werke*, vol. 5, p. 66: "Das Gefühl überwältigt: das Gesicht ist zu kalt und gleichgültig; jenes dringt zu tief in uns, ... dies bleibt zu ruhig für uns. Der Ton des Gehörs dringt so innig in unsre Seele, ... wer [kann] immer mit Aufmerksamkeit ein Farbenklavier begaffen, ohne nicht bald zu erblinden? Aber hören, gleichsam hörend Worte denken, können wir länger und fast immer".

<sup>128</sup> "Ob Malerie oder Tonkunst...", in *Werke*, vol. 15, pp. 236 resp. 239: "Wie oft hat der Ton eines Gesanges, der simple Gang einiger himmlischen Töne einen Menschen aus dem tiefsten Abgrunde der Traurigkeit bis in den Himmel erhoben! Wie oft geschiehets, daß eine einfache Melodie zarte, wehmüthige Thränen rinnen macht, die Menschen plötzlich in alte Empfindungen und Gegenden der Jugend, oder in unbekannte Auen eines seligen Paradieses versetzt, und völlig den Zaubertönen der ersten Welt, nur auf feinere Art, gleich kommt. ... Du Tonkunst hingegen hast den Zauberstab der eigentlichen Wirkung auf menschliche Herzen unmittelbar".



invisible, arousing Spirit talks with our feeling self in succession."<sup>129</sup>

The later writings of Herder seem to fit in with the then freshly blossoming German Romantic *Naturphilosophie*, in which the unity of nature and the connectedness of man with nature were much emphasized. One of the earliest books that made these ideas popular outside Germany was *De l'Allemagne*, by Madame de Staël, who had spent most of the exile Napoleon had forced her into in Germany. In her book she brought back, unknowingly, the ocular harpsichord to France, as she described how

the analogies of the various elements of physical nature together reveal the supreme law of creation, variety in unity and unity in variety. What is more astonishing than, for instance, the *rapport* between sounds and forms, between sounds and colours? ... a certain *savant* wanted to construct an ocular harpsichord which by the harmony of colours could imitate the delight that music gives. Incessantly we compare painting with music and music with painting, because the emotions we experience reveal to us analogies where cold observation discerns only differences. Each plant, each flower contains the whole system of the universe; a brief moment of life hides eternity in its bosom, the weakest atom is a world and the world is perhaps but an atom.<sup>130</sup>

It is not so much this sort of general programmatic statement that reveals an impact of colour music on Romanticism, however, as rather the use that early Romantic poets and novelists made of it. In 1781/1782, while travelling through Italy, Wilhelm Heinse read Mendelssohn's *Briefe über die Empfindungen* and commented on it in a notebook. He agreed with Mendelssohn that "it certainly is

---

<sup>129</sup> Fragment meant for Herder's journal *Adrastea* (1801-1802), but finally not included by Herder. It was published posthumously in 1809. In *Werke*, vol. 24, pp. 436-440: "Warum sollte man nun die Farbenleiter nicht mit der Tonleiter vergleichen? ... Der Umfang beider Scalen so verschiedner Sinne ist wunderbarer Weise in seiner Verhältnißgliedern ähnlich, obgleich irrational geordnet. Die Structur unsres Auges und Ohrs, oder vielmehr unsres Seh- und Hörnervs, muß eine Aehlichkeit geben, die sehr denkbar ist, ... Auch würde hieraus erklärlich, warum gewisse Töne, gewisse Farben Diesem und Jedem lieber sind als andre; sie sind das Verhältniß der Scala, bei welchem *sein* Organ das meiste Wohlbehagen findet, indem es von hieraus sich selbst die Scala aufs bequemste ordnet. ... nur darf man beide eben nach *unserm* Clavichord nicht fixieren. Andre Nationen theilten und theilen die Scala anders; sie liebten andre Intervalle wie andre Farben"; "Harmonisch mit dem geschwungenen klingenden Körper klingt in uns ein geistiges Clavichord und tönnet ihm nach. Zugemessen, zugezählt werden ihm die Töne, harmonisch, melodisch; ein unsichtbarer, weckender Geist spricht mit unserm fühlenden Ich in Succession."

<sup>130</sup> Staël Holstein, *De l'Allemagne*, vol. 3, pp. 149-150: "Les analogies des divers éléments de la nature physique entre eux servent à constater la suprême loi de la création, la variété dans l'unité, et l'unité dans la variété. Qu'y a-t-il de plus étonnant, par exemple, que le rapport des sons et des formes, des sons et des couleurs? ... un savant a voulu faire un clavecin pour les yeux qui pût imiter par l'harmonie des couleurs le plaisir qui cause la musique. Sans cesse nous comparons la peinture à la musique, et la musique à la peinture, parceque les émotions que nous éprouvons nous révèlent des analogies où l'observation froide ne verroit que des différences. Chaque plante, chaque fleur contient le système entier de l'univers; un instant de vie recèle en son sein l'éternité, le plus foible atome est un monde, et le monde peut-être n'est qu'un atome."

very difficult to create perfection and beauty and sensory pleasure with colours, since the air is a medium that acts far more powerfully on man than light. The emotions wholly disappear." He nevertheless thought he could see colour music, performed by nature itself, which made the ocular harpsichord fail by its limited capacity rather than by principle:

