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Camera Obscura vs. Camera Lucida – Distinguishing Early Nineteenth Century Modes of Seeing

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Camera Obscura vs. Camera Lucida
Distinguishing Early Nineteenth Century Modes of Seeing[1]

Erna Fiorentini

If we look at Fig. 1, we see a painter holding an inspired pose while beholding and recording the landscape. Although he appears to be indulging in purely aesthetic rapture, he is equipped with optical drawing devices and with many other instruments for observation, tracing and measuring. A Camera Lucida is arrayed on a tripod on the right, surrounded by a telescope, a setsquare, a ruler, a pair of compasses and other devices, while in the background a tent-type Camera Obscura is in use. This motif belonged to Carl Jacob Lindström's well-known satiric, illustrated book *I Stranieri in Italia*, printed and distributed in Naples in 1830.[2] Moreover, Lindström produced countless further exemplars of this scene in watercolour, engraving and lithography. Because it was circulated in so many forms, this scene was noticed extensively within the multinational community present in Naples at that time.[3] This popularity of the caricature Lindström created shows the widespread popular derision of the attitudes (in this case ascribed to English gentlemen) of both the aesthetic appreciation of nature and instrumental recording that it describes. This in turn indicates that these attitudes had pervasively entered collective consciousness. And it is evidence of the fact that the represented use of optical drawing devices while observing and depicting Nature was a widespread custom around 1830.

In this paper, I want to point out that such instrumental practices are significant factors for estimating how the visual approach to nature was coloured in the early decades of the nineteenth century. Here, in fact, the direct observation and depiction of nature were valorised as processes producing both knowledge and aesthetic values.[4] These changes in attitude, in their turn, stimulated the production of new instruments and the unfolding of new practices of using them. Analysing the degree of distribution of such

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1 Unless otherwise noted, the translations are mine. Most of the original texts and images cited in this paper are gathered in Erna Fiorentini, ed., "Drawing with Optical Instruments. Devices and Concepts of Visuality and Representation", *ECHO Open Digital Library* 2005, <http://echo.mpiwg-berlin.mpg.de/content/optics>.

2 Carl Jacob Lindström, *I stranieri in Italia di Lindström* (Napoli: Lith. Partenope, 1830). Reprint in: Franco Mancini, *Carl Jacob Lindström e l'illustrazione di costume a Napoli* (Napoli: So.gra.me., 1980).

3 For the distribution of the sheets see Germana Aprato, "L'opera napoletana di C. Lindström," *Napoli nobilissima* 2 (1962): III, 103-111. See also Margareta Windqvist, *Tre svenska konstnärer i Neapel* (Stockholm / Roma, 1978).

4 See Werner Busch. "Die autonome Ölskizze in der Landschaftsmalerei. Der wahr- und für wahr genommene Ausschnitt aus Zeit und Raum," *Pantheon* 41 (1983): 126-133; Barbara Maria Stafford, *Voyage into substance: art, science, nature, and the illustrated travel account, 1760 – 1840* (Cambridge/Mass.: The MIT Press, 1984); Werner Busch. "Alexander Cozens' 'blot'-Methode: Landschaftserfindung als Naturwissenschaft," in: Heike Wunderlich, ed., *"Landschaft" und Landschaften im achtzehnten Jahrhundert* (Heidelberg: Winter, 1995), pp. 209-228.

instruments and the practices of observation related to them, this means, can lead us to the epistemic and aesthetic forces that were at work when vision was shaped and refined for the sake of imaging. Moreover, we can disclose the constraints regulating these forces, and eventually make general statements about a prevailing state of mind – in this case the particular way of seeing characterizing this period.[5]

Fig. 1: Carl Jakob Lindström, Den engelske konstnären (The English Painter), 1830. Watercolour, 7.6 x 10,16 in. (19,3 x 25,8 cm). Nationalmuseum, Stockholm. Inscribed on the suitcase "The effect I am sure of when first I have the lineament" (artwork © Statens Konstmuseer Stockholm; photograph © Bodil Karlsson 1993).

Toward this end, I will raise an issue that recent discussions of the terms in which modifications of vision emerged at the dawn of modernity have neglected,[6] namely the difference between the Camera Obscura and the *Wollaston prism* – the so-called Camera

5 In my argument, I draw very much upon James Secord's methodical reflections on the notion of "circulating knowledge". According to Secord, historical inquiries about social phenomena ought to distance themselves methodologically from explanations based on universal categories like 'breaking changes of episteme' or 'scientific revolutions'. Using Secord's notion of "circulating knowledge" the historical importance of specific, local 'popular' phenomena and practices, which are by no means marginal values in evaluating the communication of knowledge and the diffusion of attitudes, can be underscored. See James Secord. "Knowledge in Transit," *Isis* 95 (2004): 654-672.

6 This is notably, but in no way exclusively, the case in Jonathan Crary, *Techniques of the Observer. Vision and Modernity in the Nineteenth Century* (Cambridge/Mass: The MIT Press, 1990).

Lucida. Not only does the technology and history of these two devices differ; also, their impact on early-nineteenth century visual culture varied greatly in degree and quality, and was driven by different necessities. Moreover, the images presented to the observer by these devices are dramatically at variance with each other in their nature, and provide a completely different visual experience from one another. Against this background, I propose to assess the entirely divergent optical principles of these two instruments as metaphors for different modes of vision. I shall argue that most notably one of these modes – what I shall call the *Camera-Lucida- or 'prismatic' mode of seeing* – prevailed in observation and representation, as a peculiar trait of the visual approach to nature in early nineteenth century. It expresses the struggle for "understanding the subject–object relation in experience"[7] underlying many scientific as well as artistic enterprises of this period.

1. Distinguishing Technologies: a Box and a Prism

The basic step to understand the difference between the visual experiences conveyed by Camera Obscura and Camera Lucida is to consider the two devices in terms of their technology. In spite of the analogy of their names, in fact, they are two completely different apparatuses.

The Camera Obscura is indeed a *camera*, this means a room or a box in which a scene from the outside is projected – through a pinhole or with the help of lenses – onto a wall or a screen (fig. 2). The Camera Lucida, on the contrary, is neither a room nor a box, but nothing more than a little prism mounted on a stem that can be arbitrarily fixed on a table or on a small portable drawing board (fig. 3).

The analogy of the two names is thus not due to the technical similarity of both devices. Rather, the confusing adoption of the same term to describe them goes back to the understanding of the general notion of *camera* at the time when the Camera Lucida was invented, this is, as we will see, the very beginning of the nineteenth century. As John Hammond and Jill Austin convincingly proposed, in fact, around 1800 the word 'camera' had become commonly associated with 'drawing'. The term 'Camera Obscura' seems to have been felt to describe less the device as such than the process of drawing with it. As the Latin term was translated with 'dark Chamber', Camera Obscura was thus commonly understood as something like 'drawing in the dark'. Since drawing with the help of the prism, on the contrary, was done outside of chambers and boxes, the converse literal translation into Latin was adopted for this process: 'drawing in the light' became 'Camera Lucida', and this in turn tantamount to the device itself.[8]

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[7] See Jutta Schickore, "The 'philosophical grasp of the appearances' and experimental microscopy: Johannes Müller's microscopical research, 1824-1832," *Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003): 569-592, here 570.

[8] John H. Hammond and Jill Austin, *The camera lucida in art and science* (Bristol: Hilger, 1987), 13-14.

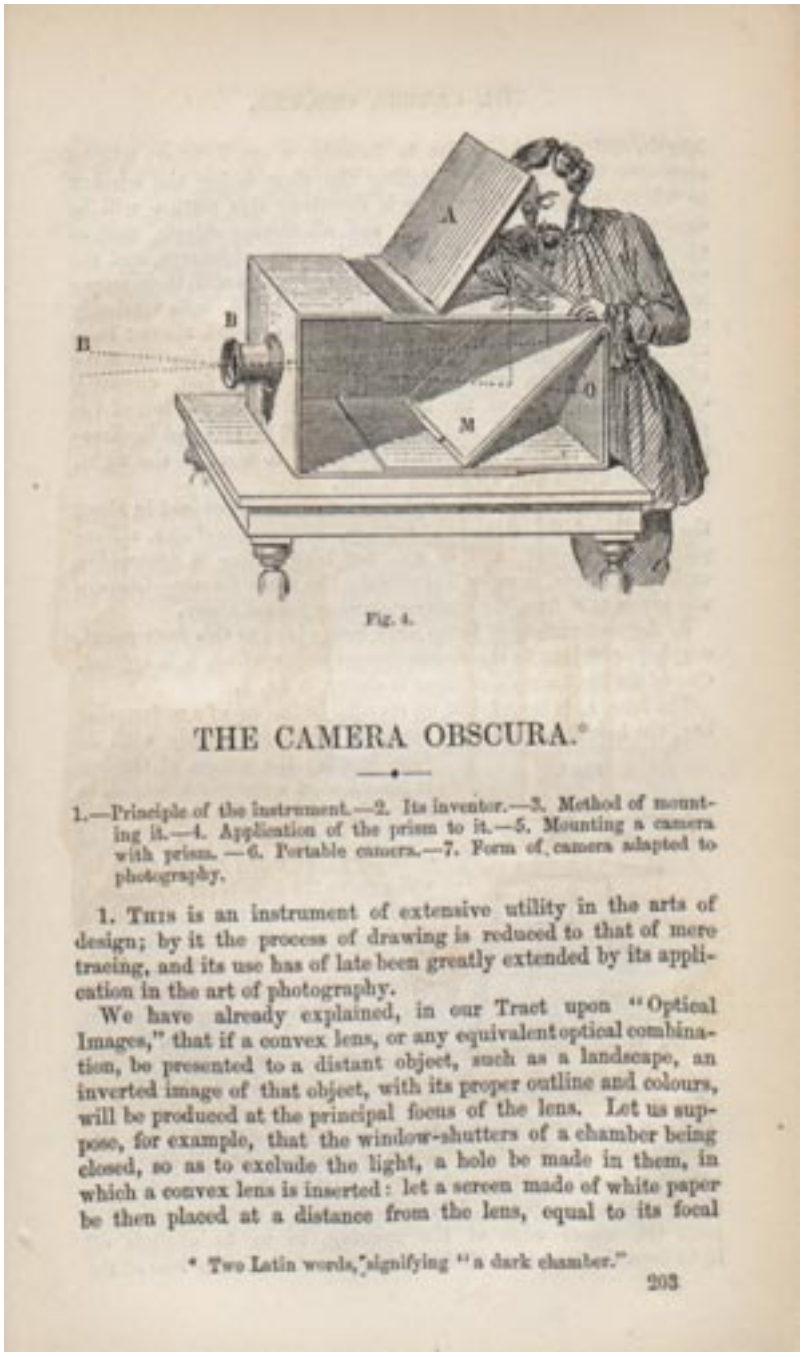

Fig. 4.

THE CAMERA OBSCURA.*

1.—Principle of the instrument.—2. Its inventor.—3. Method of mounting it.—4. Application of the prism to it.—5. Mounting a camera with prism.—6. Portable camera.—7. Form of camera adapted to photography.

1. This is an instrument of extensive utility in the arts of design; by it the process of drawing is reduced to that of mere tracing, and its use has of late been greatly extended by its application in the art of photography.

We have already explained, in our Tract upon "Optical Images," that if a convex lens, or any equivalent optical combination, be presented to a distant object, such as a landscape, an inverted image of that object, with its proper outline and colours, will be produced at the principal focus of the lens. Let us suppose, for example, that the window-shutters of a chamber being closed, so as to exclude the light, a hole be made in them, in which a convex lens is inserted: let a screen made of white paper be then placed at a distance from the lens, equal to its focal

* Two Latin words, signifying "a dark chamber."

Fig. 2: Box-type Camera Obscura, 1855, image in Dyonisus Lardner, The Museum of Science and Art, vol. 8. London 1855, p. 203.

2. Untangling Stories: an Old and a New Device

It is rather unfair to compare Camera Obscura and Camera Lucida in relation to their tradition. We could just as well liken an experienced old person with an infant.

The Camera Obscura as the older device has indeed a long and multifaceted history,[9] which starts with first reflections on the visual phenomenon peculiar to it in Aristotle's *Problemata physica.* Ibn al-Haitam, alias Alhazen, provided a first correct description of the basic principle in the tenth century, which however became broadly available only through the first edition of his work in the sixteenth century.[10] Nevertheless, after the middle ages analyses of Roger Bacon and John Pecham,[11] by the mid-fifteenth century the Camera Obscura had already become a standard device for astronomers, who used it mainly for the observation of solar phenomena. Indeed, the first image describing the principle of the Camera Obscura appeared in this context in 1545 (fig. 4).[12] In the late sixteenth century – after Geronimo Cardano's *De Subtilitate* -,[13] the introduction of convex lenses allowed a broader aperture and consequently a brighter and clearer image inside the dark room. Subsequently, explicit proposals appeared for the use of the Camera Obscura as a device suited to "draw with a pencil all the perspective and the shading and colouring, according to nature".[14] In the seventeenth century, Johann Christoph Sturm,[15] Johann Zahn[16] and Georg Friderich Brander[17] developed box-type Camera Obscurae, which were the fundament for later models commonly used by eighteenth century artists. Among them, the most prominent were

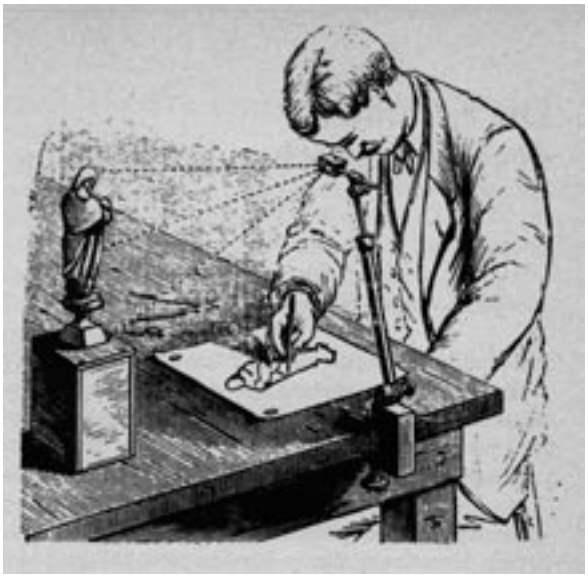

Fig. 3: Anonymous, Drawing with a Camera Lucida, first half of the nineteenth century, steel engraving, Originally George Eastman House, Rochester, current location unknown (Photograph © Deutsches Museum, München).

