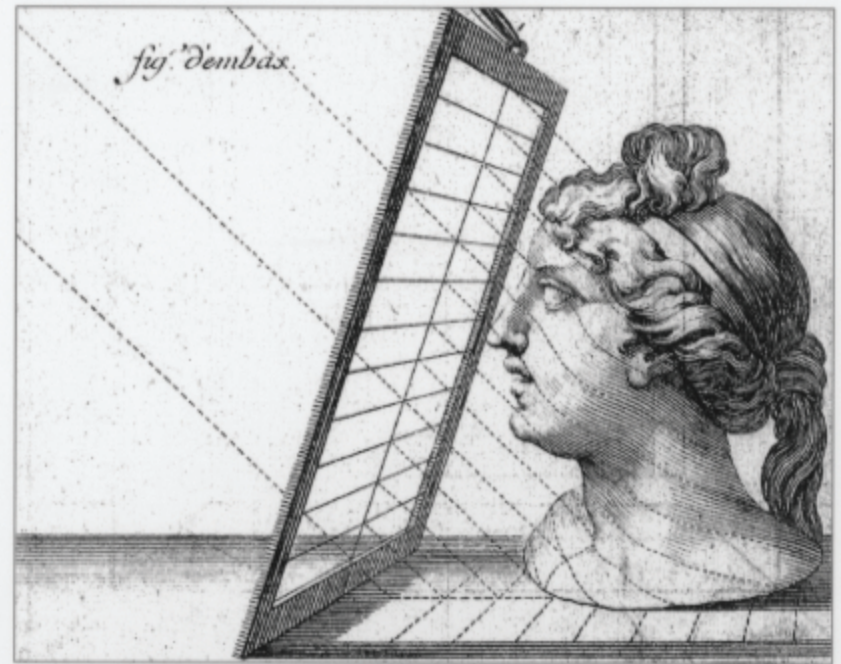


CAROLIN BOHLMANN  
THOMAS FINK  
PHILIPP WEISS · HRSG.

# LICHTGEFÜGE

## DES 17. JAHRHUNDERTS



REMBRANDT UND VERMEER  
LEIBNIZ UND SPINOZA

WILHELM FINK

Bohlmann · Fink · Weiss (Hrsg.)

Lichtgefüge  
des 17. Jahrhunderts

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## The Theory of Shadows and Aerial perspective: Leonardo, Desargues and Bosse

The problem concerning the theory of shadow projection and aerial perspective in the writings of Girard Desargues have been considered marginal for long time. Indeed, Desargues applies to both shadow projection and aerial perspective the *petit pied* method, which has already been extensively discussed for the perspective of solid bodies. But, as we shall see, examining this topic provides insights concerning the knowledge and diffusion of Leonardo's theory in France in the XVII century, namely before the publication of his *Trattato della pittura* in 1651.

In that sense, also Abraham Bosse's writings provides precious insights on these topics, because he sometimes complements Desargues' succinct rules with observations more strictly related to painting<sup>1</sup>.

The discussion of the relationships between Leonardo, Desargues and Bosse should be better addressed through the analysis of two issues: first, the origin and meaning of a drawing on shadow projection sent by Poussin to Paris second, the understanding of what Desargues and Bosse called *La Règle du fort faible*.

In the *Brouillon project* of 1640 on stone-cutting, Desargues criticizes the method for projecting in perspective *des ombres & des ombrages qui se font en campagne à la lumière du Soleil* as shown in *une figure que Monsieur Poussin très excellent peintre Français a envoyée cette année de Rome pour faire voir à Paris, en laquelle ces ombrages estoient representez au moyen de la perspective du corps du Soleil, des poincts de sa surface dont les rayons illuminoient le sujet, & de celle de ces mesmes rayons*.<sup>2</sup>

On the same drawing, Bosse writes in his *Manière universelle* of 1647: „*L'autre (comme on a vœu en des figures à la main, envoyées d'Italie en France) donne à ce lumineux autant de points d'assiette encores à distance finie qu'au reste du sujet: qui est*

1 For example, Desargues deals with the theory of shadow projection in 1636 for the first time; in this occasion he simply affirms that the *petit pied* method is also suitable to represent shadows in perspective without using any other auxiliary point outside the picture plane [Desargues, 1636], p. 10. Desargues deals with it again in 1640 but also in this second occasion he does not elaborate the problem [Desargues, 1640a], p. 1. Bosse, instead, dedicates a whole chapter of his *Manière universelle* of 1647 (Bosse, 1647-48) to „De l'ombre et ombrage a toutes sortes de lumieres”, p. 173-199.

2 Desargues, 1640a, p. 1. Desargues deals with shadows cast by the sun also in his [Desargues, 1642], p. 1-3, written against Jean Dubreuil's treatise *La perspective pratique*. In figure 132 of his treatise, Dutreuil had erroneously projected the sun (extended light source at infinite distance) on the ground line and not, as he should have done, on the horizon line. On Desargues' place in the history of the theory of shadows, see G. Da Costa Kaufmann, „The perspective of shadow: the history of the theory of shadow projection”, in: *Journal of the Warburg and Courtauld Institutes*, London, n. 38, 1975, p. 258-287.

*une chose extremement longue, & difficile à mettre à execution, si on veut que ce qu'on fait approche du vray semblable.*<sup>3</sup>

In my discussion of this drawing, I am interested not in the reasons for Desargues and Bosse's critique (it is quite clear that the method to project shadows used in the drawing does not answer the needs of *universality* that they are looking for), rather in the origin and eventual influence of this drawing.

While Desargues explicitly identifies the light source with the sun, Bosse, instead, speaks of a general light source. Both give important information concerning the breaking up of the source and object's surfaces into smaller units of identical extent. From both descriptions one infers that the shadows do not have neat and precise outlines, but account is taken of the decrease of light intensity due to the different inclinations of the body's surfaces with respect to the light source. This drawing can only refer to Leonardo's research on the photometry of shadows and the reference to Poussin is an additional, indirect, confirmation of the fact.<sup>4</sup>

Poussin's interest in Leonardo in the 1630s and 1640s is well documented and has been much studied.<sup>5</sup> It need not be elaborated upon here. Instead, I would like to point out what Poussin could know about Leonardo's theory of light and shade and what were the origins of the drawing sent to Paris.