And how far must any ocular harpsichord lag behind the evening and morning glow, the true beauties which indicate the perfection of light, of the sun? Nevertheless colour harmony certainly exists, and the beauty of colours, a fresh green, a healthy flesh tint, the red of flowers and all variations thereof certainly feed the imagination. Charm is not a mathematical nor a wavelike or flaming line of movement, but something alive approaching us lovingly, or a trace, ... The Frenchman and Moses have not themselves felt what they wanted to explain.<sup>131</sup>

Heinse was one of the first early Romantics to use synaesthetic imagery, although it still looked rather like a somewhat artificial application of his readings. In the diaries of his Italian journey he wrote phrases like: "In the Church delle Grazie [in Venice] there is a big masterpiece by Titian. The group in itself presents a fiery heroic colour music," and: "Titian was a great master in the music of light rays. Nature as well is infinitely rich in this," and: "The 12th of May - I have never seen such a sweet transition from day into night. The harmony of light tones from saffron-red to a milk-white gleam."<sup>132</sup> In his novel *Ardinghello*, published in 1787, the reflection of his Italian travels, he wrote similarly: "What magic, what infinite melody of light and dark, of cloud forms and a merry blue!"<sup>133</sup>

In this, other Romantics followed suit. Ludwig Tieck, for example, was

---

<sup>131</sup> In Heinse, *Werke*, vol. 8<sup>1</sup>, pp. 455-456: "Vollkommenheit und Schönheit und sinnliche Lust mit Farben zu erregen zu wollen, ist gewiß sehr schwer, weil die Luft ein weit stärker wirkend Medium auf den Menschen ist, als Licht. Die Leidenschaften fallen ganz weg"; "Und wie weit muß jedes Farbenclavier nach Abend und Morgenröthen stehen? den wahren Schönheiten, die die Vollkommenheit des Lichts, der Sonne anzeigen. Inzwischen gibts gewiß eine Farbenharmonie, und Schönheit in den Tinten, frisches Grün, gesunde Fleischfarbe, blumenroth mit allen Abwechslungen geben gewiß schon an und für sich der Phantasie zu schaffen. Reiz ist keine mathematische weder Schlangen noch flammichte Linie der Bewegung, sondern etwas lieblich uns entgegen kommendes lebendiges oder eine Spur, ... Der Franzose und Moses haben nicht gefühlt, was sie erklären wollten." The "wavelike or flaming line of movement" referred, of course, to Mendelssohn's proposal to combine colours with forms; see n. 118.

<sup>132</sup> All in Heinse, *Werke*, resp. vol. 7, p. 233; vol. 8<sup>2</sup>, p. 245; vol. 8<sup>2</sup>, p. 35: "In der Kirche delle Grazie selbst ist ein hohes Meisterstück von Tizian. Die Gruppe an und für sich selbst macht eine feurige heroische Farbenmusik"; "Tizian war ein grosser Meister in der Musik der Lichtstrahlen. Die Natur ist auch unendlich reich hierin"; "Den 12. Mai. - Ich habe noch keinen süßern Übergang von Tag in Nacht gesehen. Die Harmonie der Lichttöne vom Saffranrötlichen in milchweißen Schimmer."

<sup>133</sup> Cited in Fischer, "Verbindung", p. 515: "Welch ein Zauber, welche unendliche Melodie von Licht und Dunkel, und Wolkenformen und heiterm Blau!"

greatly influenced by Heinse; he urged his friend Wackenroder to read *Ardinghello*.<sup>134</sup> In Tieck's work synaesthetic imagery appears in full bloom. In his poem *Zerbino*, written 1796-1798 and published in 1799, one reads: "What by order of the gods had been jealously separated, here the goddess Fantasy has united, having the sounds know their colours, causing sweet voices to shine through the leaves and making colour, scent and song call each other sisters."<sup>135</sup> But in the *Phantasien über die Kunst*, which reads like a programme of a new Romantic aesthetics and was largely written by Wackenroder but expanded and published under his own name by Tieck, earlier objections against a full analogy between painting and music, raised earlier by, for instance, Rousseau, were taken up once again: painting cannot but imitate, and in this it is necessarily very close to nature, but at the same time it will always fall short of nature's own beauty. Music, on the other hand, is the essentially human, creative art. Therefore the evocative power of music is much greater than the power of colours.<sup>136</sup> Notwithstanding this asymmetry, however, Tieck engorged the sensory abundance of nature, agreeing with Castel that a even a single colour delights us, and he fully endorsed the use of synaesthetic imagery, although he did not justify it in any systematical way:

The variety among flowers and shrubs is an arbitrary music in beautiful interplay, in sweet repetition: the songs of the birds, the gurgling of the water, the cries of the animals are in a sense at the same time an orchard or flower garden: the most charming love and friendship winds itself with glittering chains around all forms, colours and tones inseparable.<sup>137</sup>

---

<sup>134</sup> See idem, p. 514.

<sup>135</sup> Cited in idem, pp. 521-522: "Was neidsch sonst der Götter Schluß getrennet, / Hat Göttin Phantasie allhier vereint, / So daß der Klang hier seine Farbe kennet, / Durch jedes Blatt die süße Stimme scheint, / Sich Farbe, Duft, Gesang, Geschwister nennet."