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9 A useful overview of the history of the Camera Obscura is given in John Hammond, *The Camera Obscura: A Chronicle* (Bristol: Hilger, 1981) and in Philip Steadman, *Vermeer's Camera* (Cambridge/Mass.: The MIT Press, 2001).

10 Friedrich Risner, *Opticae thesaurus: Alhazeni Arabis libri septem* (Basileae: Episcopios, 1572).

11 See David C. Lindberg. "The Theory of Pinhole Images from Antiquity to the Thirteenth Century," *Archive for History of Exact Sciences* 5 (1968-1969): 154-176. Also David C. Lindberg, *John Pecham and the Science of Optics: perspectiva communis* (Madison, Wis. [u.a.]: Univ. of Wisconsin Press, 1970).

12 Rainer Gemma Frisius, *Gemmae Frisii De radio astronomico & geometrico liber: in quo multa quae ad geographia, opticam, geometriam & astronomiam utilis sunt demonstrantur* (Antverpiae: Bontiõu, Phalesius, 1545).

13 Geronimo Cardano, *Hieronymi Cardani Medici Mediolanensis De Subtilitate: Libri XXI* (Norimbergae: Petreius, 1550).

14 Daniele Matteo Alvise Barbaro, *La pratica della perspettiva: opera molto profittevole a' pittori, scultori, et architetti* (Venetia: Camillo & Rutilio Borgominieri, 1568 (1569)), parte 9, 193.

15 Johann Christoph Sturm, *Collegium experimentale, sive Curiosum* (Norimbergae: Endter, 1676).

16 Johann Zahn, *Oculus Artificialis Teledioptricus, sive Telescopium* (Herbipoli [Würzburg]: Heyl, 1685-1686).

17 Georg Friderich Brander, *Kurze Beschreibung einer ganz neuen Art einer Camera Obscurae ingleichen eines Sonnen Microscops …* (Augsburg: Klett, 1769).

Gaspar van Wittel,[18] Antonio Canal, called *Canaletto*[19] or Joshua Reynolds – who appreciated William Storer's most acclaimed *Royal Delineator*[20] (fig. 5). The optical boxes used

Fig. 4: Solar eclipse in the Camera Obscura, 1545, image in Rainer Gemma Frisius, Gemmae Frisii De radio astronomico & geometrico liber: in quo multa quae ad geographia, opticam, geometriam & astronomiam utilis sunt demonstrantur. Antverpiae 1545.

by pioneers of photography like Thomas Wedgwood, Nicephore Niepce and Louis Jacques Mandé Daguerre in the early nineteenth century were of different fashion and called by different names. But they – except that the lenses were of improved quality – did not differ much from these early Camerae Obscurae and operated on one and the same projective principle.

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18 Cesare De Seta, *Vedutisti e Viaggiatori in Italia tra Settecento e Ottocento* (Torino: Bollati Boringhieri, 1999), 65-80; Christoph Lüthy. "Hockney's Secret Knowledge – Vanvitelli's Camera Obscura," *Early Science and Medicine* 10 (2005): 2, 315-339.

19 Giovanna Nepi Scirè, *Il Quaderno di Canaletto* (Venezia: Canal & Stamperia Editrice, 1997); Maria Agnese Chiari and Annalisa Scarpa Sonino. "Nuove osservazioni su Canaletto e la Camera Ottica," *Arte Veneta* 38 (1984): 106-118.

20 In a letter of 21 september 1777, Horace Walpole praised this instrument that "will perform more wonders than electricity". See Horace Walpole, *Selected Letters* (London, 1826) 79.

Unlike the Camera Obscura, recapitulating the history of the Camera Lucida up to the period of interest for this paper requires only few lines.[21]

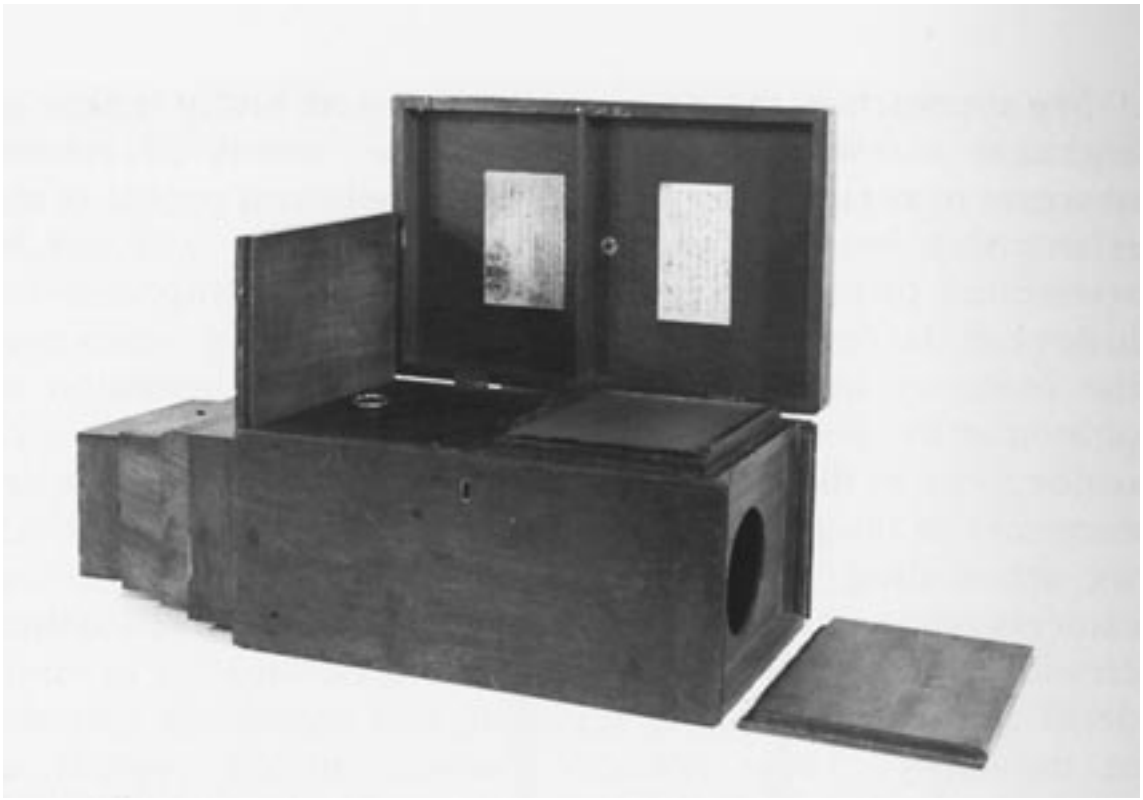

Fig. 5: William Storer, The 'Royal Delineator', 1778. Science Museum, London (photograph © Science Museum/Science & Society Picture Library).

Even though a prototype of the instrument (fig. 6) bears the date 1786,[22] this hardly corresponds to the actual history of the device, since Wollaston can have invented the instrument at the earliest in 1800. Henry Hasted reports, in fact, that during a joint geological excursion to the Lake District that year he and Wollaston "could only take the outline of the districts, for neither of us could draw well, and we lamented our not being able to do so", wishing an instrument capable of compensating this deficit.[23] Only some months later, according to Hasted, Wollaston had completed a first rudimentary prototype of the new instrument, "the very thing we wanted at the Lakes ... and very soon came forth that elegant and very useful little instrument, the 'Camera Lucida'".[24] The device was then patented in December 1806 as an "instrument whereby any person may

[21] For a detailed history of the Camera Lucida in the course of the nineteenth and twentieth centuries see Hammond / Austin, The camera lucida.
[22] Robert William Teodore Gunther, *Early Science in Cambridge* (Oxford: University Press, 1937), 109.
[23] Henry Hasted. "Reminiscences of Dr. Wollaston [Read Dec. 20, 1849]," *Proceedings of the Bury & West Suffolk Archaeological Institute* I (1853): 121-134, here 126.
[24] Hasted, "Reminiscences", 126.

draw in perspective, or may copy or reduce any print or drawing",[25] whereas the name *Camera Lucida* first appeared in Wollaston's *Description* of 1807[26] (fig. 7).

Fig. 6: William Hyde Wollaston, Prototype of the Camera Lucida, ca 1800, Whipple Museum of the History of Science, Cambridge University (photograph ©Whipple Museum of the History of Science, Cambridge University).

Fig. 7: William Hyde Wollaston, Camera Lucida, 1807, image in William Hyde Wollaston. "Description of the Camera Lucida," Journal of Natural Philosophy, Chemistry and the Arts XVII (1807): 80, plate 1.

3. Parting Fortunes: the New Eclipses the Old

The reaction to Wollaston's invention was overwhelming, and the spreading of the device throughout Europe a phenomenon of epidemic character.

That the new optical device had immediate success in England is not surprising, first because it had been invented by a very popular natural philosopher,[27] and secondly because it was produced by opticians like the Dollonds and Simms&Throughton, who

[25] The Patent No. 2993, 4th December 1806, was published as "Specification of the Patent granted to William Hyde Wollaston, ... for an Instrument whereby any Person may draw in Perspective, or may copy or reduce any Print or Drawing. Dated December 4, 1806," *The Repertory of Arts, Manufactures and Agriculture Second Series* X (February 1807): LVII, 161-164.

[26] William Hyde Wollaston. "Description of the Camera Lucida," *Philosophical Magazine* XXVII (1807): 343-347 and *Journal of Natural Philosophy, Chemistry and the Arts* XVII (1807): 1-5. See also William Hyde Wollaston. "Description de l'appareil appellé Camera Lucida," *Bibliothèque Britannique* XXXV (1807): 255-264.

[27] Contemporaries called William Wollaston "the pope". See Trevor I. Williams. "Wollaston; William Hyde (1766-1828)," in *Oxford Dictionary of National Biography* 2004, <http://www.oxforddnb.com/view/article/29842> (20 June 2005).

were not only particularly accredited but also enterprising,[28] thus contributing with their fame and advertising strategies to the quick diffusion of the device and to the lasting accommodation of the market's demands.[29]

The commercial potential of the Camera Lucida was very soon recognized, and all the major opticians of the time offered Camera Lucidas and different items thought to facilitate its use for drawing. In Paris, the 1815 edition of Jean Chevallier's catalogue already discusses the Camera Lucida, offering the corresponding portable drawing board,[30] and so did the catalogues of the brothers Charles and Vincent Chevalier, whose descriptions of the Camera Lucida should become a popular and often translated reading in the 1830s.[31] The major producers of high quality glasses in Munich, Joseph Utzschneider and Joseph von Fraunhofer, listed Camera Lucidas at least since 1816 in their catalogues.[32] Fraunhofer's fame was high, and buyers from everywhere in Europe, significantly also from England, bought the device there. Alongside the commercial, also the scholarly interest in the prism grew with great velocity, and a huge number of variants and improvements attempted by natural philosophers and physicists proliferated.[33] Most notably the variant developed by the physicist and astronomer Giovanni Battista Amici was destined to achieve the largest success under both aspects. Amici's publication of 1819[34] was translated in different languages and commented by important natural philosophers.[35] However, already early in 1817 Amici had travelled to Rome and Naples presenting his invention to the highly international audience that frequented these towns

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28 See Hugh Barty-King, *Eyes Right. The Story of Dollond & Autchinson Opticians 1750-1985* (London: Quiller Press, 1986), 84-106; Gloria Clifton. "Dollond family," in *Oxford Dictionary of National Biography* 2004, <http://www.oxforddnb.com/view/article/49855> (20 June 2005).

29 George Dollond, *The Camera Lucida. An Instrument for Drawing in true Perspective, and for Copying, Reducing, or Enlarging other drawings* (London, 1830); George Dollond. "A Catalogue of Optical, Mathematical and Philosophical Instruments," *Astronomische Nachrichten* 8 (1831): 48. Further Frederick W. Simms and Throughton. "Catalogue of Instruments," *Astronomische Nachrichten* 8 (1831): 38-42.