Only today, after decades of accurate philological and comparative research on Leonardo's manuscripts, we are able to evaluate his theories, at least on some topics, and the complex methods he used in analysing the natural phenomena.

Not much of Leonardo's theoretical work was available in France in the XVII century. Obviously, the first publication of Leonardo's *Trattato della pittura*, printed in French and Italian in Paris in 1651, made his ideas accessible to a large public, but the influence of this publication should not be overestimated.

In fact, it is well known that the original and complete version of Leonardo's *Trattato*, compiled by Francesco Melzi, Leonardo's friend and pupil, a century before and still unpublished, was not available in the XVII century.

3 Bosse, 1647-48, p. 177-178.

4 On Leonardo's theory of shadows, see: M. Rzepinska, "Light and Shadow in late writings of Leonardo da Vinci", in: *Raccolta vinciana*, XIX, 1962, p. 259-266; V. Ronchi, *Scritti di ottica*, Milan, 1968, p. 13-30; Da Costa Kauffman, op. cit.; C. Maltese, "Gli studi di Leonardo sulle ombre tra la pittura e la scienza", in: *Arte Lombarda*, n. 67, 1983-1984, p. 31-40 (also in: Id., *Per una storia dell'immagine*, Rome, Il Bagatto, 1989, p. 181-189).

5 On the relationship between Poussin and Leonardo, see: A. Blunt-W. Friedlaender, *The Drawings of Nicolas Poussin. Catalogue Raisonné*, London, 1939-1974, vol. IV, p. 26-33; Kate T. Steinitz, "Poussin illustrator of Leonardo da Vinci and the problem of replicas in Poussin's studio", in: *The Art Quarterly*, Detroit, spring 1953; Id., Leonardo da Vinci's *Trattato della pittura*. A Bibliography of the printed edition, 1651-1956, Copenhagen, 1958, p. 70 ss; T. Kamenskaya, "Le manuscrit du 'Traité de la Peinture' de Leonard de Vinci au Musée de l'Hermitage", in: *Raccolta vinciana*, XIX, 1962, p. 255-258; C. Pedretti, "The Zaccolini Manuscript", in: *Bibliothèque d'Humanisme et Renaissance*, Paris, XXXV, 1973, p. 39-53; E. Cropper, "Poussin and Leonardo: Evidence from the Zaccolini Mss.", in: *Art Bulletin*, 62, 1980, 570-583; J. Bell, "Cassiano dal Pozzo's copy of the Zaccolini manuscript", in: *Journal of the Warburg and Courtauld Institutes*, London, 51, 1988, p. 111-114.

Furthermore, the *Trattato* was known through some 'abridged' versions which, in comparison with the original, lacked entire sections, including the Fifth Book dedicated to Light and Shade.<sup>6</sup> Even Cassiano dal Pozzo, coordinator in Rome of the difficult work of comparison and collation of Leonardo's manuscripts aimed at the first printed edition of the *Trattato*, had to base his research upon one or more than one 'abridged' versions. Therefore, also the Parisian publication of the *Trattato* in 1651 lacked the section concerning light and shade and could provide only a partial understanding of Leonardo's ideas on painting.<sup>7</sup>

Having said that, it is clear that the drawing Poussin sent to Paris cannot derive from Leonardo's *Trattato della pittura*.

This drawing could be derived from the treatise of the Teatine scholar Matteo Zaccolini, especially from the volume on *Descrizione delle ombre*, which we know Poussin studied and copied. But unfortunately Desargues and Bosse's descriptions do not fit any of the drawings of Zaccolini concerning light and shade.<sup>8</sup>

On the contrary, the drawing Poussin sent to Paris could be better derived from a XVII century compilation of Leonardo's observations on light and shade, now in the Ms. H 227 inf. in the Biblioteca Ambrosiana in Milan.<sup>9</sup> This manuscript on light

6 The other sections that do not appear in the 'abridged' versions are: the First Book on the "Paragone delle arti", the Sixth, Seventh and Eighth Books, respectively dedicated to "Degli alberi e delle verdure", "De' nuvoli" and "Dell'orizzonte". The original manuscript is now kept in the Biblioteca Apostolica Vaticana (codex Urb. Lat. 1270). On the history of Leonardo's *Trattato della pittura* and its 'abridged' versions, see: K. T. Steinitz, op. cit., 1958; Id., "Bibliography never ends", in: *Raccolta vinciana*, XVIII, 1960, p. 97-111; Id., "Trattato Studies II", in: *Raccolta vinciana*, 1962, p. 223-254; C. Pedretti, *Leonardo da Vinci on Painting: a lost book* (Libro A), London, P. Owen, 1965; Id., *The Literary works of Leonardo da Vinci: A commentary to Jean Paul Richter's Edition*, 2 vol. Oxford, Phaidon Press Ltd., 1977.

7 Some 'abridged' versions are documented in Paris already in 1640. Among them, I shall cite only those which might have been available to Desargues and Bosse: a) the manuscript of Chantelou and Chambray, which Cassiano dal Pozzo donated to them during their visit to Rome in 1640 and that arrived in Paris in the same year (it is now kept in the Hermitage Museum in Leningrad); b) the manuscript of André Félibien, which originated also in Cassiano's library in Rome and that arrived in Paris in 1649 (it is impossible to identify it today); c) a third manuscript, which belonged to Melchisédech Thévenot and that had to be in Paris before 1651, since Raphael Du Fresne cited it in the Introduction of the Italian edition of 1651 (it is today lost or impossible to identify). Chantelou and Chambray were the nephews of Sublet De Noyers, famous and influential ministry of royal buildings until 1643, who asked Desargues to experiment a new stereometric method at the Louvre Palace in 1639-1640 [Desargues, 1640a], p. 1. Bosse affirms that he studied the *Trattato della pittura* before its publication; moreover, in 1649 he informed Félibien of Chambray's project concerning the publication of the *Trattato* [Bosse, 1665], p. 127, p. 134-135. Thévenot was a divulgator of scientific knowledge who had a precious library on scientific matters; he was also very active in meetings of Parisian scientists (see C. Stewart Gillmor, in: *Dictionary of Scientific Biography*, New York, vol. 13, 1976, p. 334-337).