<sup>136</sup> Tieck [& Wackenroder], *Phantasien*, esp. pp. 119-121, 240-245.

<sup>137</sup> Idem, p. 118: "Die Mannigfaltigkeit in Blumen und Gesträuchen ist eine willkürliche Musik im schönen Wechsel, in lieber Wiederholung: die Gesänge der Vögel, der Klang der Gewässer, das Geschrey der Thiere ist gleichsam wieder ein Baum- und Blumengarten: die lieblichste Freundschaft und Liebe schlingt sich in glänzenden Fesseln um alle Gestalten, Farben und Töne unzertrennlich." Tieck did try to establish something of a formal analogy between colours and sounds, though. He rejected the elementary analogy of the ocular harpsichord as he had come to know it, but proposed instead an analogy not between single colours and tones but between the different shades of one colour and different tones. The single colours themselves had to be seen not as the analogues of single tones but of timbres or instruments. In this, Tieck repeated an interpretation that had been suggested already a couple of times before. The French printer Gauthier d'Agoty, one of the first printers to produce three-colour prints, had thought along these lines in 1753, and the German Hellwag had written an article about it in 1786 and even presented the idea to Kant. The one to have elaborated this idea the farthest was the German Johann Leonhard Hoffmann, in his in 1786 published book *Versuch einer Geschichte der mahlerischen Harmonie überhaupt und der Farbenharmonie insbesondere*. Hoffmann even gave a list of all the different analogues of colours and instrument, coupling indigo to the violoncello, blue to the violin, green to the human voice, yellow to the clarinet, scarlet to the trumpet, pink to the oboe, kermes to the flute, purple to the

Tieck, in his turn, was a dominating influence on E.T.A. Hoffmann, one of the outstanding figures of German Romanticism, and it is in his writings that a last mention of the ocular harpsichord can be found in Germany. On the one hand, Hoffmann admitted that "tone is in music exactly what colour is in painting". On the other hand he rejected the kind of formal colour music the ocular harpsichord apparently performed. Melody and harmony in music had to be compared with the full bloom of nature itself:

It is not the colour green, it is the wood with the graceful beauty of its foliage, that engenders the thrill and sweet melancholia in our breast. The deep blue of the sky will soon start to appear empty and sad to us when there are no clouds rising in myriads of changing images. Apply this to art and realize how soon you would be tired of seeing the most beautiful colours without any form, and how briefly sight would be tickled by them. Think of the silly ocular harpsichord of Father Castel! - And in music the same is true. The tone will only deeply affect the soul when it has formed itself into melody or harmony, in short, into music.<sup>138</sup>

It is an indication of the aesthetic changes near the end of the eighteenth century as described by Neubauer and Barry, that Heinse and Tieck speak of fantasy and the imagination as the vehicle of artistic delight, and the Romantic synaesthetic imagery clearly has a primarily evocative function rather than a descriptive one. However, for all of these early Romantics, music is still standing very much apart; a harmony and melody of colours they find in nature itself, something they would not have deemed appropriate for music at all.

Meanwhile, the word play of synaesthesia was developed and used especially

---

horn and violet to the bassoon. Of course, the notion of a well-defined colour scale had at this stage of the historical development completely drifted out of the picture. See Gauthier d'Agoty, *Observations*, pp. 174-175; Hellwag, "Vergleichung", and his letter to Kant of December 1790, in Kant, *Briefwechsel*, vol. 2, pp. 194-204. For Hoffmann, see Goethe's *Materialien zur Geschichte der Farbenlehre*, pp. 395-399. Gauthier d'Agoty and Hoffmann developed their ideas in reaction to Castel's ocular harpsichord, which they rejected all the more vehemently for it. Tieck just as well called it a "kindische Spielwerk" (p. 243). A list of comparisons of colours with musical instruments similar to Hoffmann's, developed independently by the Englishman William Gardiner, was given in *The lives of Haydn and Mozart*, London 1817, the English translation of the original French book by L.-A.-C. Bombet, a pseudonym of M.-H. Beyle, better known as Stendhal. See the note there on p. 255.

<sup>138</sup> Hoffmann, "Ein Brief des Kapellmeisters Johannes Kreisler" (1819), in *Werke*, vol. 14, pp. 93-94: "Der Ton ist in der Musik ganz und gar dasselbe was in der Malerei die Farbe. ... Es ist nicht die Färbung des Grünen, es ist der Wald mit der anmutigen Pracht seines Laubes, der in unserer Brust das Entzücken weckt und die süße Wehmut. Das tiefe Blau des Himmels dünkt uns bald öde und traurig, steigen nicht die Wolken auf in tausend wechselnden Bildern: Wendet das auf die Kunst an und denkt Euch, Würdiger, wie bald es Euch ermüden, oder was für einen momentanen Sinneskitzel es von Haus aus erregen würde, die schönsten Farben ohne Gestaltung zu schauen? - Denkt an das läppische Farbenklavier des Paters Castel! - Und nun ist's ebenso in der Musik. Der Ton wird nur dann erst tief unser Gemüt ergreifen, wenn er sich zur Melodie oder Harmonie, kurz, eben zur Musik gestaltet."