30 Jean C. Chevallier, *Le conservateur de la vue* (Paris, 1815), 305-309.

31 Charles Chevalier, *Conseils aux artistes et aux amateurs, sur l'application de la chambre claire a l'art du dessin, ou Instruction théoretique et pratique sur cet instrument, ses différentes formes et son utilité dans les arts et les sciences* (Paris, 1838); Vincent Chevalier, *Notice sur l' usage de la chambre claire (camera lucida)* (Paris, 1834); Charles Chevalier, *Die Camera Lucida. Eine gründliche Anweisung für Künstler und Liebhaber der Zeichenkunst über den Gebrauch dieses neuen optischen Instruments, das jetzt in Frankreich vielfach angewendet wird* (Quedlinburg/Leipzig, 1839).

32 See "Verzeichnis der optischen Werkzeuge, welche in der Mechanischen Werkstätte Utzschneider, Liebherr et Werner in München um nachstehende Preise verfertiget werden," *Zeitschrift für Astronomie und verwandte Wissenschaften* (August 1816): 165-179; "Verzeichnis der optischen Werkzeuge welche in dem Optischen Institute zu Benedictbeuren Utzschneider u. Fraunhofer für nachstehende Preise verfertiget und […] besorgt werden," *Anzeiger für Kunst- und Gewerbfleiß im Königreiche Bayern*, Dritter Jahrgang, Monatliche Anzeige, 2 (1817): 27.

33 E.g. Joseph Schöps, *Beschreibung und Erklärung eines neu erfundenen Graphoskop* (Wien, 1811); "Beschreibung einer veränderten Camera Lucida. Von Professor Lüdicke in Meissen," *Annalen der Physik* 42 (1812): 3, 338-342; W. G. Horner. "New and important combinations with the camera lucida," *Annals of philosophy* 6 (1815): 281-283; Anonymous. "Maschine zum Zeichnen," *Anzeiger für Kunst und Gewerbefleiß im Königreiche Baiern* 47 (23 November 1816): 723-730; Alexander Wadell. "Account of a New Optical Instrument, which combines the properties of a Compound Microscope, Camera Obscura, Camera Lucida, and Diagonal Mirror," *The Edinburgh Philosophical Journal* V (1821): 143-146.

34 Giovanni Battista Amici. "Sopra le camere lucide," *Opuscoli Scientifici* 3 (1819): 13, 25-35.

after the Napoleonic wars.[36] The following resounding success of his Camera Lucida is witnessed in many letters, in which Amici complains not to be able to satisfy quickly enough the countless incoming orders.[37] In turn, Amici's selling books provide exhaustive evidence for an extremely international and varied network of Camera Lucida buyers covering all Europe and overseas.[38] A statistical overview of the selling movements from this major centre of distribution makes evident that the Camera Lucida rather suddenly and very lasting eclipsed the Camera Obscura as an instrument serving observation and drawing: Amici's workshop delivered 269 Camera Lucidas between 1815 and 1832, whereas only 2 Camera Obscurae were sold in this period.[39] Moreover, specific discussions about the pros and cons of the two devices were only sporadically carried out short after the invention of the Camera Lucida,[40] and hushed afterward. Accordingly, after the spreading of the Camera Lucida, the Camera Obscura was no longer the most celebrated wonder of visuality and visualization it had been by the end of the eighteenth century,[41] but became no more than an "amusing optical instrument"[42] and a "curious object".[43]

4. Diverging Necessities: Old and New Demands

There are many concomitant reasons for the triumphal procession of the Camera Lucida associated with the eclipse of the Camera Obscura. The most striking are related to

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35 "Sur la chambre claire (camera lucida). Par le Professeur J.B. Amici, de Modène. Traduit de l'italien," *Annales de Chimie et Physique, par MM. Gay-Lussac et Arago* 22 (1823): 137-155; David Brewster. "Prof. Amici's improved camera lucida," *Edinburgh Journal of science* 3 (1825): 157.

36 See *Giovanna Amici Grossi* (ed), I Diari dei viaggi e altri documenti della vita e dell'attività di Giovanni Battista Amici, in: Atti della Fondazione Giorgio Ronchi 51,6 (1996) 873-919, in particular 886-897. For a new edition of Amici's travel diaries see Alberto Meschiari, ed., *Il Libro de' conti del laboratorio di Giovanni Battista Amici e altri documenti inediti* (Firenze : Tassinari, 2003).

37 "non potete immaginarvi le pressanti ricerche che mi son state fatte di quelle camere lucide per cui mi sono trovato imbarazzato a contentare tutti" (letter of october 19, 1818). See Alberto Meschiari. "Giovanni Battista Amici e il Reale Officio Topografico di Napoli: Corrispondenza con i Colonnelli Visconti, De Sauget, Melorio," *Physis* NS, XXXIX (2002): 197-199, letter no. 14.

38 Alberto Meschiari. "Il Libro de' conti del laboratorio di Giovanni Battista Amici," *Atti della Fondazione Giorgio Ronchi* LVI, 1 (2001): 55-114, here 59. For an enlarged edition see Meschiari, Il Libro de' conti 2003.

39 Meschiari. "Il Libro de' conti" 2001, 61-62.

40 See for instance Robert Brettell Bate. "On the camera lucida (Letter)," *Journal of Natural Philosophy, Chemistry and the Arts* 24 (1809): 146 -150; T. Sheldrake. "On the Use of the Camera Lucida as a Substitute for the Camera Obscura (Letter)," *Journal of Natural Philosophy, Chemistry and the Arts* 25 (1810): 173-177; T. Sheldrake. "On the Camera Lucida (Letter)," *Journal of natural philosophy, chemistry and the arts* 23 (1809): 372-377; Anonymous. "The camera lucida," *Athenaeum* 148 (28 August 1830): 540-541.

41 "Say, rare machine, who taught thee to design? / And mimick Nature with such Skill divine … / Exterior objects painting on the scroll / True as the Eye presents 'em to the Soul". Anonymus poem published in 1747 by the Londoner instrument Maker John Cuff. See *The Dictionary of Art* (New York: Grove [u.a.], 1996), vol. 5, s.v. Camera Obscura.

42 George William Francis, *The dictionary of the arts, sciences, and manufactures* (London: Brittain, 1842), sv. Camera Obscura.

43 "Objet curieux", see Ernest Hareux, *L'outillage et le matériel nécessaires à l'atelier ou en plein air. Cours complet de peinture a l'huile* (Paris: Laurens, (1901), 34.

changes in the demands of observation and recording taking place at the beginning of the nineteenth century. As I will try to show in the following, these changing demands were connected with new, more sophisticated expectations towards technological advancement. They also went along with fundamental shifts in the conception and in the goals of landscape surveying, which modified the view on the problem of portability and immediate recording, affecting several different fields of study.

Fig. 8: Robert Hooke, Picture Box, 1694, image from Robert Hooke. "An Instrument of Use to take the Draught, or Picture of any Thing. Communicated by Dr. Hook [sic] to the Royal Society Dec. 19., 1694", in William Derham, Philosophical Experiments and Observations of the late eminent Dr. Hooke (London, 1726) 295.

The flair of novelty and the surprise about a technical wonder always triggered the interest in a new optical instrument, and this was indeed a major component at every stage of the recurring success of the Camera Obscura.

In the case of the Camera Lucida, though, the fascination of technological advancement went along with new, more sophisticated expectations. At the beginning of the nineteenth century, in fact, the quality standards which should be fulfilled for the production of a functioning optical device had become higher, and there was a broader awareness of the difficulties that had to be surmounted in order to fill the requirements of these standards.[44] First, the availability of the appropriate basic material for high quality raw glass – sandstone and different alkali minerals -, should be guaranteed, a condition depending not only on the financial power of the producer, but also on the geographical position and on a favourable commercial and political constellation supporting the accessibility of suitable mineral deposits. Moreover, the state of the art in optics at the beginning of the nineteenth century, and particularly at the heyday of the Camera Lucida around 1820, was not so advanced to allow good results and an extensive production everywhere.[45] It was indeed very difficult to produce raw glass with the necessary properties for a high quality prism, which were manifold: the glass had to be homogeneous in chemical composition and free from striae, streaks, and bubbles, which deflect the paths of transmitted light rays producing impairments of the perceived image. Furthermore, the raw glass had to be free from colour, perfectly transparent, physically and chemically stable, and to have precisely known refraction indices for different colours.[46] In addition, high technical skills were required to grind the optimized raw glass into the desired form.[47] Not surprisingly, those keeping the monopoly for high quality optical instruments like the Camera Lucida were at the same time the most skilled opticians possessing enough expertise and command of the technology to fulfil these criteria: Beyond the Dollonds and the Chevaliers, they were most notably again Fraunhofer and Amici. Given these new difficulties in creating ideal conditions in the optical material, respect and admiration for the command of technological skills and for scientific insight were the elements adding, for the Camera Lucida, a new and unusual force to the aura of wonder always surrounding the opticians' ability in supplying optical instruments able to improve observation and depiction.[48]

Another important area of changing demands in this period was related to landscape surveying. From the seventeenth century onwards, following the need to optimise the study and recording of natural formations with the help of optical instruments, first

44 In 1824, these criteria for a desirable quality of glass for optical purposes were officially enumerated in order to establish a standard of quality. John Herschel outlined for instance such a catalogue for the Joint Committee of the Board of Longitude and the Royal Society for the Improvement of Glass for Optical Purposes (created 1.4.1824). See *Royal Society of London Archives*, Herschel Letters, 26.45, folio1, cited in Myles W. Jackson, *Spectrum of Belief. Joseph von Fraunhofer and the Craft of Precision Optics* (Cambridge, Mass. [u.a.]: The MIT Press, 2000), 34.

45 What in this case is meant with 'optics' is of course not so much the theoretical optics of the natural philosophers, but the "trial-and-error procedures of instrument makers and opticians" (Jackson, Spectrum of Belief, 17).

46 Jackson, Spectrum of Belief, 61-62.

47 See e.g. Amici. "Sopra le camere lucide," 28.

48 "Dr. Wollaston gave me a little prism, which is doubly valuable, being of glass manufactured at Munich by Fraunhofer.", Mary Somerville around 1820, as cited in Jackson, Spectrum of Belief, 100.

portable models of Camera Obscurae had been developed for the activity afield.[49] Robert Hooke's helmet[50] (fig. 8) did not find particular acceptance, and further singular efforts to develop a portable box-type Camera Obscura did not lead to a satisfying form of the device.[51] One model, Johannes Kepler's tent-type Camera Obscura,[52] later improved by a revolving turret for circular observation (fig. 9), proved to comply well with the increasing mobility demands. Thomas Sandby, for instance, who was employed in the Drawing Office of the Tower of London as an official topographer, might have used this model for his on-the-spot panoramic views, like the sight on Windsor Castle (fig. 10), which in fact bears the inscription "drawn *in* a camera".[53] In the eighteenth century, the device was not only used in topography, but was deemed "advantageous for the landscape painter… when used in the field".[54] The tent Camera Obscura survived until late in the nineteenth century, as Lindström's sheet (fig. 1) and numerous sales catalogues demonstrate.[55]
However, these more or less portable models seem not to have appropriately satisfied the new necessities of surveying emerging at the very end of the eighteenth century and after the Napoleonic era. These new necessities were concomitant with the passage of cartography from the direct influence of the Royalties and their geographers to the plural responsibility of military institutions representing national interests, where geographical engineers developed the maps.[56] The new needs followed a new principle prevailing in the

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49 "It is, therefore, the interest of all such, as desire to be rightly and truly informed … to promote the use of such contrivances … that may be of use to curious navigators and travellers … to take prospects of countries, and coasts as they appear at sea from several distances, and several positions … and any other thing of which an accurate representation, and explanation, is desirable". It was in fact complained that most printed topographical recordings in travel guides did not provide a realistic representation of the actual landscapes, but little more than "Mr. Engraver's fancy … that instead of giving us a true idea, … misguide our imagination, and lead us into error". See Robert Hooke. "An Instrument of Use to take the Draught, or Picture of any Thing. Communicated by Dr. Hook [sic] to the Royal Society Dec. 19., 1694," William Derham, *Philosophical Experiments and Observations of the late eminent Dr. Hooke* (London: Innys, 1726), 292- 296, here 292, 294, 295.

50 Hooke described it in two variants. The first in Robert Hooke. "A Continuation of the former Subject of Light. Being the Lectures read in June, 1681," *The Posthumous Works of Robert Hooke.* Published by Richard Waller (London: Printed by S. Smith and B. Walford, 1705), 127-128, plate 1, fig. 7; the second in Hooke. "An Instrument of Use", 296.

51 "Packing and repacking, mounting and rectifying these instruments alone, besides the attention and time necessary in using them, required what would have occupied one man". See James Bruce, *Travels to discover the Source of the Nile* (Edinburgh: Printed by J. Ruthven for G.G.J. and J. Robinson, 1790) viii-xii, here xi.

52 The "little black tent" is described in a letter to Francis Bacon by Henry Wotton, *Reliquiae Wottonianae* (London: Marriot u.a., 1651) 413. Wotton met Kepler during a visit to Linz in Austria in 1620. See also Steadman, Vermeer's Camera, 11-13.

53 Adolf P. Oppé, *The Drawings of Paul and Thomas Sandby* (Oxford: Pahidon, 1947) no. 14602, emphasis is mine.

54 "Zum Beschluß erinnert man noch, daß sich die Landschaftmahler mit Vortheil der finstern Cammer (camera obscura) bedienen, wenn sie in der Natur eine Landschaft zeichnen wollen. … Beym Gebrauch dieses optischen Instruments auf flachen Felde stellen sie es auf ein Stativ, und verhüllen sich beym Zeichnen den Kopf, damit ihnen das Licht nicht hinderlich sey". See Peter Nathanael Sprengel, *Handwerke und Künste in Tabellen* (Berlin, im Verlag der Buchhandlung der Realschule, 1773), 30-31.