8 On Zaccolini's treatise see: Pedretti, op.cit., 1973; Cropper, op.cit., 1980; Bell, op.cit. 1988

9 The Ms. H 227 inf. contains three sections: the first is the compilation that interest us on light and shade; the second contains different notes on painting extracted from different manuscripts; the third part concerns the so-called 'added chapter'. On Ms. H 227 inf., see: Steinitz, op.cit., 1958, p. 99; C. Pedretti, "Copies of Leonardo's lost writings in the Ms. H 227 inf. of the Ambrosiana Library, Milan", in: *Raccolta vinciana*, XIX, 1962, p. 61-94, who tracks down the origins of each note from Leonardo's original manuscripts; and recently, Bell, op. cit., p. 117.

and shade, dated 1639 and made specifically upon Cassiano's request to fill the *Trattato's* most obvious gap, is a compilation of Leonardo's notes on the topic extracted from various manuscripts, namely Mss. A and C, and the Codice Atlantico.<sup>10</sup> An inscription on the first page of the Ms. H 227 inf. shows that Poussin studied this manuscript ("*Monsu Pussin deve rest.re uno dell'ombre e lumi con figure appartate*").<sup>11</sup> It is possible that, as we know he did for Zaccolini's treatise, Poussin copied some of the drawings for his own use and that he took care to inform the Parisian artists about the latest developments concerning Leonardo's writings in Rome. The problems raised in the drawing must thus have been one of current interest. The drawing Poussin sent to Paris must have circulated widely among artists, if Desargues and Bosse could see and describe it precisely. Figure 1 shows one of the illustrations of Leonardo's Ms. C copied in 1639 in Ms. H227 inf., which best fits Desargues and Bosse's description. However, we cannot assume a direct contact between Poussin and Desargues: it is rather unlikely, beside being impossible to prove.<sup>12</sup> It is more probable that Poussin sent the most advanced research on Leonardo concerning light and shade to Paris to a fellow painter, who was interested in the same kind of problem and with whom he carried on a regular correspondence.<sup>13</sup>

Desargues and Bosse's discussion of the drawing sent by Poussin to Paris, which has been overlooked by art historians, is therefore significant to gain insights concerning the knowledge and diffusion of Leonardo's theory of light and shade in France in the XVII century.

But it seems that Desargues and Bosse knew more of Leonardo's theory than this single drawing. Leonardo's research must have had a significant role, certainly for Bosse but probably also for Desargues, in relation to "*La Regle du fort et faible*", which Poudra went so far as to describe as being: *le commencement de ce qu'on a appelé depuis la perspective aérienne*.<sup>14</sup>

10 See Leonardo's original manuscripts in the following facsimilar editions: A. Corbeau-N. De Toni, Ms. C de l'Institut de France, Grenoble, ed. Roissard, 1972; Id., *Manuscrit A de l'Institut de France*, 3 vol., Grenoble, ed. Roissard, 1972; A. Marinoni, *Il Codice atlantico*, Florence, Giunti Barbera, 1975-1980.

11 Bell, op.cit., p. 115, has rightly remarked that the drawings of Ms. H 227 inf. were originally collected together at the end of the written text and that only later they have been divided and applied near the correspondent text; therefore, Bell can rightly affirm that the manuscript lent to Poussin was the compilation on light and shade and not the entire Ms. H 227 inf. as other scholars have argued (ctr. Cropper, op. cit., p. 573). Instead, Pedretti, op. cit., 1973, p. 41, thinks that the manuscript lent to Poussin was the volume *Descrizione delle ombre* from Zaccolini's treatise.

12 G. Kaufmann dealt with the relationship between Poussin Desargues and Bosse in "*La 'Sainte Famille a l'escalier' et le probleme de proportions dans l'oeuvre de Poussin*", Nicolas Poussin, CNRS. Colloques internationaux Sciences Humaines, Paris, 1960, vol. I, p. 141-150; Id., *Poussin Studien*, Berlino, 1960, p. 66-71.

13 Poussin's regular correspondence with Chantelou and Sublet de Noyers of 1639-1640 concerning his sejour in Paris is still available [C. Jouanny, "Correspondence de Nicolas Poussin", in: *Archives de l'art français*, Paris, 1911]; A. Blunt, *Nicolas Poussin. Lettres et propos sur l'art*, Paris, Hermann, 1964, [II edition, 1989]. Instead, nothing has remained of Poussin's correspondence of the same period with the painter Jacques Stella.

14 Poudra, 1864, I, p. 428.

Here we come to the second part of my discussion.

We know how much the atmosphere effects the perception of outlines and colors in the real space. But the atmosphere, being indefinite and unmeasurable, escapes the rules defined to represent the solid bodies in perspective and its correct analysis had been usually disregarded by painters in the early XV century. Leonardo was the first to attempt a systematic analysis of chromatic and luminous variations due to the atmosphere. After many attempts, he was able to fix a system of variables which included: the light source, the body, the viewer, as well as their shapes, extensions, and their relative orientations and distances. He also tried to reproduce colors and outlines' loss of definition by means of an abstract model.<sup>15</sup>

The complexity of the problems concerning *La Regle du fort et faible* were already clear to Desargues in 1636. In fact, in his essay of that year he writes: "*Il y a régle aussi de la place du fort et du féble coulory, dont la demonstration est melée en partie de Geometrie, en partie de Phisique, et ne se trouve en France encore expliquée en aucun livre public.*"<sup>16</sup>

Moreover, replying to Jean Dubreuil in 1642, Desargues writes that "*la regle de la place des fortes et foibles touches (...) est de telle consequence en la pourtraiture, que c'est en cette partie là que resident la pluspart des moyens (...) qui font estimer les ouvrages de cette nature, sans que la lumiere et l'ombre en soient la cause, comme plusieurs ont pensé; Mais tout ainsi qu'il y a le clair et le brun à cause de la lumiere et de l'ombre. Il y a aussi le clair et le brun à cause du fort et du foible: Et comme ces deux sortes de clair et de brun ont leur causes diverses, elles sont aussi deux choses diverses et differentes*".<sup>17</sup>