in early Romantic England, and there, one person only seems to have passed on the Castellian notion of colour music. In the prose interludes of his famous poem *The loves of the plants*, first published in 1789, Erasmus Darwin mentioned Newton's "happy discovery" of the analogy of spectral colours and the minor scale proposal of deducing a luminous music from this analogy by Father Cassel [sic]. He accepted the conclusion that there was "a sisterhood of music and painting", and added that "hence they claim a right to borrow metaphors from each other; musicians to speak of the brilliancy of sounds, and the light and shade of a concerto; and painters of the harmony of colours, and the tone of a picture."<sup>139</sup> If Castel's colour music did play any role in English Romantic poetry, Darwin is a very likely source, since his poems had a great influence on the next generation of poets, particularly Shelley.<sup>140</sup>

Interestingly enough, Darwin was the first to be able to defend colour harmony by a physiological argument, answering one of the most frequently raised objections against Castel, i.e. that the difference between the organs of hearing and sight was too great to support any analogy. Somewhere in the early 1770s Darwin had discovered the phenomenon of the afterimage, which has a colour complementary to the colour of the object itself. In *The love of the plants* he proposed this as the physiological basis for colour harmony, in that on the retina the colour of the afterimage caused by the last object would interfere with the real colour of the next object. It is sad that this discovery has never been able to join the debate on colour music.<sup>141</sup>

### Conclusion

It might seem strange that at the same moment when synaesthetic imagery became a frequently used stylistic device, the ocular harpsichord and the colour music it was supposed to play disappeared out of sight. However, with its entrance in poetry, the harmony of the senses became a thing of the imagination, to be treated in many kinds of ways, only not as a truthful description of

---

<sup>139</sup> Darwin, *Love*, 3rd Interlude, pp. 140-141. Darwin repeated all this almost verbatim in the "Additional notes" to his posthumous poem *The temple of nature* (1803), under the heading "Melody of colours". Darwin seems to have derived his knowledge of the ocular harpsichord from Guyot's *Récréations!*

<sup>140</sup> See Desmond King-Hele, *Erasmus Darwin and the Romantic poets*, London 1986. For an extensive documentation on the emergence of synaesthetic imagery in poetry, see the writings of Von Erhardt-Siebold and Wellek.

<sup>141</sup> Darwin, *Love*, p. 141. The existence of the afterimage was announced by Erasmus' son Robert, the father of Charles Darwin, in the *Philosophical Transactions of the Royal Society* 76, 1786, but the original discovery was almost certainly his father's. See Desmond King-Hele, *Doctor of revolution: the life and genius of Erasmus Darwin*, London 1977, p. 177.

natural phenomena. The ocular harpsichord was in this respect essentially an eighteenth-century instrument, as this century seems to me to be pre-eminently dominated by problems of sensory perception. Philosophical empiricism is largely a product of the eighteenth century, developed and articulated by philosophers like Berkeley, Hume, Condillac, and others. The eighteenth century also saw the birth of aesthetics as an empirical theory of art, as distinct from the earlier theories of art which mostly consisted of prescriptive rules. Especially Diderot and Herder tried to base their aesthetics on a clear view of the nature of all the different senses. The evocative power of music emphasized by Rousseau and Herder was for them an experiential fact of human psychology, which any aesthetics had to incorporate. It is, then, I think, with respect to an empiricist aesthetics rather than to the emergence of synaesthesia in Romanticism that it seems undeniable that "the ocular harpsichord counted as an invention that one had to come to terms with", as Von Erhardt-Siebold wrote. Whether there indeed was "wide recognition of the facts behind it" is then perhaps not the most important question concerning it.

With respect to the developments in late eighteenth-century aesthetics argued for by Neubauer and Barry, the way the ocular harpsichord was discussed testifies above all to the growing emphasis on the special problems that put music apart from the other arts. Of course this process cleared the ground for the changes of view concerning the place of representation in art, but the part the ocular harpsichord played in these later phases of the process, and especially its precise relation with the emergence of synaesthetic imagery, tends to be drowned in the polyphonic crescendo at the turn of the century.<sup>142</sup>

It is, on the other hand, remarkable that after the superficial enthusiasm of the theorists of painting in the first half of the century, the harpsichord was henceforth ignored by the visual arts. The early Romantic theorists of colour, like Runge, Friedrich and Turner, showed no interest in Castel, nor any knowledge of his ideas. If by anyone, they were influenced by Goethe, and although Goethe did praise Castel as a small champion of anti-Newtonianism in optics, his colour music left him cold. Nothing of Castel's views entered Goethe's own writings on the theory of colours.<sup>143</sup> This no doubt originated in the highly eclectic character of Castel's conception of colour music. The basic analogy Castel seemed to have believed in was that of colour music as a strict parallel to instrumental music. It was this analogy that necessitated an unambiguous and,

---

<sup>142</sup> Of course, Neubauer's and Barry's theses do not coincide, and in this study I can hardly do justice to their arguments.