55 See for instance Simms / Throughton. "Catalogue of Instruments,"; Benjamin Pike Jr., *Pike's Illustrated Descriptive Catalogue of Optical, Mathematical and Philosophical Instruments, manufactured, imported, and sold by the author* (New York, 1856), Vol. I, 58-60, 343-345, 363-364, 373; Hareux, L'outillage, 32-33.

theory and practice of surveying, the principle of "perceptive conformity"[57] between representation and territory. According to this principle, it was of the utmost importance that the drawings made afield enabled the user to associate immediately the topographical information of the map with the features of a factual landscape.[58] This was equally important for military scopes: the panoramic spatial description recorded by drawing *à coup d'oeil* and highlighting "what is essential vis-à-vis the negligible"[59] was practised to support immediate field recognition as a crucial strategic issue in land and coastal surveying.[60] The Camera Lucida ideally fulfilled these demands, which up to 1810 were only insufficiently met using cumbersome glass pane apparatuses like the *glace a calquer*.[61] Although the Camera Lucida was not suitable for numerical recording,[62] its pocket format and the small weight of the optional items necessary for drawing were precious in the immediate gathering and recording of the most salient features of the observed spot according to the new principles.

The portability of the new device, supporting the immediate experience afield, also met new attitudes connected to the observation of nature in the first three decades of the nineteenth century. Here, in fact, the interest in landscape and on-the-spot observation and recording grew dramatically, and in terms of experience and representation very much was expected from the direct exposure to the physical world.[63] The most typical

56 Vladimiro Valerio. "Dalla cartografia di Corte alla cartografia dei Militari: aspetti culturali, tecnici e istituzionali," *Cartografia e Istituzioni in Età Moderna* (Genova: Societa Ligure di Storia Patria, 1987), vol. I, 59-78.

57 See Vladimiro Valerio. "Cartography, Art and Mimesis," in: Erna Fiorentini, ed., *The Osmotic Dynamics of Romaticism. Observing Nature – Representing Experience 1800-1850* (Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, 2005), 55-78.

58 "Il faut que le dessin nous transporte sur le terrain", see Aristide Michel Perrot, *Modèles de Topographie* (Paris: Chez l'auteur, Rue du Cherche-Midi, no.39; Magimel, Anselin et Pochard, a la libraire militaire Rue Dauphine, no9 Picquet, graveur-géographie, Quai Conti, no.17; Ladvocat, libraire, Palais-Royal, Galerie de Bois, no.197., 1819), 5. See also Vladimiro Valerio, *L'occhio mutevole: militari e mappe tra rivoluzione e restaurazione* (Firenze: L. S. Olschki, 2003).

59 Fernand-Louis-Joseph-Élisé Lefebvre, *Le Paysage militaire, emploi du croquis panoramique en campagne et dans les reconnaissances* (Paris: R. Chapelot, 1901).

60 See for instance Claude Matieu Delagardette, *Nouvelles règles pour la pratique du dessin et du lavis de l'architecture civile et militaire* (Paris: chez Barrois l'aîné & fils, an XI [1803]), §295-296, §475-485; F. Schienert, *Die Situationszeichnung für Soldaten* (Berlin: Schropp, 1805); Arthur Frank Umfreville Green, *Landscape Sketching for Military Purposes* (London: Hugh Rees, 1908).

61 Delagardette, Nouvelles règles, §508-512, Pl. XV, fig. 1, fig. 2

62 Surveyors and cartographers accomplished this measuring and numerical activity up to the twentieth century with the help of mathematical instruments like the plane table or planchette as the "universal instrument of topography". See *Cenno storico dei lavori geodetici e topografici eseguiti nel Reale Officio Topografico di Napoli e metodi in essi adoperati* (Napoli, Reale tip. militare, 1851),15. See also Pike, Illustrated Descriptive Catalogue, 58-60 and *Catalogo generale descrittivo degli strumenti geodetici e topografici dell'Istituto Geografico Militare al 27 ottobre 1922* (Firenze: Tip. Barbera, di Alfani e Venturi, 1922), 236.

63 "... the variety of a surface observable in nature should be indicated ... the neglect of this will render it impracticable to make a picture with sufficient degree of local truth from the sketch, when out of sight of the scene in nature". See Francis Nicholson, *The practice of drawing and painting landscape and nature* (London: J. Murray, 1823), 28. See further *A Concise Summary of a Series of Notes and Observations, Practical and Theoretical, on the Art of Landscape Painting in Water Colours* (London, 1831), 27: "Artists of real talent ... make it a rule to admit nothing into their pictures which has not been poutrayed [sic] and studied from Nature".

trait was a shifting of interests from issues of "position and site" to issues of "place and region".[64] The latter – referring to physical spaces as loaded with connections to the personal experience and the history of the singular observer – became the proper objects of landscape experience and representation. This shifting did not necessarily express the interest in the fixation of glimpses, but rather in the re-construction of what was experienced on the site in relation to the 'history' of this site and of its individual observer.

Fig. 9 A: Anonymous, Tent-type Camera Obscura, image in Ernest Hareux, L'outillage et le matériel nécessaires à l'atelier ou en plein air. Cours complet de peinture a l'huile (Paris, 1901) 33.

Fig. 9 B: Revolving turret for tent-type Camera Obscura, 1865, brass and glass, ca 7 x ca 3.5 in. (ca 18 cm x ca 9 cm). Physics Laboratory & Museum of Scientific Instruments, University of Urbino (photograph ©Physics Laboratory & Museum of Scientific Instruments, University of Urbino).

The memory of the immediate and manifold personal experiences of the place – retained through real-time visual recording with the Camera Lucida – facilitated on the one hand the emotional identification with an entire region;[65] on the other hand, it also sustained the factual knowledge about this region,[66] meeting the methodical demands of contemporary inductive natural philosophy, based on the "*after-rumination*"[67] and analysis of the multiplicity of observations collected on the field.[68] In this light, it is surely

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64 Edward S. Casey, *Representing Place. Landscape Painting & Maps* (Minneapolis/Minn.: Univ. of Minnesota Press, 2002), 271.

65 This was the programmatic goal of illustrated descriptions commissioned at the beginning of the nineteenth century, for instance the *Viaggio pittorico nel Regno delle Due Sicilie dedicato a sua Maestà il Re Francesco primo. Pubblicato dai SSri Cuciniello e Bianchi in Napoli presso gli editori Vico S. Anna di Palazzo n. 38 e presso Nicola Settembre negoziante di carta strada Toledo n. 290.* See Maria Rosaria Nappi. "Il Viaggio Pittorico nel Regno delle Due Sicilie," *Dialoghi di Storia dell'arte* VIII-IX (1999): 50-68.

66 Casey, Representing Place, 76-77.

not surprising that the idea for the new instrument was conceived in England. Indeed, the feeling for 'places' as a notion opposed to mere 'space' had a long tradition here, in spite of the philosophical "regime of space"[69] in which it was rooted. The foundation of the English Watercolour Society in 1804[70] is symptomatic of this attitude that John Constable will later congenially represent, wishing to "not forget early impressions",[71] thus approaching the places and their representation in the light of personal emotional and historical memory. However, many examples show that these changes in the feeling for places must have been prevalent throughout Europe at the beginning of the nineteenth century, and that the rapid and widespread adoption of the Camera Lucida was a phenomenon closely connected with these changes.[72]

Fig. 10: Thomas Sandby, "Windsor Castle from the Goswells, Drawn in a Camera", 1770, pencil and water colour. Royal Library, Windsor (artwork and photograph: The Royal Collection ©2006, Her Majesty the Queen Elizabeth II.)

Moreover, the success of the Camera Lucida was not confined to a specific field of application, but was pervasive in many different spheres concerned with on-the-spot observation and visualization. The Camera Lucida is "used by all ye artists I find!",[73] the painter John Sell Cotman reports in 1817. He himself – during his *Picturesque Tour of Normandy* between 1817 und 1820[74] – used the device, as did the sculptors Sir Francis

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67 John Frederick William Herschel, *A preliminary discourse on the study of natural philosophy* (London: Printed for Longman, Rees, Orme, Brown, Green, and J. Taylor, 1830. Reprint Chicago/Ill. [u.a.]: University of Chicago Press, 1987) 77, §67.

68 See Erna Fiorentini. "Practices of Refined Observation. The Conciliation of Experience and Judgement in John Herschel's Discourse and in his Drawings," in: Fiorentini, The Osmotic Dynamics, 13-34.

69 Most notably the philosophy of Gassendi, Newton, Locke and Leibniz. See Edward S. Casey, *The Fate of Place. A Philosophical History* (Berkeley: Univ. of California Press, 1998), Ch.VI, 8.

70 Charles Holme, *English Watercolours* (London: Offices of "The Studio,", 1902).

71 Constable's Letter of 1812, as cited in Michael Rosenthal, *Constable: The painter and his landscape* (New Haven: Yale University Press, 1983), 49.

72 See for instance Erna Fiorentini. "Nuovi Punti di vista. Giacinto Gigante e la Camera Lucida a Napoli," in: Martina Hansmann and Max Seidel, eds., *Pittura Italiana nell'Ottocento* (Venezia: Marsilio, 2005), 535-557. Further Erna Fiorentini. "Scambio di vedute. Lo sguardo sulla natura e la Camera Lucida tra i paesaggisti internazionali a Roma intorno al 1820," in: Lorenz Enderlein and Nino Zchomelidse, eds., *Looking across borders: Artistic and intellectual exchange in Rome during the first half of the 19th century* (Roma: L'Erma di Bretschneider, 2006).

73 John Sell Cotman, Letter to Dawson Turner, 12 june 1817. See H. Isherwood Kay. "John Sell Cotman's Letters from Normandy," *Walpole Society* 14 (1925-1926): 94.

74 See Michael Pidgley. "Cornelius Varley, Cotman, and the Graphic Telescope," *Burlington Magazine* 114 (1972): 4, 781-786.

Chantrey[75] and Thomas Campbell.[76] The device "has come into very general use for drawing landscapes",[77] and was adopted by international landscape painters from Wilhelm Huber and Giacinto Gigante[78] to Massimo d'Azeglio, from Julius Schnorr von Carolsfeld and Franz Horny to Wilhelm Götzloff.[79] The head of the Turin academy of Fine Arts, Giovanni Battista Biscarra, purchased a Camera Lucida at Giovanni Battista Amici's laboratory in Modena in 1821, together with draughtsman Angelo Boucheron,[80] whose "magic and furious pencil astonished all town"[81] with the help of the device. Besides all the professional artists, a whole generation of amateur draughtsmen and draughtswomen was fascinated by the Camera Lucida, representative examples being Henrietta Ann Fortescue[82], a pupil of Francis Nicholson,[83] or the family of Henry Fox Talbot.[84] A number of archaeologists put particular emphasis on their using the Camera Lucida to draw the views of the monuments they studied. William Gell, for instance, considered in the 1819 edition of his *Pompeiana* that "it may be proper to state, that the original drawings for this work were made with the camera lucida", reiterating in the 1835 edition "that the views and pictures have been uniformly made by the Author, as before, with the prism of Dr. Wollaston". [85] Edward William Lane maintained in his *Description of Egypt* that "delineations of the monuments, scenery &c. of those countries… [were], with few exceptions, made with the camera-lucida".[86] Also military institutions of surveying, for instance the Officio Topografico in Naples, were particularly interested in the Camera Lucida,[87] and the device became a useful companion for the documentation of voyages in remote countries.[88] As Captain Basil Hall stated after his travels in North America, "this valuable instrument ought, perhaps, to be more generally used by travellers than it now is; for it enables a person of ordinary diligence to make correct outlines of many foreign scenes, to which he might not have leisure, or adequate skill, to do justice in

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75 Larry J. Schaaf, *Tracings of Light* (San Francisco: The friends of photography, 1990), 27-28.
76 Helen Smailes. "Thomas Campbell and the Camera Lucida," *The Burlington Magazine* 129 (1987): 1016, 709-714.
77 David Brewster, *A Treatise on Optics* (London: Longman, Rees, Orme, Brown and Green, 1831), 333.
78 Fiorentini. "Nuovi Punti di vista".
79 Fiorentini, "Nuovi punti di vista".
80 Meschiari. "Il Libro de' conti " 2001, 67.
81 Letter of Nicola Crosa di Vergagni to Giovanni Battista Amici (Biblioteca Universitaria Estense di Modena, Fondo Giovanni Battista Amici, cartella 291).
82 See Katherine Macinnes. "Unconventional Tourist," *Antique Dealer and Collector's Guide* 50 (1996): 38-41.
83 Nicholson, The practice of drawing, 28.
84 See Martin Kemp. "Talbot and the Picturesque View. Henry, Caroline and Constance," *History of Photography* 21 (1997): 4, 270-282.
85 See William Gell & John Peter Gandy, *Pompeiana: The topography, Edifices, and Ornaments of Pompeii* (London: Rodwell and Martin,1817-1819), xvi; William Gell & John Peter Gandy, *Pompeiana: The topography, Edifices, and Ornaments of Pompeii* (London: Lewis A. Lewis, 1835), I, 109.
86 Jason Thompson, ed., *Edward William Lane, Description of Egypt: notes and views in Egypt and Nubia, made during the years 1825, 1826, 1827, and 1828: chiefly consisting of descriptions and delineations of the monuments, scenery &c. of those countries; the views, with few exceptions, made with the camera-lucida* (Cairo: American Univ. in Cairo Press, 2000).
87 Meschiari. "Giovanni Battista Amici e il Reale Officio Topografico di Napoli", 197-199.
88 William Bullock, *Six Months' Residence and Travels in Mexico* (London: John Murray, 1824), 54.

the common way".[89] Many natural philosophers, physicists, engineers and anatomist were also enthusiastic users of the Camera Lucida.[90] John Herschel was a skilled Camera Lucida draughtsman, and integrated the device in his multifaceted method of inquiry,[91] as did the Scottish astronomer Charles Piazzi Smith.[92] After Giovanni Battista Amici's patent of a catoptrical microscope with a Camera Lucida ocular,[93] the device became an indispensable option also for microscopic observation and drawing.