In his *Manière universelle* of 1647, Bosse devotes more than hundred pages and 15 illustrations to *La Place et proportion des fortes et foibles touches, teintes ou couleurs* (fig. 2 and fig. 3). He even writes that, in the open air, the atmosphere produces (une sensation d') "*union generale d'entre les parties d l'ouvrage, si gracieuse, & agreable à la veue, que lors qu'elle y est obmise, ou qu'elle n'y est pas bien pratiquée avec raison, un bon oeil instruit à cela, s'aperçoit et se choque uussi bien du demanchement & des-union des parties que ce deffaut y produit, que d'aucun autre sorte de mesconte.*"<sup>18</sup>

But, how closely is *La Regle du fort et faible* related to Leonardo's aerial perspective?

15 On Leonardo's colors and aerial perspective, see: C. Pedretti, op. cit., 1977; M. Barasch, *Light and color in the Italian Renaissance Theory of art*, New York, 1978, p. 44-88; C. Maltese, "*Leonardo e la teoria dei colori*", in: *Römische Jahrbuch für Kunstgeschichte*, n. 20, 1983, p. 209-219 [also in: Id., *Per una storia dell'immagine*, Rome, 1989, p. 171-180]; C.J. Farago, "*Leonardo's Color and Chiaroscuro Reconsidered: The visual force of painted images*", *Art Bulletin*, March 1991, p. 63-88.

16 Desargues, 1636, p. 10.

17 Desargues, 1642, p. 3. Moreover, he criticizes Dubreuil because he copied his figure of 1636 eliminating "*une des principales parties, à sçavoir la touche convenable aux places du fort et du foible, sans laquelle une Perspective ne fait point à l'oeil à beaucoup pres de l'effet qu'elle doit faire*" [Desargues, 1642], p. 1.

18 Bosse, 1647-48, p. 235.



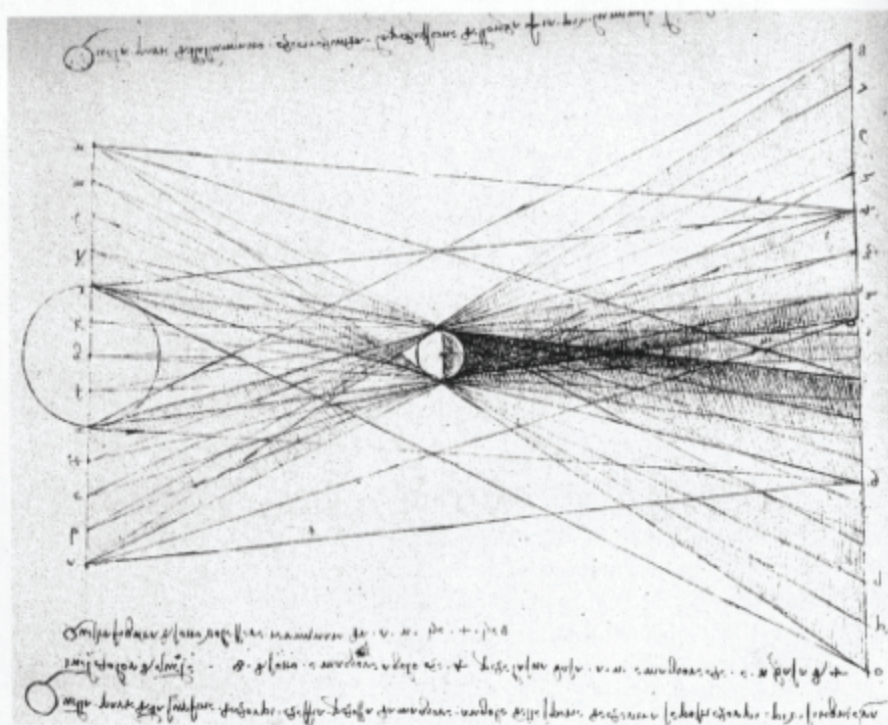


Abb. 1: Leonardo Ms. C, fol. 4v°

I shall now quote a page concerning *La Regle du fort et faible*, published by Bosse at the end of his 1647 treatise, although its authorship still remains controversial<sup>19</sup> (fig. 3). We read that „Mais quant à ce qui est du fort & foible de ses touches, il n'aparoist point qu'on y eust encore fait de reilexion pour cela; puis qu'on faisoit descendre la forte ou foible sensation visuelle du sujet de la grandeur ou petitesse de l'angle d entre les rayons visuels par lesquels il avient que loeil voit.”<sup>20</sup>

Moreover, it is added that „l'impression de la touche d'une point dans l'oeil, y est forte ou foible à proportion ou selon que le rayon visuel par lequel il voit ce point est court ou long.”<sup>21</sup>

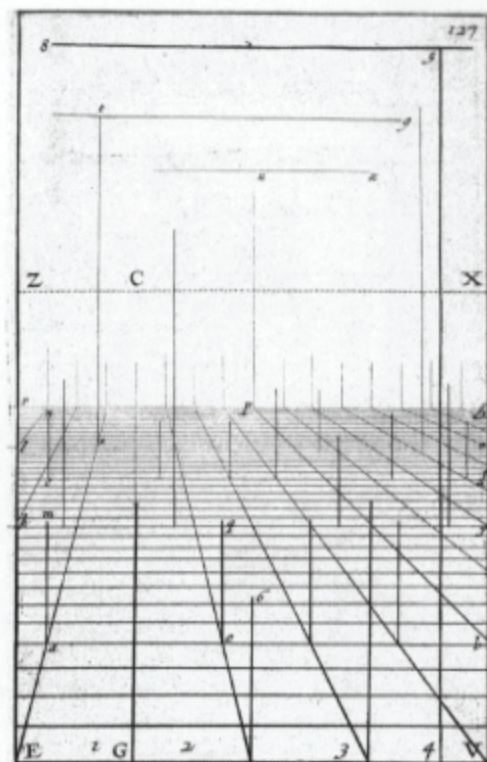
Consequently, taking two points (one in the real space and one as seen in 3 perspective) seen with rays of different length, „les impressions de leurs touches dans l'oeil sont inegales entr'elles, et la sensation visuelle de l'un ne revient pas a celle de l'autre;

19 The fundamental principles of perspective, published by Bosse ([Bosse, 1647-48], p. 336-342,) are usually attributed to Desargues. However, until today it is not possible to assert if, and eventually when, Desargues himself ever published them. On the problem see: Pondra, 1864, II, 427-428; Taton, 1951a (Field, Gray, 1987).