<sup>143</sup> See Goethe's chapter on Castel in the *Geschichte der Farbenlehre*, pp. 328-333. In fact, Goethe had only read Castel's *Optique des couleurs*, and thought Castel had been a dyer! He also copied Krüger's draft of an ocular harpsichord, but all without comment. See the *Ergänzungen und Erläuterungen* to the *Geschichte der Farbenlehre*, pp. 192, 199-203, 262, 286.

moreover, physically or psychologically "true" colour scale. On the other hand, Castel seemed to believe that the existing colour arts, not only painting but also dance and pantomime, were somehow parts of this as yet nonexistent colour music, or somehow subordinate to its rules. The suggested comparison of music with painting as these art forms existed in general was too vague, and already too often voiced in the past, to be able to convince painters that there was anything to be gained from studying it.

On the whole one has to admit that Castel himself took no part in the adventures of his harpsichord. Both in his science and in his aesthetics Castel was looking backward rather than forward, although many passages in his writings seem to point to future developments. The groping way in which Wilhelm Heine towards the end of the century tried to frame his experiences of the beauty of nature into the language of colour harmony are remarkably similar to the way Castel spoke about his colour music on some occasions: "I saw a garden dotted with flowers: a sweet zephyr blew, and singling out that moment, I saw the harpsichord. I saw a meadow strewn with rose drops; the sun rose, I moved my head a little, and my eye said to me: there is the harpsichord."<sup>144</sup>

### Epilogue

With E.T.A. Hoffmann, in 1819, the debate on the ocular harpsichord and on colour music in Germany finally died. The same year also saw its final flickering in England. In 1814 David Brewster had invented the kaleidoscope, an instrument of which in London and Paris together 200.000 copies were sold within three months. In 1819 Brewster wrote *A treatise on the kaleidoscope*, explaining its working, as so many bad ones were circulating. In his book he praised Castel as "the first person who attempted to supply the organ of vision with the luxuries of light and colour", criticizing him, however, for not having realized that colours can not please for long if they are not combined with beautiful forms. After sixty years Brewster saw himself as having achieved what Castel had so vainly toiled at:

Those who have been in the habit of using a correct Kaleidoscope, furnished with proper objects, will have no hesitation in admitting, that this instrument realizes, in the fullest manner, the formerly chimerical idea of an ocular harpsichord. The combination of fine forms, and ever-varying tints, which it presents, in succession, to the eye, have already been found, by experience, to communicate to those who have a taste for this kind

---

<sup>144</sup> *Mémoires de Trévoux*, December 1735, p. 2699: "J'avois vû un Parterre jonché de fleurs: un doux Zéphire avoit soufflé, & saisissant cet instant, j'avois vû le Clavecin. J'avois vû une Prairie semée de rosée; le Soleil s'étoit levé, j'avois fait un mouvement de tête, & mon oeil m'avoit dit, voilà le Clavecin."

of beauty, a pleasure as intense and as permanent as that which the finest ear derives from musical sounds.<sup>145</sup>

In France, on the other hand, Castel's name was already completely forgotten at the beginning of the 19th century. In his review of the *Salon* of 1846, Baudelaire suddenly argued for an analogy between colours and sounds, in apparently complete ignorance of its history. In fact, he almost sounded like Castel reincarnated: "In colour there are harmony, melody and counterpoint to be found. ... Harmony is the basis of the theory of colour. Melody is the unity in colour, or colour in general. ... The colorists design from nature; their figures are naturally delimited by the harmonious struggle of harmonious masses," and he ended with: "I do not know whether any analogist has ever solidly established a complete scale of colours and feelings, ..."<sup>146</sup>

During the 19th century nothing more was said on the subject except by one or two isolated figures, until, from about the last decades of the 19th century, there suddenly emerged an enormous interest in the psychological phenomenon of synaesthesia. Wellek has listed some 800 titles on this subject for the period 1880-1931.<sup>147</sup> The phenomenon was considered a purely psychological one, a kind of automatic association of certain colours with certain sounds or smells, or combinations of such, which people reported actually to experience. There was no connection at all with the eighteenth-century discussion on colour music. In fact, the phenomenon of synaesthesia is hardly reported before the period it was so extensively studied. One of the first instances is a fragment of E.T.A. Hoffmann from 1814, in which he confessed to experience in the

state of delirium that immediately precedes falling asleep, especially when I have listened a lot to music, an analogy of colours, tones and scents. ... The smell of the dark red carnation has a strange magical force on me; inadvertently I sink into a dreamlike state and I

---

<sup>145</sup> Brewster, *Treatise*, pp. 131, 134-135. The 200.000 copies are mentioned on p. 7. Note, moreover, with an eye on the theses of Neubauer and Barry, that Brewster's kaleidoscope did not show the abstract colour patterns of today's toy versions, but instead used the standard heroic human figures of academic painting.

<sup>146</sup> In Baudelaire, *Oeuvres complètes*, vol. 2, pp. 423-426: "On trouve dans la couleur l'harmonie, la mélodie et le contrepoint. ... L'harmonie est la base de la théorie de la couleur. La mélodie est l'unité dans la couleur, ou la couleur générale. ... Les coloristes dessinent comme la nature; leurs figures sont naturellement délimitées par la lutte harmonieuse des masses colorées. ... J'ignore si quelque analogiste a établi solidement une gamme complète des couleurs et des sentiments".