5. Discerning Visual Modalities: Projective vs. Prismatic Seeing

The broad success of the Camera Lucida was an international phenomenon independent from the fields of application of the device and from the different interests and goals connected to these fields. Moreover, the Camera Lucida fulfilled expectations related to the direct, first person experience of nature and its imaging that the Camera Obscura was no longer able to meet. This suggests that these new expectations must have had a general validity.

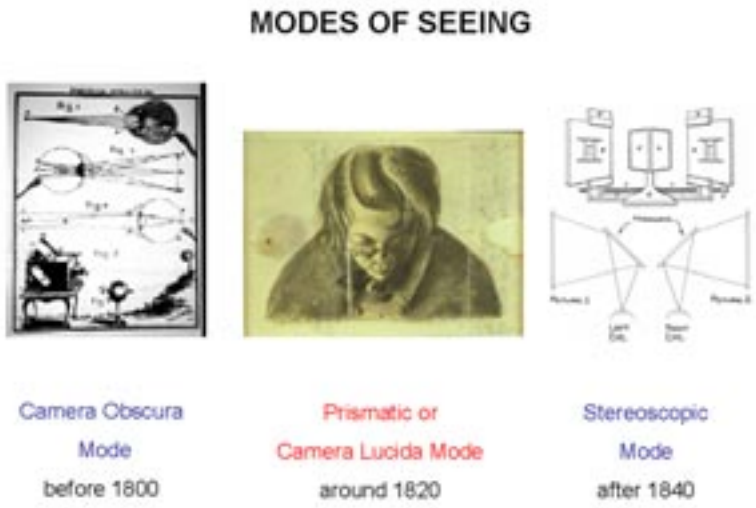

Fig. 11: Diverse modes of vision in early nineteenth century (© the author).

If so, I argue, an own modality of vision must have been established at the beginning of the nineteenth century. An appropriate description of this modality would fill the historical gap left by the scholarly assumption of a sudden and overthrowing transition to

89 Basil Hall, *Forty etchings – from sketches made with the camera lucida in North America in 1827 and 1828* (Edinburgh: Cadell & Co., 1829), ii.

90 Among many others, the physicist Marc-Auguste Pictet, the microscopist Friedrich Hoffmann and the head of the Museum of Physics and Natural History in Florence, Girolamo Bardi, purchased a Camera Lucida. See Meschiari. "Il Libro de' conti" 2001, 55-114.

91 Fiorentini. "Practices".

92 Brian Warner, *Charles Piazzi Smith. Astronomer-Artist* (Cape Town [u.a.]: BALKEMA, 1983).

93 Giovanni Battista Amici. "Account of an Improved Catoptrical Microscope," *Edinburgh Philosophical Journal* 2 (1820): 135-138.

'modern' systems of perception and knowledge in this period[94] (fig. 11). The necessity of a further differentiation of visual categories for the beginning of the nineteenth century becomes evident if we listen to the users' voices about what the Camera Obscura and Camera Lucida could accomplish in terms of visual experience and of its translation into images. Against this background I shall eventually regard the optical principles upon which these devices are constructed as metaphors for two clearly distinguished modes of seeing. Although they were to a certain degree concomitant, they nevertheless represent competing visual modalities. I propose to call these respectively 'projective' and 'prismatic seeing'.

5.1. Accuracy and Perceptual Experience: Criteria in Comparison

5.1.1. Degrees of 'Truth to Nature'

One of the principal criteria used to ascribe a certain value to an optical device for observation and drawing was the degree of accuracy of the image it produced in comparison to the original object. Specifically, this could mean the amount of vraisemblance or veracity that could be reached in the depiction of the image the device was able to bring into view. Intriguingly, in this point the Camera Obscura and the Camera Lucida do not differ very much from each other, since both of them present deficiencies, though of different kind.

In the case of the Camera Obscura, the common sense notion of a mechanical copying device in which "nature depicts itself, presenting outer objects in apparent proportion and lively colour which can be copied"[95] with a high degree of accuracy, was just one side of the coin. In fact, it was generally acknowledged that the optical effects resulting from the curved surfaces, the varying thickness and the quality of the lenses impaired the exactness of the image produced by the Camera Obscura. Thus, users like Antonio Canal, *il Canaletto*, had "to become familiar with the faults it [the camera] causes to painting if the artist places full reliance upon the perspectives he sees in the camera, particularly the aerial colours, and to remove all what hurts the senses".[96] One major defect was the distortion in the image seen in the Camera Obscura, which could be "traced right only in the centre,

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94 The idea of truncation that has been threading the discussion from Michel Foucault, *Les mots et les choses: une archéologie des sciences humaines* (Paris: Gallimard, 1966) to Jonathan Crary, Techniques of the Observer, I argue, cannot alone account for changes gaining momentum in a historical space.

95 "Darauf die Natur sich selbsten abmalet, und die äußere Gegenstände in scheinbarer Verhältnis und lebhaften Farben … zum nachzeichnen vorstellt". See Johann Heinrich Lambert, *Anlage zur Perspektive* (1752). Manuskript Cod. chart. B. 736 in the Basel University Library, 69 v, in: Johann Heinrich Lambert, *Schriften zur Perspektive. Herausgegeben und eingeleitet von Max Steck* (Berlin: Lüttke, 1943), 161-186, here 161-163.

96 "a conoscerne i difetti che recar suole ad una pittura, quando l'artefice interamente si fida delle prospettive che in essa camera vede, e delle tinte spezialmente delle arie, e non sa levar destramente quanto offende il senso". See Anonio Maria Zanetti, *Della Pittura veneziana e delle opere pubbliche de' veneziani maestri* (Venezia: Albrizzi, 1771), 463.

because in the periphery the light rays mix and disperse".[97] Even at the beginning of the nineteenth century the improved quality of the lenses could not remove these disadvantages, and it was deplored that "because of the convexity of the glass through which pass the light rays which reflect Nature, [the projected image] results in being visibly bent while drawing in a Camera Obscura and copying Nature".[98] Besides the distortion effect, the chromatic aberration due to different degrees of dispersion of the glass was also a criticised defect of the Camera Obscura in terms of exactitude. It was complained, for instance, that the contrivance presented steady and distinct hues only in the central, focussed parts. Moving apart from this area, they considerably lost brightness and brilliance, eventually mixing into each other and no longer giving a distinct image, most of all if the white light spectrum was more intensive than it should be.[99]

However, René Descartes had acknowledged that "no image should completely liken the object it represents, for otherwise there could be no point of distinction between the object and its image",[100] and that to apprehend an object, a "controlled dissimilarity"[101] is fruitful, because it is the imperfection of an image which supports its function as a means to achieve knowledge. Accordingly, in spite of its defective representation, the Camera Obscura was recommended in the seventeenth century for "gaining knowledge of nature" while recording the "main and general characteristics [belonging] to a truly natural painting";[102] moreover, it was considered suitable to "discover new objects and sometimes new landscapes upon the paper".[103] Around 1800, conversely, the use of the instrument was no longer advised in this sense for observing and depicting nature. It was in fact generally suggested that the Camera Obscura – mostly in its portable variants – should not be employed "to copy nature, neither tracing the projected lines onto paper, nor reproducing the colours displayed by the projection".[104]

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97 "Die Abzeichnung [ist] ... nur mitten im Gemälde richtig; weil sich die Strahlen am Ende untereinand mischen und ausschweifen". See Lambert, Anlage zur Perspektive, 161-163.

98 "À cause de la convexité du verre à travers lequel passent les rayons qui réfléchissent la Nature … en dessinant dans la chambre noire et calquant la Nature, elle se treuve visiblement fausse". See Pierre-Henry de Valenciennes, *Éléments de perspective pratique à l'usage des artistes* (Paris: Chez l'auteur, Desenne, Duprat, an VIII [1800], Reprint Genève: Minkoff, 1973), 208.

99 "Cette machine … en présente un autre [défaut] pour la couleur et sa pureté, en ce que le teintes ne sont nettes et fermes que dans le foyer. À mesure qu'elles s'en éloignent circulairement, elles s'affoiblissent par gradation, et finissent par se confondre entr'elles et ne plus rien former de distinct, sour tout si le spectre blanc qui reçoit l'image de la nature est plus grand qu'il ne doit être" (Valenciennes, Éléments, 296).

100 "Il n'y a aucunes images qui doivent en tout ressembler aux objets qu'elles représentent: car autrement il n'y aurait point de distinction entre l'objet et son image". See Charles Adam and Paul Tannery, *Oeuvres de Descartes* (Paris: L. Cerf, 1897-1910) VI, 113.

101 "Dissemblance réglée". See Fabian Stech. "La vision du paysage selon Descartes," *Interfaces* 11-12 (1997): 113-127, here 117.

102 Samuel van Hoogstraeten, *Inleyding tot de Hooge Schole der Schilderkonst* (Rotterdam: by Fransois van Hoogstraeten, 1678. Reprint Utrecht: Davaco, 1969), 263.

103 Robert Boyle. "On the Systematical or Cosmical Qualities of Things (1671)," in: *The Works of the Honourable Robert Boyle III* (London: Printed for J. and F. Rivington [etc.] 1772), 308-315, here 312.

104 "Ainsi, nous ne conseillerons pas aux jeunes artistes de copier la Nature dans la Chambre noire, soit en calquant les lignes sur du papier, soit en copiant les ton des couleurs, en supposant que cela soit possible", see Valenciennes, Éléments, 296.

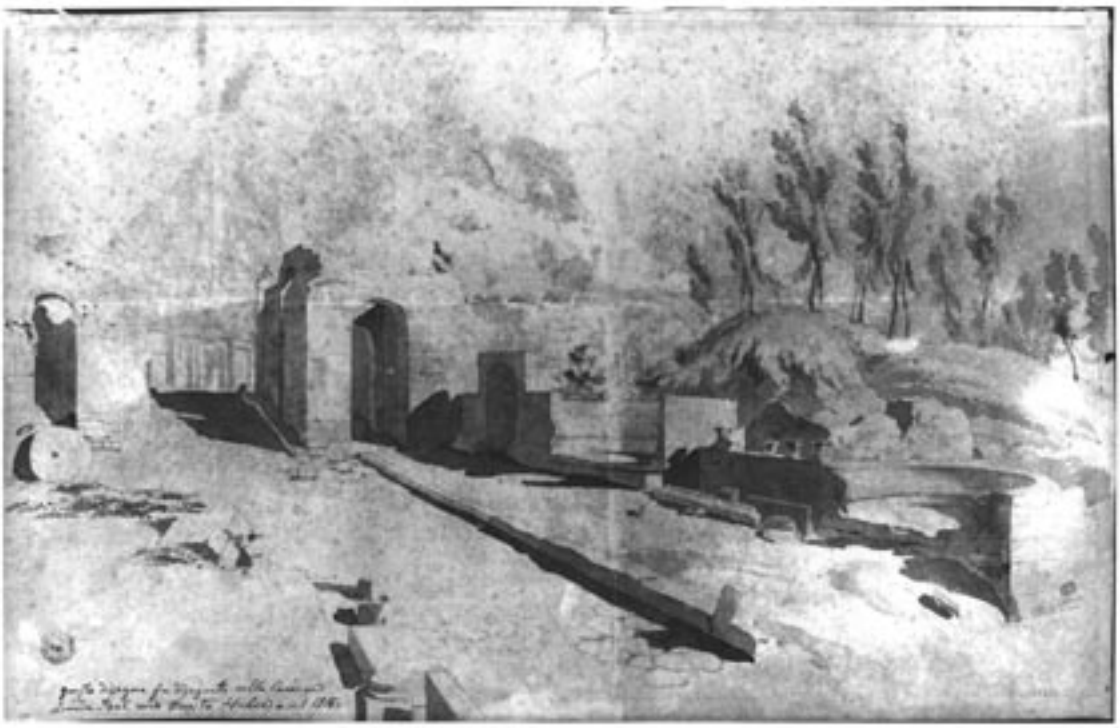

Fig. 12: Wilhelm Huber, Pompei, Porta Ercolano, 1816, pencil and watercolour, 10.47 x 16.53 in. (26,6 x 42 cm). Museo Nazionale di San Martino, Napoli. Captioned by Giacinto Gigante: "Questo disegno fu disegnato alla Camera Lucida dal mio maestro Huber nel 1816" (artwork and photograph ©Soprintendenza ai beni Artistici e Storici di Napoli).