20 Bosse, 1647-48, p. 338.

21 Ibid., p. 338.

Abb. 2: Abraham Bosse,  
Manière universelle...1647,  
table 127



*Mais celle de celui qui est veu par le rayon moins long ou plus court, y est plus forte que celle de l'autre.*<sup>22</sup>

Therefore, the different visual sensation caused by two points is measured according to the distance of the two points from the eye and drawn in perspective according to the linear proportion fixed by the scale on the line at the base of the picture.

I must say at once that Desargues does not take into consideration the light source nor its orientation to the object and the viewer, nor does he consider illumination with multiple light sources. In that respect, he places severe limitations on the system (observer, body, light source) already established by Leonardo. Moreover, it seems reasonable to deduce that Desargues considers only the loss of definition of body's outlines and variations in luminosity, but that he does not face the problem of luminosity in relation to colors. Also the distinction between *clair ou brun* and *fort ou faible* does not deal with color but with *touche* meant as minimum signifying signs. Had this distinction been related to colors, it would have implied the two concepts of luminosity and saturation. But, the concept of saturation, in

22 Ibid., p. 338.

the middle of XVII century, was still far in the future. Indeed in 1640, Desargues writes that the „petit pied donne (...) cognoissance de la raison des effects generalement de toutes les choses auxquelles tous les peintres, sculpteurs et semblables essayent de parvenir à force de pratiquer en taston'nant (...) excepté ce qui est de la nature et du meslange des couleurs.“<sup>23</sup>

In that respect *La Regle du fort et faible* is only a partial acceptance of Leonardo's theory. Leonardo himself had always looked for the illusion of depth and relief through the gradual loss of definition and luminosity of colors.

Evidence of Desargues' partial reading of Leonardo's aerial perspective is provided by the famous cage of 1636 which, for Desargues, is also an excellent representation of *La Regle du fort et faible*. In this perspective drawing, Desargues uses graphic technique to extend the significance of the drawing and, at the same time, to limit its ambiguity.<sup>24</sup> Unlike in his geometrical drawings (for example the figure that illustrates his famous theorem on homological triangles), he treats the width of a line differently according to its position in space in relation to the viewer: the lines in the foreground are rendered with a heavier sign, while those in the background are rendered with a weaker sign. Finally, the thickness of oblique lines is not uniform, rather the lines become thinner and thinner as they recede from the picture plane. Consequently, the blank page is not, as in the geometrical drawings, the representation of an empty, homogeneous space, rather it is the representation of a real discontinuous space.

For Desargues, in the perspective representation, the width of a line is an integral part of the graphic sign, meant both analogically and symbolically, in order to represent an object in perspective seen by the viewer in a real space and in the atmosphere. In his graphic language Desargues respects also the semantic precision that he had achieved for the verbal definition of geometric and perspective terms. With the same rigour, he transposes the perspective terms from the verbal to the graphic language.<sup>25</sup>

Although Desargues' *Regle du fort et faible* deals only with graphic representation and not with colors, its transposition to the graphic language is of primary importance. In fact, Desargues was the first to attempt to diminish gradually the width of a line in a perspective drawing according to the position of the represented object in the real space and in the atmosphere.

Speaking about *La Regle du fort et faible* Bosse completes Desargues' partial reading of it. He clarifies that the visual sensation of an object becomes weaker because

<sup>23</sup> Desargues, 1640a, p 1.

<sup>24</sup> On the graphic language see: C. Maltese, „Sulla rappresentazione grafica (geometrica) come linguaggio“, in: Id., *Per una storia dell'immagine*, Rome, 1989, p. 29-42.

<sup>25</sup> The new terms that Desargues introduced to indicate geometrical and perspective concepts were highly criticized; but Descartes, in his letter to Mersenne of 25 May 1637, did not hesitate to say that „la curiosité et netteté de son langage est à estimer“ (*Oeuvres des Descartes*, edited by C. Adam & P. Tannery, I vol., Paris, 1969, p. 376-377).