<sup>147</sup> Wellek, "Synaesthsieforschung", pp. 369-373. In his other articles, Wellek discusses the ocular harpsichord as being part of the early history of synaesthesia. My study will have made clear, I hope, that this is not the right way to look at it.



hear, coming from afar, crescendo and decrescendo, the deep tones of the basset horn.<sup>148</sup>

Nevertheless, this phenomenon of synaesthesia soon made itself felt in contemporary music. Some colour instruments were built in Great Britain and in the United States; in Russia one Alexander Mozer tried to do the same on request of the composer Scriabin, who wrote a part for such an instrument in his symphonic poem *Prométhée, le poème du feu* of 1908-1910. None of these instruments seem to have been based on any formal rules of harmony. The eighteenth-century debate remained a closed book. The only reminiscence was the article "Colour-music" (the contemporary version, of course) by Adrian B. Klein in the 14th edition of the *Encyclopaedia Britannica*, published in 1929, where Castel was mentioned as "the Giotto or Guido d'Arezzo of colour-music", although the author hardly knew anything about Castel's views.

If one wonders whether since the eighteenth century anything has been achieved in keeping with Castel's ideas, perhaps one should say that the light and laser shows of the modern discotheque come closest. Indeed, Castel himself already suggested that "by using carefully installed mirrors, or covering the walls of an apartment with mirrors, one can multiply the object and scatter it in all directions," or that the keys of his instrument could be coupled to centrally placed lights in casings of coloured glass, such that "the whole room would bath in light of a single colour which changes incessantly through the movements of the keys".<sup>149</sup>

---

<sup>148</sup> Hoffmann, "Kreisleriana": "Höchst zerstreute Gedanken", in *Werke*, vol. 1, p. 56: "im Zustand des Delirierens, der dem Einschlafen vorhergeht, vorzüglich wenn ich viel Musik gehört habe, finde ich eine Übereinkunft der Farben, Töne und Düfte. ... Der Duft der dunkelroten Nelken wirkt mit sonderbarer magischer Gewalt auf mich: unwillkürlich versinke ich in einen träumerischen Zustand und höre dann wie aus weiter Ferne die anschwellenden und wieder verfließenden tiefen Töne des Bassethorns."

<sup>149</sup> *Mémoires de Trévoux*, December 1735, p. 2746: "par des Miroirs placés avec art, & en tapissant même tout un appartement de Glaces, on peut multiplier l'objet & le semer de toutes parts"; "ensorte que tout un appartement soit coloré d'une couleur mobile que le mouvement des touches fait changer à chaque instant".

### Summary

In the first part of this essay an overview is presented of Castel's theory of colour music and the ocular harpsichord. It is investigated to what extent he succeeded in building his harpsichord, concluding that various models have existed, none of which could perform up to Castel's expectations. Nor did anyone else succeed in this. In the second part of the essay contemporary comments (up till 1819) on the ocular harpsichord and on the idea of colour music are analysed. It is shown that these comments fit in with the search for a more empiricist aesthetics in the second half of the eighteenth century, and with an increasing emphasis on the special status of music that was a part of this development.

*Department of Philosophy  
Universiteit van Amsterdam  
Nieuwe Doelenstraat 15  
1012 CP Amsterdam  
The Netherlands*

### Bibliography

#### UNPUBLISHED SOURCES

A great number of manuscripts of Castel were acquired by the Royal Library in Brussels from the collection of Van Hulthem. They are catalogued as numbers 15743 till 15757 of the collection of manuscripts. Amid these nr. 15746 is a "Journal historique et démonstratif de l'exécution pratique du clavecin des couleurs". In 1850 the Royal Library acquired four more Castel manuscripts, bound together as nrs. 20753-20756. This set contains, as nr. 20754, another version of the "Journal historique et démonstratif..." Up till now, the latter manuscripts seem not to have been noticed by any of the researchers on Castel.

#### PRINTED SOURCES

(Articles in the *Mémoires de Trévoux* and the *Mercure de France* are not listed separately.)

- Algarotti, Francesco, *Le Newtonianisme pour les dames, ou entretiens sur la lumière, sur les couleurs, et sur l'attraction*. Amsterdam, 1741. Transl. of the Italian original *Il Newtonianismo per le dame. Dialoghi sopra la luce e i colori*. Napoli, 1737.
- Baudelaire, Charles, *Oeuvres complètes*. Claude Pichois ed. 2 vols. Paris: Gallimard, 1975-1976. (Bibliothèque de la Pléiade)
- Boeckmann, Johann Lorenz, *Naturlehre. Oder: die gänzlich umgearbeitete malerische Physik*. Karlsruhe, 1775.
- Brewster, David, *A treatise on the kaleidoscope*. Edinburgh, 1819.
- Butler, Alban, *Travels through France & Italy, and part of Austrian, French, and Dutch Netherlands, during the years 1745 and 1746*. Charles Butler ed. Edinburgh, 1803.
- Castel, Louis-Bertrand, *L'optique des couleurs, fondée sur les simples observations, & tournée sur-tout à la pratique de la peinture, de la teinture & des autres arts coloristes*. Paris, 1740.
- , *Le vrai système de physique générale de M. Isaac Newton, exposé et analysé en parallèle avec celui de Descartes; à la portée du commun des physiciens*. Paris, 1743.
- , *L'homme moral opposé à l'homme physique de Monsieur R\*\*\*. Lettres philosophiques, où l'on réfute le déisme du jour*. Toulouse, 1756.
- Chabanon, Michel-Paul-Guy de, *Observations sur la musique et principalement sur la métaphysique de l'art*. Paris, 1779.
- Darwin, Erasmus, *The loves of the plants. A poem. With philosophical notes*.