The Camera Lucida, being a prism with plane surfaces, did not display any of these problems connected with the features and properties of lenses.

First of all, since the light rays are not passing a convex medium, there were neither linear distortions nor deformations of any kind from the centre to the periphery like in the Camera Obscura,[105] and this made the Camera Lucida particularly suitable for the direct recording of architectural structures (fig. 12). Further, unlike the Camera Obscura, the geometry of the prism allowed focusing different distances simultaneously[106] (fig.13). And finally, due to its highly polished surfaces and to the commonly increased quality of the glass, the prism of the Camera Lucida is a perfect reflector.[107] This means that the colours of the perceived image neither lose brightness nor are modified or merged into each other. So, in terms of the reliability of the image's colours, the Camera Lucida

[105] Wollaston. "Description of the Camera Lucida," Phil. Mag., 347; William Ford Stanley, *Instruments Intended to Facilitate the Delineation of Natural Objects, Buildings, etc. – Camera Lucida – Optical Compasses, etc.* (London: Published by the Author at 5, Great Turnstyle, Holborn, 1866), 118.

[106] Stanley, Instruments, 117.

[107] Amici. "Sopra le camere lucide," 30.

Fig.13: Edward William Lane, Entrance of the Seventeenth Tomb – That of Osiree 1st – The great tomb opened by Belzoni, 1825-1828, pencil Camera Lucida sketch. British Museum, London (artwork and photograph © British Museum London).

Fig. 14: Giacinto Gigante, Alle falde del Vesuvio, ca 1830, Camera Lucida sketch in pencil and watercolour, ca 9 x 5.9 in. (ca 23 x 15 cm). Collezione Astarita, Gabinetto di Disegni e Stampe, Museo Nazionale di Capodimonte, Napoli (artwork © Soprintendenza ai beni Artistici e Storici di Napoli; photograph © Luciano Pedicini).

was considered "undoubtedly the best [instrument], for this apparently lays the complete reduced image, upon the paper, in all its natural colours and shades".[108] Accordingly, it was not only used to trace outlines, but also to take notice of the hues of the scene observed. Regardless of the intention of the users, methods were developed in order to colour while sketching with the Camera Lucida, and painters and travellers likewise[109] complied with the common suggestion to apply colours before tracing the contours of a certain object[110] (fig. 14).

However, as for the accuracy of the images perceived and traced with the help of the prism, there were serious contradictions. "It frequently happens that in attempting to draw an extended view with the Camera Lucida, we are surprised at the smallness of the distant objects; neither can we … give them the importance they assume in nature".[111]

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[108] Stanley, Instruments (as in note 105) 114.

[109] See for instance Fiorentini. "Nuovi Punti di vista" and Fiorentini. "Scambio di vedute". Basil Hall reports in a letter to John Herschel of 22 July 1832 (*The Royal Society, London, Herschel Correspondence*, HS 9:170), that Frederic F. De Roos was using this method for the images destined to illustrate his *Personal Narrative of Travels in the United States and Canada in 1826* (London: Ainsworth, 1827).

[110] "In sketching with this instrument […] it is not absolutely necessary to begin with [the outline], as in ordinary drawing; and I conceive this change in the order of shade and outline, one of the great advantages of the instrument". See Basil Hall, *Travels in North America in the years 1827 and 1828*, Vol. III, Appendix on the use of the camera Lucida (Edinburgh: Printed for R. Cadell, 1830), 6.

Indeed, in panoramic views made with the Camera Lucida, a mountain chain appears considerably lower than it should according to the natural proportion (fig. 15). Moreover, since early Camera Lucidas were used monocularly, there was a loss of depth of field in the perceived image, an effect that was regularly maintained in the drawings (fig. 16).

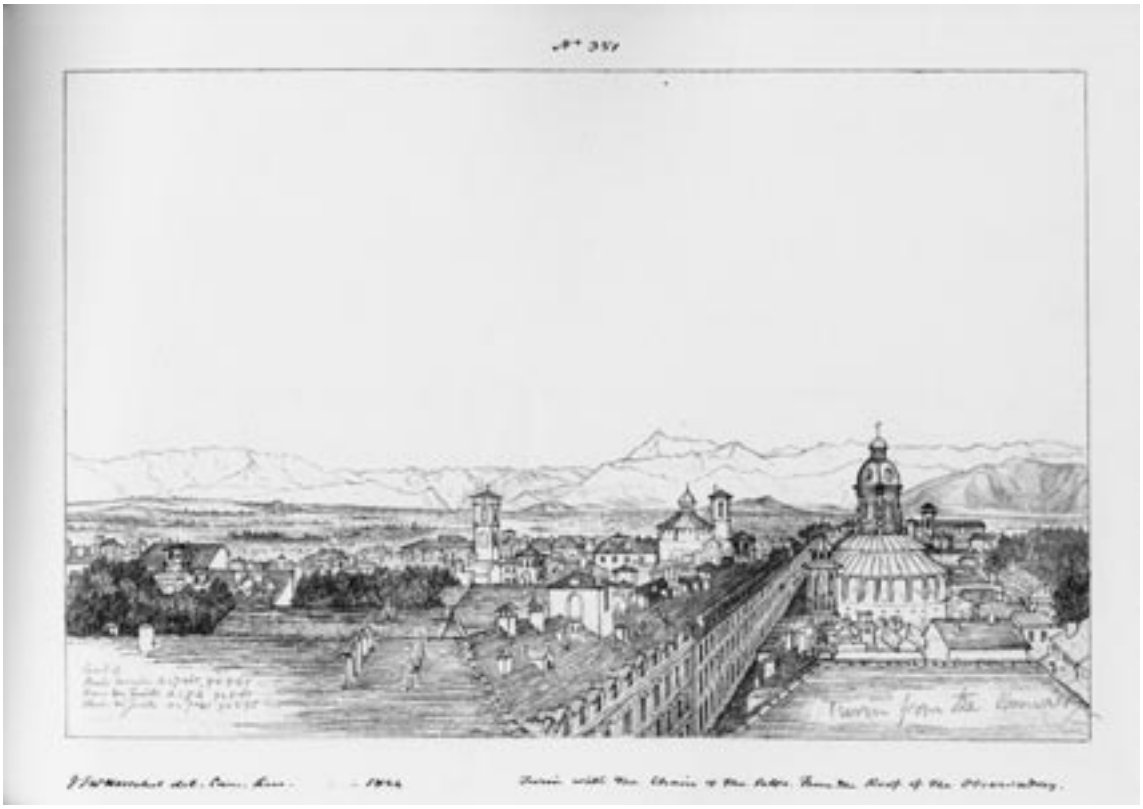

Fig. 15: John Herschel, Turin, 1824, Camera Lucida pencil sketch, 7.95 x 12.2 in. (20,2 x 31 cm). Formerly Graham Nash Collection, Malibu. Current location unknown. Captioned "J.F.W. Herschel del. Cam. Luc. [18.april] 1824. Turin with the chain of the Alps from the roof of the observatory" (artwork and photograph ©Digital reproduction with the permission of the author from Larry J. Schaaf, Tracings of Light: Sir John Herschel & the Camera Lucida. San Francisco 1989, plate 9).

These defects, like those of the Camera Obscura, contributed to the general opinion that the Camera Lucida was not a reliable device in terms of accuracy of representation. Many contemporaries refused to accord it status of an exact instrument. The architect Léon Vaudoyer, who saw drawing techniques as a method of research, was disgusted with his father's proposal to use the Camera Lucida for the description of the Pompeian ruins in 1827. The device, Léon maintained, supported merely superficial observation, and diverted from the "mathematical description of the objects". Considering it to produce "nothing but picturesque effects", he regarded the device as an obsolete method for a modern architect who aims at an analytical documentation of his observations.[112]

[111] Anonymous. "The camera lucida," 540-541.

Fig. 16: Massimo d'Azeglio, Veduta della campagna romana da Frascati, ca 1819, oil on camera lucida pencil sketch, transposed onto canvas, 15.35 x 20.47 in. (39 x 52 cm). Galleria d'Arte Moderna – GAM, Torino (artwork and photograph © Galleria d'Arte Moderna – GAM, Torino).

5.1.2. Degrees of Perceptual Experience

The most relevant dissimilarity between Camera Obscura and Camera Lucida is thus not related to the "exactness" which can be reached with the help of these optical devices. Camera Obscura and Camera Lucida – and their appreciation – differ rather in the way in which the observer experiences the natural image they produce.

The process of observing with the Camera Obscura, – although "instructive and suitable to intensify the imitating verve without which the paintbrush would be no more than a cold and sterile instrument" – was considered to "excite imagination much more easily than facing nature itself".[113] The Camera Obscura should lead to "a better understanding and representation of Nature, the painters [should use it] in the same way astronomers and physicists use the telescope and the microscope".[114] The Camera

[112] Léon Vaudoyer, letter to his father of 4 April 1827, cited in Paula Young Lee. "The Rational Point of View: Eugène-Emmanuel Viollet-le-Duc and the Camera lucida," in: Jan Birksted, ed., *Landscape of Memory and Experience* (London: Spon, 2000), 63-76, here 63. On Léon Vaudoyer's method see Barry Begdoll, *Les Vaudoyer: Une dynastie d'architect* (Paris: Réunion des musées nationaux, 1991).

Obscura was considered a "very pleasant and interesting way to study nature",[115] and as such it should be "consulted very often" [116] in order to train the eyes by observing its projections. However, the thus developed "true manner" of depiction resulting from this training was not thought to replicate Nature, but only to be "borrowed" from it.[117] Consequently, even the relatively portable tent-type Camera Obscura was not deemed able to support the direct experience of the observed natural fact. Using the device, it was in fact criticised, involved "interruption of all communication with the external world".[118] Moreover, early Camera Obscurae produced only a fixed framed section of the scene observed which could not easily be modified, except by changing the construction or the aperture ratio of the box; and the visual field was – with an angle of approximately 35 degrees[119] – very narrow. These limitations contributed to the perceptual detachment of the observers from the actual surrounding in which they placed the Camera Obscura.

The Camera Lucida, on the contrary, permits to the sketcher to arbitrarily change size and the shape of the section observed. They can both be modified by varying the position and the chosen viewing angle of the observer in relation to the object.

Moreover, the prism was praised for including a very broad visual angle in one view with distinctness, which is – with nearly 80 degrees – very similar to the human field of vision.[120] Accordingly, the observer could record what he or she actually saw from a particular point in space, which could be selected corresponding to his or her preferences: either a very broad panorama of a coast while standing on a higher and distant point (fig. 17), or an unusual sight taken off-hand from very near (fig. 18), both are thus 'real' only for the observers having experience of these particular situations. Besides its portability, admitting – as we have seen – for a full physical immersion into the natural environment, these optical peculiarities of the Camera Lucida allowed the user to stay in direct relation to both the place observed and the momentary situation with which he or she was

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113 "Mais il est un effet de la chambre obscure à l'aide duquel le peintre peut plus facilement peut-être exalter son imagination qu'en presence même de la nature; ... ces admirables resultats ne peuvent, dis je, être que très-instructifs e très-prpres à exalter chez le peintre la verve imitatrice, sans laqulle le pinceau ne serait qu'un froid et stérile instrument", See Jaques Nicola Paillot de Montabert, *Traité complet de la Peinture* (Paris : Bossange, 1829), Vol. 9, 635-636.

114 "Quell'uso che fanno gli Astronomi del Cannocchiale, i Fisici del microscopio, quel medesimo dovrebbon fare della Camera Ottica i pittori. Conducono egualmente tutti codesti ordigni a meglio conoscere, e rappresentar la Natura", see Francesco Algarotti, *Saggio sopra la pittura* (Livorno: Marco Coltellini, 1763), 71

115 "Il est une manière très-agréable et très-interessante d'etudier la Nature: c'est de la voir dans la Chambre noire…", see Valenciennes, Éléments, 295.

116 "Mais nous … exhortons a la consulter très-souvent, …" (Valenciennes, Éléments, 296).

117 "… ils y formeront une manière vraie, puissée dans la Nature" (Valenciennes, Éléments, 296).

118 "...il est encore un grand désagrément dans ces espèces de Chambre noire, et auquel il n'y a pas moyen de remédier: comme on est obligé de s'Enfermer dans cette machine, le plus hermétiquement qu'il est possible, pour … ôter toute communication au jour extérieur, in manque bientôt d'air pour respirer librement ; et la vapeur qui s'exhale par la respiration, ternit bientôt le verre convexe qui est au dessus de la tête, et l'empêche de produir la reflexion ; on est à chaque instant obligé de l'essuier" (Valenciennes, Éléments, 298-299).

119 Wollaston. "Description of the Camera Lucida," Phil. Mag., 347.

120 Wollaston. "Description of the Camera Lucida," Phil. Mag., 347.

confronted. Sketching with a Camera Lucida cut the observer free to notice the things happening around, enabling him or her to communicate this experience – through the resulting depictions – to "those who have not the means of seeing, what [the observer] has been so fortunate as to witness".[121]

Fig. 17: Edward William Lane, New Harbour of Alexandria, 1825-1828, Camera Lucida sketch in pencil and watercolour. British Museum, London (artwork and photograph © British Museum London).