Abb. 3: Abraham Bosse, *Manière universelle...* 1647, table 152

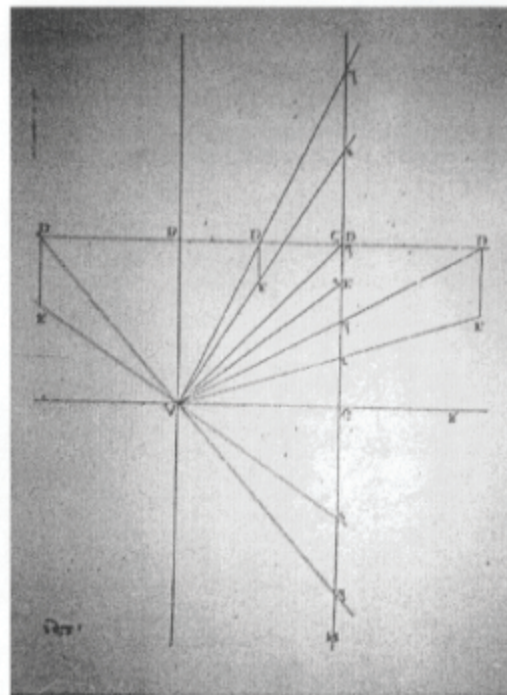
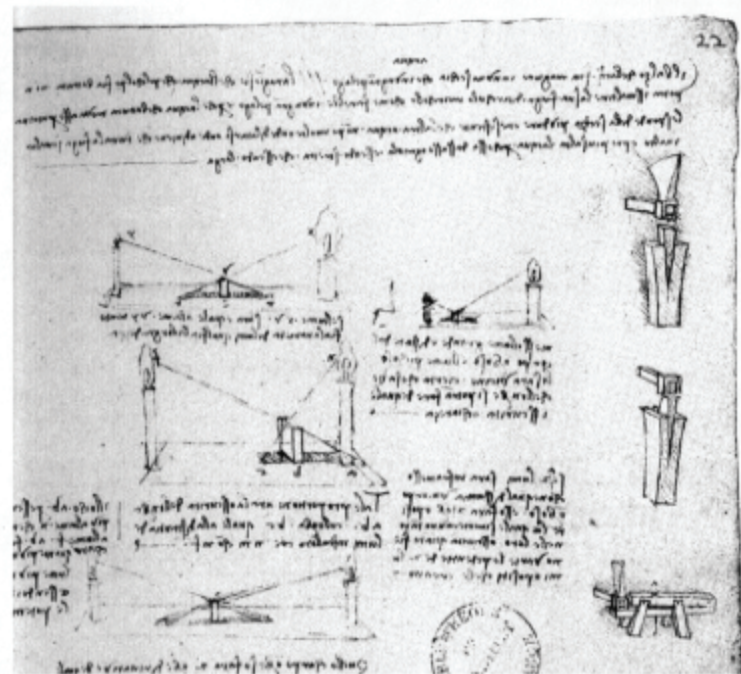


Abb. 4: Leonardo Ms. Ms. C, fol., 22r<sup>o</sup>



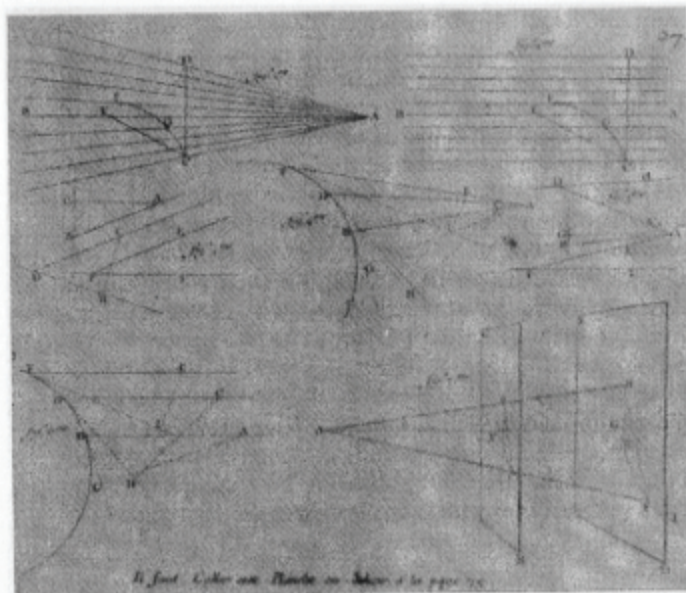


Abb. 5:  
Abraham Bosse,  
*Moyen univer-  
sel...*, 1653,  
table 27

of distance and atmosphere „tant en ce qui est de son traict, qu'en ce qui peut estre de sa couleur”.<sup>26</sup>

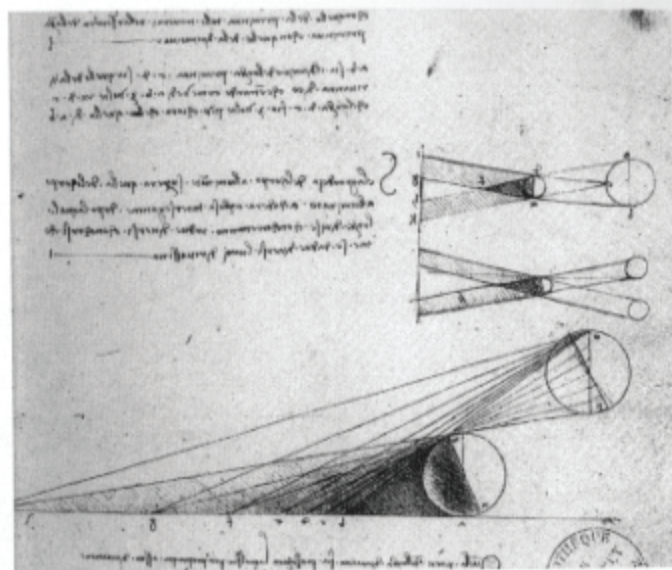
Then, he gives an extensive discussion of the light source, which was not mentioned by Desargues, showing an accurate knowledge of the treatises influenced by Leonardesque ideas (Daniele Barbaro, Pietro Accolti, Matteo Zaccolini, François Aguilon).

In addition, Bosse also faces two other problems, to which Leonardo had already given special attention and of which he could have been aware only through a deep understanding of Leonardo's writings: namely, how to obtain constant illumination on a surface, and how to measure how the quantity and quality of illumination of a surface varies with its inclination to the light source.

In considering the first problem, Bosse resorts to an experiment. He takes as light source a line of four candles, of which only one is lighted; with an open book in his hands, he places himself at the limiting distance beyond which it is impossible to distinguish the letters of the book. Then, he places himself at the double of the previous distance. In order to obtain a constant illumination on the book, the light source should be increased from one to four candles. But this experiment concerns the graphic representation, because for colors Bosse admits that: „il y a une difficulté à comparer les forces des couleurs, c'est que nous ne sçavons point le moyen de les diviser par moitié, tiers ou quart, c'est pourquoy dans la pratique

<sup>26</sup> Bosse, 1647-48, p. 231.

Abb. 6: Leonardo  
Ms. Ms. C,  
fol. 21r<sup>o</sup>



celuy qui aura l'adresse d'approcher le plus près des proportions que nous avons dit et dirons pour les touches et les teintes, réussira le mieux comme estant plus près de la vérité”.<sup>27</sup>

Bosse's experiment is conceptually analogous to one of Leonardo's famous experiment. In a few of the drawings of Ms. C Leonardo tries to fix the equality of shadows projected by two light sources of different intensity (fig. 4). He faces strictly photometric problems, although he does not express them in numerical terms<sup>28</sup>. The only difference between Leonardo and Bosse is that Bosse considers the loss of definition of the graphic sign, while Leonardo looks only at the intensity of the projected shadows. It is not by chance, I believe, that Leonardo's experiment has been accurately copied in the first pages of Ms. H 227 inf., already mentioned as Poussin's only possible source for Leonardo's theory of light and shade.