- (1789) 2nd edition. In *The botanic garden; a poem, in two parts*. Part II. London, 1790.
- Diderot, Denis, *Oeuvres philosophiques*. Paul Vernière ed. Paris: Garnier, 1961.
- , *Oeuvres esthétiques*. Paul Vernière ed. Paris: Garnier, 1959.
- , *Oeuvres complètes*. J. Assézat & M. Tourneux eds. 20 vols. Paris: Garnier, 1875-1877.
- , *Correspondance*. Georges Roth & Jean Verloot eds. 16 vols. Paris: Editions de Minuit, 1955-1970.
- Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*. Par une société des gens de Lettres. 17 vols. Paris/Neuchâtel, 1751-1765.
- Erxleben, Johann Christian Polykarp, *Anfangsgründe der Naturlehre*. (1772) 6th ed. Mit Verbesserungen und vielen Zusätzen von G.C. Lichtenberg. Göttingen, 1794.
- Esprit, saillies et singularités du P. Castel*. [Joseph de La Porte ed.] Amsterdam, 1763.
- Euler, Leonhard, *Lettres à une princesse d'Allemagne sur divers sujets de physique et de philosophie*. (1768-1772) In *Opera omnia*, 3rd series vols. 11-12. Andreas Speiser ed. Zürich: Orell Füssli, 1960
- Explanation of the ocular harpsichord, upon shew to the public*. London, 1757.
- Gauthier d'Agoty, Jacques, *Observations sur la peinture et sur les tableaux anciens et modernes*. Paris, 1753.
- Goethe, Johann Wolfgang von, *Die Schriften zur Naturwissenschaft*. Leopoldina-Ausgabe. I. Abt. Bd. 6: *Materialien zur Geschichte der Farbenlehre*. (1810) Dorothea Kuhn ed. Weimar: Hermann Böhlau Nachf., 1957. II. Abt. Bd. 6: *Zur Farbenlehre. Historischer Teil. Ergänzungen und Erläuterungen*. Dorothea Kuhn & Karl Lothar Wolf eds. Weimar: Hermann Böhlau Nachf., 1959.
- Guyot, Guillaume-Germain, *Nouvelles récréations physiques et mathématiques, contenant, toutes celles qui ont été découvertes & imaginées dans ces derniers temps, sur l'aiman, les nombres, l'optique, la chymie, &c. & quantité d'autres qui n'ont jamais été rendues publiques*. 4 vols. Paris, 1769-1770.
- Heinse, Wilhelm, *Sämtliche Werke*. Carl Schüddekopf ed. 10 vols. Leipzig: Insel-Verlag, 1901-1910.
- Hellwag, Christoph Friedrich, "Ueber die Vergleichung der Farben des Regenbogen mit den Tönen der musikalischen Oktave," *Deutsches Museum* 1786 vol. 2, 293-297.
- Herder, Johann Gottfried, *Sämtliche Werke*. Bernhard Suphan ed. 33 vols. Berlin, 1877-1913.
- Hoffmann, Ernst Theodor Amadeus, *Werke*. Georg Ellinger ed. 15 vols. Berlin etc.: Deutsches Verlagsanstalt Bong, s.a. [1912].
- Hogarth, William, *The analysis of beauty*. (1753) Joseph Burke ed. With the