To draw "in true perspective"[122] with the Camera Lucida meant then not primarily a perspective tracing thought to construct the visibility of what could not be perceived at one view, as it was the case for the composed Camera Obscura *vedutas* of, say, Gaspare Vanvitelli or Antonio Canal.[123] Instead, the perspective of the Camera Lucida was instantaneous, intuitive, and more closely related to the observer's perception and the circumstances of observation rather than to the capacities of the instrument he or she used.

5.2. Projective vs. Prismatic: Optical Principles in Comparison

If these traits of Camera Obscura and Camera Lucida can be clearly distinguished, also the differences separating their optical principles are fundamental.

The Camera Obscura, as we have seen, is an apparatus producing images as projections on a screen. The observer, thus, always sees a steady picture, which he or she can observe with both eyes and which is, moreover, visible for several persons at the same time. A Camera Obscura image, this means, can be looked at in a way corresponding to the beholding of "a painting … brought [by the Camera] upon a sheet of paper, where

[121] Hall, Travels in North America, 8.
[122] This main distinctive of the Camera Lucida is recurrent motif in the literature concerned with the device until today. For the first use see of course Wollaston, "Specification of the Patent".
[123] De Seta, Vedutisti e Viaggiatori, 65-80; Chiari / Sonino. "Nuove osservazioni"; Lüthy. "Hockney's Secret Knowledge – Vanvitelli's Camera Obscura," 315-339.

everyone can comfortably see and contemplate it",[124] and which "is completely in … [the observer's] power at one view".[125]

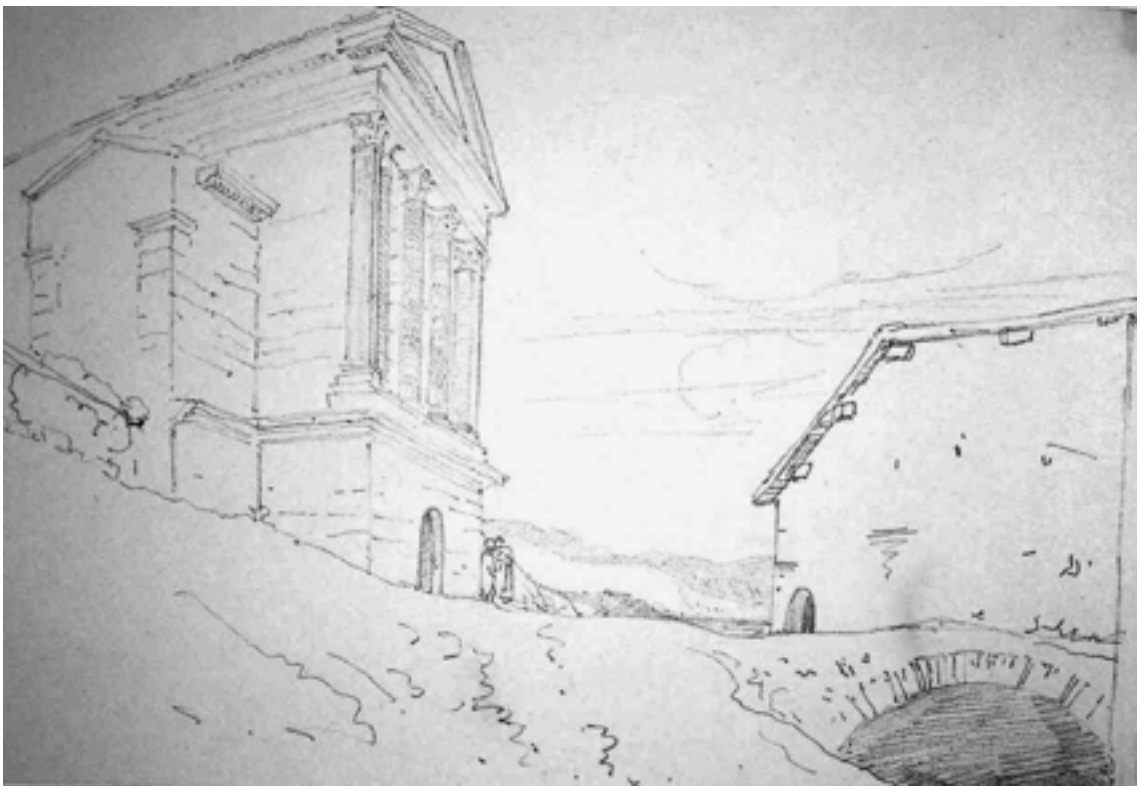

Fig. 18: James Hakewill, Temple of Jupiter Clitumno, near La Vene, 1817, pencil. Probably a Camera Lucida (and not a camera Obscura) sketch. British School at Rome (artwork and photograph ©British School at Rome).

That the Camera Obscura enables us to see nature as an image with the attributes of a painting is the peculiarity grounding the main interest in this device through history. Leonardo da Vinci already refers to the analogy of the Camera Obscura image with a picture, observing that the images "falling in a dark room, through a pinhole, on a sheet of paper really look as if they were painted on this paper".[126] Giovanni Battista Della Porta proposed to "put a white paper against the hole … until the Sun cast a perfect representation upon … it".[127] In the eighteenth century, Francesco Algarotti praised the fact that in the Camera Obscura "Nature paints the things nearest to the eye with fine paintbrushes, those far away with rough strokes. … An excellent painter, having seen such

[124] "Un ordigno, il quale porta la immagine o il quadro di che che sia, e di una assai competente grandezza, sopra un bel foglio di carta, dove altri può vederlo a tutto suo agio, e contemplarlo". See Algarotti, Saggio, 67.
[125] Sheldrake. "On the Use of the Camera Lucida," 176-177.
[126] As cited in Wolfgang Baier, *Quellendarstellungen zur Geschichte der Fotografie* (Leipzig: Fotokinoverl., 1966), 9.
[127] Giovanni Battista Della Porta, *Natural magick. Magia naturalis libri viginti* (London: Printed for T. Young and S. Speed, 1658), 364.

an image for the first time, confessed that nothing can be compared with the paintings of such an outstanding master". Therefore, Algarotti recommends, young artists "should begin very early to study the pictures of the Camera Obscura, in order to produce similar pictures someday".[128] Inversely, Joshua Reynolds judged a painting of Jan van der Heyden to render "very much the effect of nature as seen in the Camera Obscura".[129] For Pierre-Henry de Valenciennes, the image in the Camera Obscura helps to conceive a painting, because "it is framed on a plane surface and makes the effect of a painting in miniature" from which, "without being diverted by external objects" the harmony of aerial perspective and colour can be studied as it should appear in the painting.[130] Thus, around 1800, the Camera Obscura was expected to show nature not as it could be experienced directly, but as it should look like in order to make a good picture. The Camera Obscura seems to have satisfied the needs of a literally 'picturesque' visual approach to nature: What mattered for the users was not the degree of concordance between the 'reality' outside the device and the image inside it, but rather the painterly effect which nature was able to produce on the screen. These effects, mostly those in colour, resulted from the optical deficiencies of the apparatus. Since in the most cases the optical aperture was insufficient, the light quantity was weakened and the simultaneous contrast between adjacent colours resulted modified. The Camera Obscura images, thus, were modified or at least filtered by a 'seeing machine', which was expected to convey its own 'visual experience' to the observer, and not so much to show a faithful reproduction of the natural image. The box functioned as a substitute for the eye, offering the experience of new variants of visuality, or a background on which to construct an imaginative representation. It is the optical device which perceives outer nature and creates images of it, and not the individual observer, who merely uses these images as they are projected, regardless of their degree of resemblance to nature or to the individual sensory experience. In this kind of 'projective seeing', the eye registers images in the form provided by the optical apparatus, with all the imperfections due to its technical deficiencies, and processes them as they appear, for the sake of apperception, apprehension or representation.

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[128] "Niuna cosa può meglio mostrarla quanto la Camera Ottica, in cui la Natura dipinge le cose più vicine all'occhio con pennelli … acutissimi e fermi, le lontane con pennelli più spuntati di mano in mano, e più folli. … a un valente professore di pittura venne mostrato per la prima volta un tale ordigno. Da indicibile diletto egli era preso … apertamente confessava niente potersi stare a fronte dei quadri di così eccellente e sovrano maestro. … Cominci adunque il giovane ad istudiargli [i "quadri della Camera Ottica"] di buon'ora per avvicinarsi un giorno a quelli per quanto uom può". See Algarotti, Saggio , 69-71.

[129] Joshua Reynolds, Journey to Flanders and Holland, in: *The Literary Works, 1781* (London: T. Cadell, 1835), 200.

[130] "L'image des objets devient, pour ainsi dire, plus facile à concevoir que la Nature elle-même, parce qu'elle s'etrouve encadrée sur une surface plane et qu'on la regarde d'une manière à la quelle on n'est pas habitué: l'oeil ne voit que ce qu'il peut et doit embrasser. Elle fait l'effet d'un tableau en miniature don't on peu distinguer toutes les parties, soit pour l'harmonie aérienne, soit pour celle des coleurs, en appécier la valeur, et les comparer entr'elles avec autant plus d'attention, qu'on n'est distrait par aucun objet extérieur". See Valenciennes, Éléments, 295.

The 'projective seeing' is informed by the traditional analogy between Camera Obscura and human eye, according to which the eye provides a screen on which the shape of the outer world is projected,[131] an analogy that maintained its validity through the end of the eighteenth century, as the Camera Obscura was termed an "artificial eye"[132] (fig. 19), and still exerts a strong fascination in our present days, even though we know better.

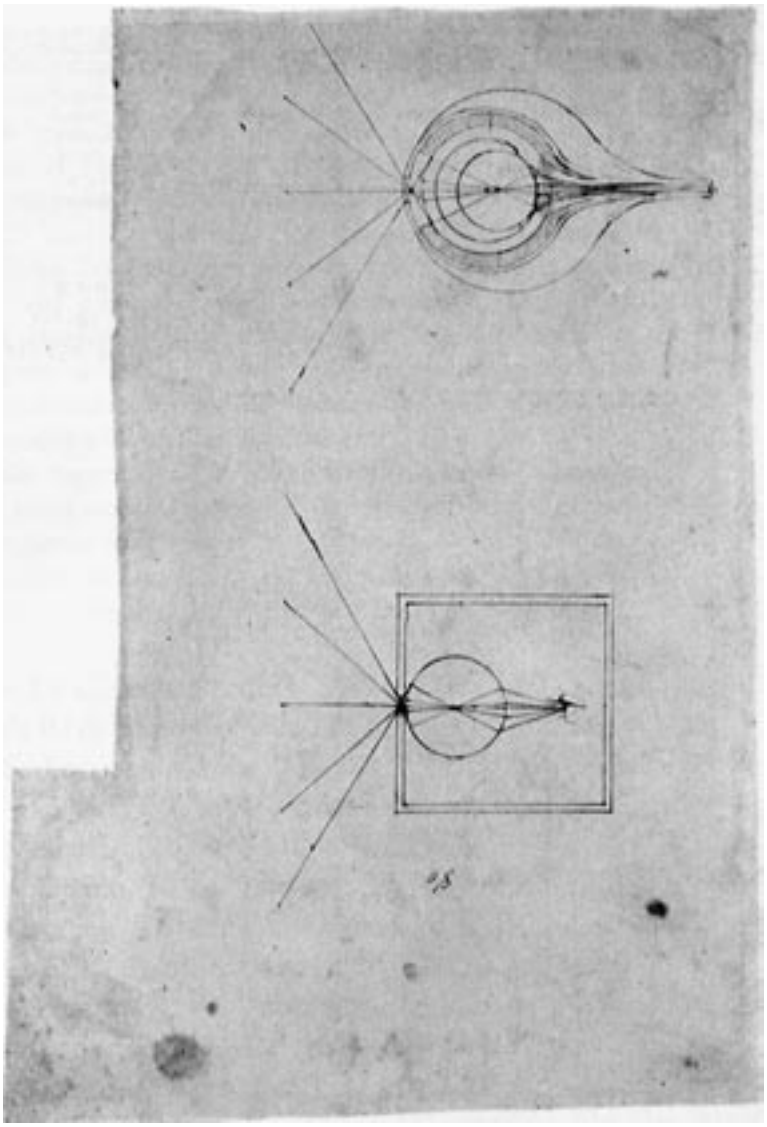

Fig. 19: Leonardo da Vinci, Eye as Camera Obscura, pen and puntasecca, 0.35-11,1 x 6.41-7.56 in. (0,9-28,2 x 16,3-19,2 cm). Codex Atlanticus, 921recto, previously 337recto a. Biblioteca Ambrosiana, Milano.

[131] This analogy was drawn e.g. by Leonardo (Codex D and Codex Atlanticus, see Kim Veltman. "Leonardo and the Camera Obscura," *Studi Vinciani in memoria di Nando de Toni* (Brescia: Geroldi, 1986), 81-92, particularly 91), René Descartes (La Dioptrique 1637, see Adam / Tannery, Oeuvres de Descartes, VI, 114-117) and Gottfried Wilhelm Leibniz (*Neue Abhandlungen über den menschlichen Verstand 1765*. Edited by Ernst Cassirer (Hamburg: Meiner, 1971), 126).

[132] "Occhio artificiale", see Algarotti, Saggio, 67.