The surface's greater or smaller inclination with respect to the light source (both at finite and infinite distance) is discussed by Bosse in table 27 of his 1653 treatise (fig. 5). On this problem also a reference to Leonardo becomes inevitable. In fact, Leonardo made a detailed study of the relation between the illumination of a surface and the angle of incidence of the light. In many drawings, mostly present in Ms. C and copied in Ms. H 227 inf., he resolved this relation graphically, although

<sup>27</sup> Bosse, *Moyen universel*, 1653, p. 69.

<sup>28</sup> Leonardo, Ms. C, fol. 22r: „Ma se il lume grande è distante dal corpo onbroso e il lume piccolo li sarà vicino, certa cosa è che l'ombra si potran fare d'equal oscurità e chiarezza. Se a 2 lumi è inframesso con equal distantia un corpo onbroso, esso farà due ombre, le quali si varieranno tanto nelle loro oscurità quanto fieno varie le potentie de' due lumi oposti che le creano”. See also: V. Ronchi, *Storia della luce*, Bari, 1983, p. 246.

he never expressed it mathematically (fig. 6). On this problem, Bosse goes beyond Leonardo, trying a first approximate calculation of luminance. May be, this is his most meaningful completion of Desargues' theory.

In fact, in 1653 he writes: „des Sçavans en la Geometrie (...) m'ont adverty d'une distinction necessaire lors qu'il s'agit de comparer la force des touches et teinctes de deux objets inegalement esloignez du Tableau“.<sup>29</sup>

He says that considering „les surfaces comme estans cormposées de lignes pl-tysiques et visibles à la façon de ceux de notre profession (...) ces lignes seront de petites surfaces dont les plus esloignées seront aux plus proches dans la raison des quarrés de leurs distances, à laquelle raison reviendra reciproquement celle de leurs forces visibles“.<sup>30</sup>

Even if one breaks up the surface into points, for Bosse, one should use „la raison des quarrés des distances, pource qu'il s'agira des points visibles qui sont des petites surfaces tels que sont tous les points physiques qui tombent sous les sens“.

It is clear that Bosse knows about the research of Kepler, who formulated the fundamental photometric law in his *Ad Vitellionem Paralipomena* of 1604.

Bosse then gives the rule (fig. 5): „la force de la vision ou de l'illumination du point B est à celle du point D en raison composee de la raison du quarre de AD, au quarre de AB, et de la raison du sinus AG, au sinus CH“.<sup>31</sup>

The effect of the angle of incidence is measured through its sine and not through its cosine, as today (after the studies of Jean Henry Lambert).<sup>32</sup>

Obviously, we cannot expect Bosse to be master of a level of scientific precision which will be attained only a century later, but it is important to point out that, on this topic, he assimilates, at least partially, the scientific research of the time. In fact, from Kepler to Descartes, the analysis of the subjective elements in vision is avoided, both from a philosophical and a scientific point of view. On the other hand, attention is given to the scientific explanation of the mechanism of image formation, understood as *natura physica* and unconnected to the eye-brain system.<sup>33</sup>

Most probably, those last considerations on luminance are a result of the personal initiative of Bosse who, having informed Desargues (then in Lyon) about the matter, received the following answer: „Quant à la regle de la pratique du fort et foible qu'il a eu sa raison de la fonder sur la reciproque d'entre ses distances ou pieds de front et non de leurs quarez ou de leurs solides, comme d'autres peuvent faire ayant peut estre aussi raison“.<sup>34</sup>

At this point, it is possible to be more precise about the relationships between Desargues, Bosse and Leonardo. For Desargues, indeed, we cannot go beyond the

29 Bosse, *op. cit.*, 1653, p. 67.

30 *Ibid.*, p. 68.

31 *Ibid.*, p. 70.

32 J.H. Lambert, *Photometria sive de mensura et gradibus luminis, colorum et umbrae*, Augustae Vindelicorum, Sumptibus Viduae Eberhardi Klett Typis Christophori Petri Detleffsen, 1760, fixes the so called 'cosine law', basis of modern photometry.

33 See V. Ronchi, *Scritti di ottica*, Milano, 1968, p. XXIX.

34 Bosse, *op. cit.*, 1653, p. 69.

reference to the drawing on shadows cast by the sun, sent by Poussin to Paris; we can note their common interest in aerial perspective only in general terms.

The relationship between Leonardo and Bosse is better articulated. Some of Bosse's theoretical choices, argued polemically against the dominant artistic output of the time, could find in Leonardo's writings a rich and authoritative heritage of information and confirmation. Leonardo's *Trattato della pittura*, even in the 'abridged' versions, could give theoretical and scientific support to Bosse's preference for the luministic variations obtained with the diffused light of the sky or with the combination of multiple light sources, in contrast to those obtained with only one *lume particolare*. In addition the *Trattato* could confirm Bosse's consequent preference for blurred shadows, in contrast to shadows with neat and defined outlines. Since Bosse's *Manière universelle* was published in 1647, he must have known the *Trattato della pittura* before its publication in 1651, most probably through 'abridged' versions then available in Paris.<sup>35</sup>

In fact, Bosse proposes the realistic representation of light and shade but, unlike the French artists so-called Tenebrists, he recommends avoiding illumination by candlelight in closed spaces. He advocates, instead, illumination by diffuse light and, in closed spaces, he recommends the combination of multiple light sources. Opposing Simon Vouet's conventional treatment of color in his last paintings, he writes that colors should diminish gradually according to the rules of aerial perspective. On the other hand, he does not approve of Venetian painters or of Rubens because their brushwork is not always controlled and refined, especially in the background.