- rejected passages from the manuscript drafts and autobiographical notes.  
Oxford: Clarendon Press, 1955.
- Kant, Immanuel, *Kritik der Urteilskraft*. (1790) Karl Vorländer ed. Hamburg: Felix Meiner, 1963.
- , *Briefwechsel*. H.E. Fischer ed. 3 vols. München: Georg Müller, 1912-1913.
- Kircher, Athanasius, *Musurgia universalis sive ars magna consoni et dissoni*. 2 vols. Rome, 1650.
- Krüger, Johann Gottlob, "De novo musices, quo oculi delectantur, genere," in *Miscellanea Berolinensia, ad incrementum scientiarum ex scriptis Societati Regiae Scientiarum exhibitis edita* 7, 1743, 345-357.
- , "Anmerkungen aus der Naturlehre über einige zur Musik gehörige Sachen," *Hamburgisches Magazin* 1 nr. 4, 1748, 363-377.
- , *Naturlehre*. (3 vols., 1740-1749) Vol. 1, 2nd edition, Halle, 1744, 3rd edition, Halle, 1750.
- Lemierre, Antoine-Marin, *La peinture, poëme en trois chants*. (1769) Nouvelle édition, augmentée de divers morceaux de comparaison, tirés des ouvrages des meilleurs poëtes didactiques latins et françois, [...] Amsterdam, 1770.
- Mairan, Jean-Jacques Dortous de, "Discours sur la propagation du son dans les différents tons qui le modifient," *Mémoires de Mathématique et de Physique, tirés des registres de l'Académie Royale des Sciences 1737* [publ. 1740], 1-58bis.
- Mendelssohn, Moses, *Schriften zur Psychologie und Aesthetik und zur Apologetik des Judentums*. Moritz Brasch ed. 2 vols. Leipzig: Leopold Voss, 1880.
- Montesquieu, Charles de Secondat baron de, *Oeuvres complètes*. André Masson ed. 3 vols. Paris: Nagel, 1950-1955.
- Newton, Isaac, *Opticks or a treatise of the reflections, refractions, inflections & colours of light*. (1704; 4th edition 1730) London: G. Bell, 1931. Repr. New York: Dover, 1952.
- Piles, Roger de, *L'idée du peintre parfait, pour servir de règle aux jugemens que l'on doit porter sur les ouvrages des peintres*. (1699) London, 1707.
- , *Cours de peinture par principes*. Paris, 1708.
- Rousseau, Jean-Jacques, *Essai sur l'origine des langues ou il est parlé de la mélodie et de l'imitation musicale*. (publ. 1781) Edition critique. Charles Porset ed. Paris: A.-G. Nizet, 1970.
- Savérien, Alexandre, *Histoire des progrès de l'esprit humain dans les sciences et dans les art qui en dépendent*. (1766) 2nd ed. Paris, 1774.
- Staël Holstein, Anne-Louise-Germaine Necker baronne de, *De l'Allemagne*. 2nd edition. 3 vols. London, 1813.
- Telemann, Georg Philipp, *Beschreibung der Augenorgel, oder des Augenclavicimbels, so der berühmte Mathematicus und Jesuit zu Paris, Herr Pater Castel, erfunden und ins Werck gerichtet hat*. (1739) Repr. in Lorenz Mizler, *Musikalische Bibliothek oder gründliche Nachricht von alten und*

- neuen musikalischen Schriften und Büchern, [...] Band 2, vol. 2. Leipzig, 1742.*
- Tieck, Ludwig [& Wackenroder, Wilhelm Heinrich], *Phantasien über die Kunst, für Freunde der Kunst*. Hamburg, 1799.
- Voltaire, François-Marie Arouet, *Éléments de la philosophie de Neuton, mis à la portée de tout le monde*. Amsterdam, 1738.
- , *Correspondence*. Theodor Besterman ed. 107 vols. Genève: Institut & Musée Voltaire, 1953-1965.
- Watelet, Claude-Henri, *L'art de peindre. Poëme, avec des réflexions sur les différentes parties de la peinture*. (1760) Nouvelle édition, augmentée de deux poëmes sur l'art de peindre, de Mr. C.A. du Fresnoy et de Mr. l'Abbé de Marsy. Amsterdam, 1761.

#### SECONDARY LITERATURE

- Barry, Kevin, *Language, music and the sign. A study in aesthetics, poetics and poetic practice from Collins to Coleridge*. Cambridge: Cambridge University Press, 1987.
- Chouillet-Roche, Anne-Marie, "Le clavecin oculaire du Père Castel," *Dix-huitième Siècle* 8, 1976, 141-166.
- Erhardt-Siebold, Erika von, "Synästhesien in der englischen Dichtung des 19. Jahrhunderts. Ein ästhetisch-psychologischer Versuch," *Englische Studien* 53, 1919-1920, 1-157 & 196-334.
- , "Some inventions of the pre-Romantic period and their influence upon literature," *Englische Studien* 66, 1931-1932, 347-363.
- , "Harmony of the senses in English, German, and French Romanticism," *Publications of the Modern Language Association of America* 47, 1932, 577-592.
- Fischer, Ottokar, "Über Verbindung von Farbe und Klang. Eine literar-psychologische Untersuchung," *Zeitschrift für Ästhetik und allgemeine Kunstwissenschaft* 2, 1907, 501-534.
- Hakfoort, Casper, *Optica in de eeuw van Euler. Opvattingen over de natuur van het licht, 1700-1795*. Amsterdam: Rodopi, 1986.
- Neubauer, John, *The emancipation of music from language. Departure from mimesis in eighteenth-century aesthetics*. New Haven/London: Yale University Press, 1986.
- Schier, Donald S., *Louis Bertrand Castel, anti-Newtonian scientist*. Cedar Rapids, Iowa: The Torch Press, 1941.
- Topper, David, "Newton on the number of colours in the spectrum," *Studies in History and Philosophy of Science* 21, 1990, 269-279.
- Wellek, Albert, "Zur Geschichte und Kritik der Synästhesie-Forschung," *Archiv für die gesamte Psychologie* 79, 1931, 325-284.

- , "Renaissance- und Barock-Synästhesie. Die Geschichte des Doppelempfindens im 16. und 17. Jahrhundert," *Deutsche Vierteljahrschrift für Literaturwissenschaft und Geistesgeschichte* 9, 1931, 534-584.
- , "Farbenharmonie und Farbenklavier. Ihre Entstehungs-geschichte im 18. Jahrhundert," *Archiv für die gesamte Psychologie* 94, 1935, 347-375.
- , "Das Doppelempfinden im 18. Jahrhundert," *Deutsche Vierteljahrschrift für Literaturwissenschaft und Geistesgeschichte* 14, 1936, 75-102.