He adds that observation of aerial perspective stimulates the artist's attention in natural phenomena, but that, until now, it has been „plustost l'ouverture d'une opinion sur cette matiere qu'un precepte instructif de ce qu'il y faut faire“.<sup>36</sup>

That said, Bosse himself clarifies his and Desargues' position in relation to Leonardo.

The contrast he draws involves both the scope and the method of scientific research. In his notes, Leonardo records his endless observation on natural phenomena, his experiments and his interpretative hypotheses. On some occasions, he tries to elaborate a scientific model, but more usually than not the synthesis made in his notes is called into question by new experiments, observations and hypotheses. Desargues, instead, wants to establish a universal science that will become the foundation of many specialized disciplines. For Desargues, this universal science is geometry, which governs perspective, the theory of shadows, aerial perspective, stone-cutting and gnomonic. Moreover, for Leonardo, practise and direct observation are the privileged method of analysis: what the eye sees prevails over what the rules establishes. For Desargues, experience and observation remain necessary

35 see note n. 7.

36 Bosse, 1647-48, p. 203.

starting points for scientific research; but he aspires to define an universal law that governs practise and that, ultimately, replaces practice altogether.

Bosse combines philosophical interpretation and a more specifically artistic approach. Even though he can accept Leonardo's observation as a basis for naturalistic representation, he cannot, on the other hand, share Leonardo's whole scientific system nor his method of analysis.

Bearing this in mind, it is worth looking again at the controversy raised in the *Academie Royale de la Peinture et Sculpture* over Leonardo's *Trattato della pittura*, which Freart de Chambray defined as *la regle de l'art et la guide de tous vrais peintres* in his dedication to Poussin. For Bosse, on the other hand, the *Trattato della pittura* could not become the only guidance to artists<sup>37</sup>.

In 1665, when he had already been expelled from the Academy, Bosse wrote a short essay on Leonardo's *Trattato*<sup>38</sup>. I shall leave for another occasion the detailed analysis of it. Here it is enough to note that Bosse, in addition to his rejection of Leonardo's method of analysis, points out a fundamental defect of the 1651 edition, concerning the drawings in some chapters that deal with colored shadows and colored reflections.<sup>39</sup>

In the 1640's in Paris, the discussion on general laws of art and science brought out criticism of the Mannerist painting and led to its being superseded. Artists like Jacques Stella, Laurent de La Hire, Eustache Le Sueur and Abraham Bosse reached common artistic solutions: they built unitary and coherent spaces, they used only one point of view, and simplified the composition and volumes. But, above all, they rejected the dichotomy between foreground and background, which is typical of Vouet's last paintings. Instead, they introduced many intermediary planes, characterized by less saturated colors, less defined outlines and lower gradients of contrast.<sup>40</sup> (fig.7-8)

37 On Leonardo's *Trattato della pittura* and the *Academie Royale*, see: M. Kemp, "A chaos of intelligence", in: *Il se rendit en Italie, Etudes offerts a Andre Chastel*, Rome, 1987, p. 415-426; Id., *The Science of Art*, New Haven, Yale University Press, 1990, p. 119-131.

38 Bosse, 1665, p. 132-140.

39 Ibid., Bosse criticizes the drawings of chapters LXXX-LXXXV (numeration refers to the 1651 edition) entitled respectively: "De' riflessi duplicati e triplicati"; "Comme nessun colore riflesso è semplice, ma à misto con le specie degli altri colori"; "Comme rarissime volte i riflessi sono del colore del corpo dove si congiungono"; "Dove più si vedra il riflesso"; "De' riflessi"; "Riflessione". The drawings were made in Rome by Pierfrancesco degli Alberti (before 1638) and were engraved in Paris by Charles Errard (around 1650). On these drawings see: F. Fiorani, "Le prime critiche al 'Trattato della pittura'", in: *Accademia Leonardi Vinci*, Firenze, 1992.

On Leonardo's theory of reflected colors, see: V. Ronchi, *op. cit.*, 1968; and C. Maltese, *op. cit.*, 1983.

40 Many drawings of L. De La Hire and E. Le Sueur document their diffuse use of Desargues' petit pied method in constructing perspective images (See: Laurent De La Hire, 1606-1656, exhibition catalogue, edited by J. Thuillier and P. Rosenberg, Grenoble, 14 jennuary-10 april 1989; A. Merot, Eustache Le Sueur, Paris, 1990). On La Hire, R. De Piles writes in his *Abregé de la vie des Peintres*, Paris, 1699, p. 487: "Il étoit tellement attache à la Perspective Aeriene qu'il confondoit toujours ses lointins dans l'exhalaison selon la méthode qu'il avoit apprise de Desargues. Il en usoit dans ses Figures comme dans ses lointins, car à la reserve de celles qui étoient sur les pré-

Abb. 7: Simon Vouet, *Le repos de la Sainte Famille*, Grenoble, Musée des Beaux Arts, 1636-40



Abb. 8: Laurent de la Hire, *Nativité*, Creil Eglise, Saint Médard, 1641 ca



mières lignes toutes les autres se perdoient dans un broüillard à mesure qu'elles s'éloignoient". In many of his drawings, L. de la Hire gives special attention to the loss of definition of the graphic sign according to its position in the real space and in the atmosphere, as Desargues did in his cage of 1636. The real contribution of J. Stella, Poussin's fellow and correspondent, is far more difficult to evaluate, since his letters to Poussin have been lost and since until today does not exists a modern and exhaustive study of his activity.

Around 1645 Poussin also designed compositions that point attention to the theory of shadows and aerial perspective and, no doubt, his paintings, which continued to arrive from Italy, were a constant point of reference for French artists; but certainly Desargues and especially Bosse's writings gave the needed theoretical and scientific support to contemporary artists.

On the other hand, we cannot assume that Desargues contributed to the definition of a new kind of pictorial space: his modern conception of space remains substantially foreign to contemporary artists. His infinite space, which has no privileged viewing point, but rather it is defined by an arbitrarily chosen center, is best to be seen in Desargues's geometrical drawings, not in the works of his contemporary artists. What Desargues provides them is in fact no more than a reliable, universal and briefer method for constructing a perspective image.