The Camera Lucida differs dramatically from the Camera Obscura, since the prism does not allow the observer to see a projected, steady image resembling a completed *pictura*. This becomes apparent from the optical principle of the device (fig. 20). The image of the object toward which the prism is directed (position D in fig. 20) is not projected on the drawing board, but reflected twice (on the points E and A in fig. 20) by the mirroring plane surfaces into the observer's eye, which, due to the principle of double (or prismatic) reflection, perceives it in correspondence to direct observation, i.e. upright and true sided. The observer's glance is constantly directed to the drawing surface, and not to the object itself. Due to optical illusion, the retinal image produced by the prismatic reflection overlaps the sheet of paper on the drawing board, where the hand and the pencil of the draughtsman trace the perceived forms overlapping the paper, and fix shadows and colours. This means that the observer sees on the paper merely a *virtual* image corresponding to his or her retinal impression. It is not a projection existing outside the eye, but an image available only to the observer's perception, and invisible to others.

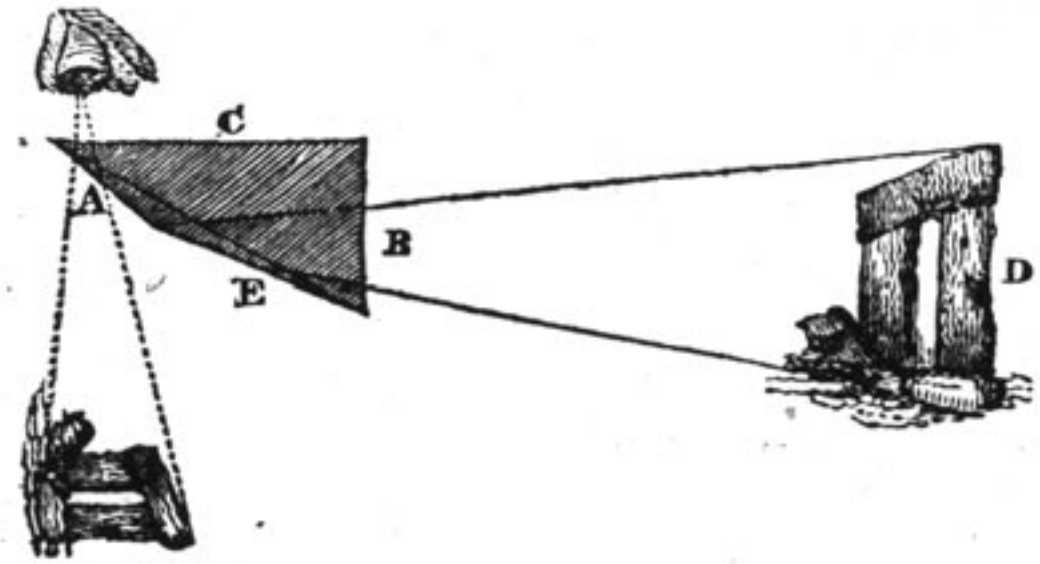

Fig. 20: Anonymous, Optical Principle of the Wollaston Camera Lucida, 1840, image in The Magazine of Science and School of Arts I, XLIII (1840): 338.

Basically, the image produced by the Camera Lucida in the eye of the observer corresponds to the naked eye's perception of the natural object. The prism, however, helps to convert this image into signs, that is, it helps to "trace on the paper figures which are *similar* to those produced by a certain object in the eye of the observer".[133] Using the prism, in fact, the memorization step otherwise needed in the interval elapsing while turning from the object to the drawing can be spared. Indeed, it was considered an advantage that, in this way, the Camera Lucida "saved time, trouble and thought" while

[133] Amici. "Sopra le camere lucide," 25, emphasis is mine.

drawing, where "thought" referred to "the great deal of consideration" necessary to memorize all the particulars observed in order to transfer them onto the paper.[134] The mental activity directed to the technical accomplishment of the drawing, thus, recedes in favour of an inspection of the observed in terms of its meaning. This kind of inspection comprises the analysis and the estimation of the perceived data, and requires at the same time the selection of those particulars deemed relevant to accomplish the goal of the representation. That means that instead of concentrating on the technique to adopt for a correct transposition of the observed scene the Camera Lucida user could focus his or her attention to consider the relevance of its whole and of its singular component. In this complex process of judgment, "an attention to details is not so necessary in order to produce the desired effect… I should therefore recommend sketchers with this instruments to avoid minute particulars … in this way the sketch will convey, upon the whole, a more correct idea of the object … than if twice the pains had been taken to render all its parts rigidly correct".[135] Visual impression should thus not be 'copied' with the Camera Lucida, but be 'translated' onto paper while critically examining the momentary perceptual data. This ongoing process of "perceptual and intellectual possession"[136] induced while seeing with the prism is the most important peculiarity of observing and recording with the Camera Lucida. It met the highest approval of the contemporaries, who appreciated the fact that with this device "eye and judgement may then be exercised", and that "referring to the reflections … in the prism for the true situations of the objects in comparison with those the judgement has assigned them, [the camera lucida] seems capable of affording the most valuable aid in cultivating a delicacy of discrimination".[137] Indeed, the Camera Lucida was very soon "well known as corrective of the … decisions of the eye or a succidaneum [sic] in the labour of educating that organ".[138]

It is remarkable that, while using the Camera Lucida, this complex activity of percepting and judging must be nearly simultaneously transposed into drawing. In fact, since the virtual image produced by the prism is not steadily present on the paper like a projection, even a slight movement of the draughtsman's head can remove the observed scene from the parts already traced on the paper. The perceived image can easily vanish from sight on the paper surface, and it is painstaking, if not impossible, to bring it to overlap again with the lines of the original drawing.[139]

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[134] Anonymous. "Utility of the Camera Lucida," *The Mechanics Magazine* 11 (1829): 281-282, here 282.
[135] Hall, Travels in North America, 9.
[136] Lee. "The Rational Point of View", 73.
[137] Bate. "On the camera lucida," 149.
[138] W.G. Horner. "New and important combinations with the camera lucida," *Annals of philosophy* 6 (1815): 281-283, here 281.
[139] "It is true that by moving my head to one side, and looking diagonally through the eye glass … I could get all the horizontal lines that were within the range of the instrument or the drawing: But it was impossible, by any artifice to do so as much with the perpendicular lines … without altering the position of the glass, and in doing this it was found impossible to connect the different portions of the scene that were viewed upon changing the position of the glass, with a degree of truth comparable to what may be attained by the camera obscura without any trouble at all". See Sheldrake. "On the Camera Lucida," 375.

This peculiar relationship between perception and visualisation indicates the complexity of the exchange between inside and outside while using the Camera Lucida. The prism transfers visual information from the surroundings to the perception of the observer, and here they must be processed ad hoc before they appear again on the visible surface of the drawing. On this surface, the processed information becomes available again for perception, thus influencing the course of the further transposition of the additional data coming from outside and consequently also the shape of the representation.[140] In this way, a quite redundant oscillation between inside and outside takes place if one looks with the Camera Lucida. A self-portrait done in a mirror with the Camera Lucida in 1830 (fig. 21 A) impressively visualizes these dynamics. It is important to maintain that this portrait is done in a mirror. What we see in this sketch is the image that is reflected by a mirror placed in front of the draughtsman to the plane surfaces of the prism, which in turn conveys this image into the sketcher's eye.

Concurrently, this image is exactly what the draughtsman sees, with the help of the Camera Lucida prism he is using, on his paper. He looks through the prism at his sketch, this means, but at the same time at his own mirror image. The plane surfaces of the prism not only reflect the mirror image into the eye of the sketcher, they also reflect, conversely, the image of the eye (Fig. 21 B) into the mirror in front of him. In short, the image simultaneously shows what the sketcher sees while looking at the paper and what the mirror or an external observer sees, namely the sketcher's eye observing itself in the mirror.[141] Outside and inside are intriguingly interwoven in this process of looking, reflecting and drawing, which is frozen in the final image.

This sketch illustrates vividly how users of the Camera Lucida float between the immediate recognition of the visible outer world and the need to understand its variations in perception, and to decide whether they must be included in or excluded from representation. For the sake of imaging, vision is controlled and shaped by the observer, and not by the device (the prism), which acts merely as a regulating membrane between the object and its perception through the observer. This means that the device as such *enhances*, but by no means replaces the individual experience of looking.

This process of visual appropriation implies object *and* a subject related components. It can be termed 'prismatic seeing', since it corresponds to the optical principle of the prism. On the one hand, the mirroring surfaces of the prism guarantee the fidelity of the perceived image in relation to the chosen scene; however, the degree of congruence of the

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[140] This process is adequately rendered by Merleau-Ponty's description of seeing and drawing, where the eye is "an instrument … deeply moved by the impact of the outside world, an emotion which is given back to the visible by tracing with the hand" ("l'oeil est ce qui a été ému par un certain impact du monde et le restitue au visible par le traces de la main"). The resulting images can be then seen as "the inside of the outside and the outside of the inside enabling the double nature of sensation" ("… le dessin et le tableau … sont le dedans du dehors et le dehors du dedans, que rend possible la duplicité du sentir…"). See Maurice Merleau-Ponty, *L'oeil et l'esprit* (Paris: Gallimard, 1964), 23-26.

[141] The experience of the infinite regress of reflection, which is inherent in this image, can hardly be described appropriately. It can be approximately be retraced standing between two mirrors which face each other.

Fig. 21 A: Selfportrait (?), Reverend Calvert Jones (?) sketching with a Wollaston camera lucida (probably a self-portrait done in a mirror), ca. 1830, pencil Camera Lucida drawing on the back of a letter, 8.98 x 3.39 in. (22,8 x 8,6 cm). The National Library of Wales (artwork and photograph © By permission of Llyfrgell Genedlaethol Cymru / The National Library of Wales).

Fig. 21 B: Detail.

resulting picture depends on the process of selection performed by the observer after having perceived the virtual image conveyed by the prism in his or her eyes. Indeed, it was appreciated by contemporaries, "the accuracy which belongs to all its [the prism's] delineations … is quite consistent with the most perfect freedom of execution".[142]

'Prismatic seeing' recognises that the retina is not a simple projection screen, but a resonance apparatus for visual stimuli. It also reflects the opinion of the time that "the common explanation of vision as the formation of an objective image *on* – and not *within* – the retina degrades the living eye to a dead optical tool".[143] In a regime of 'prismatic seeing', only the natural, direct visual experience of the observer matters, as does his or her conscious control of this experience in terms of a figurative translation onto paper.

6. An Epilogue: the 'Prismatic' as the Camera-Lucida-Mode of Seeing

The differing success and estimation of Camera Obscura and Camera Lucida make clear that a new orientation in the visual approach to nature took place in the early nineteenth century, and that this orientation shifted decidedly in the direction expressed by the Camera Lucida as a device and as an optical principle.

As a device for observation and drawing, the Camera Lucida satisfied upcoming new demands related to technologies and processes of observation and depiction of nature, which the Camera Obscura was apparently unable to cover. These demands called for a refinement of the glance at the physical object as well as at the conditions surrounding it and the observer. Moreover, a high level of authenticity was requested in representation. This authenticity, however, was not related to veracity, but was understood in terms of a tension between the collection of sensory data and the momentary, individual response to them, this means, in terms of the very *experience* of individual observation.[144]

The optical principle of the Camera Lucida, in its turn, displays the "subjective and objective virtues"[145] attested to prisms in the early nineteenth century, and it can be therefore used as a metaphor for the new visual modality of 'prismatic seeing', which I call the 'prismatic seeing'. In this new modality of vision, a complex relationship of interaction and mutual assessment connected internal and external values, subject and the object of observation and experience. In this relationship, the observed 'reality' is transformed by

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[142] Basil Hall and Augustin Creuze. "Drawing and Description of the Capstan Lately Recovered from the Royal George," *The United Service Journal and Naval and Military Magazine* Part III (1839): 376- 380, here 377.

[143] "Die gewöhnliche Erklärung des Sehens durch ein objectives Bild auf – nicht in – der Retina würdigt das lebendige Auge zu einem todten optischen Werkzeuge herab". See Heinrich Ficinus, *Optik oder Versuch eines folgerechten Umrisses der gesammten Lehre vom Licht, wie sie dem gegenwärtigen Stande unsrer physiologischen und physikalischen Kenntnisse angemessen ist* (Dresden: Hilscher, 1828), §18 note.

[144] For the tension between experience and sensorial response see Catrin Misselhorn. "Ästhetische Erfahrung und die Perspektive der ersten Person," in: Thomas Grundmann et al., *Anatomie der Subjektivität. Bewußtsein, Selbstbewußtsein und Selbstgefühl* (Frankfurt am Main: Suhrkamp, 2005), 417-437, here 419.

[145] "Subjektive und objektive Wirksamkeit", see Ficinus, Optik, §55-§62.

the observer[146] in a process which not only "shows what is real, … but with the help of what *is* … also shows what does not exist, … ideas, impressions, sensations and desires".[147]

This 'primatic seeing' can be detected in many aspects of early nineteenth century visual culture, where vision was understood as "concurrence of objective and subjective light" and as a physio-psychological "interaction of internal activities and external stimuli".[148] Indeed, the epistemological enterprises in philosophical and scientific projects of the period were striving for an answer to the general question of how experience enables the subject to acquire knowledge about objects, and of how the subject-object relationship should be evaluated in the process of gaining knowledge.[149] Modifications in methods, according to these epistemological efforts, tried to fill the gap between the observer and his or her object in the practices of induction and in the following hypothetico-deductive reasoning.[150] Likewise, the 'prismatic' or Camera-Lucida-Mode of seeing concurs with new paths in the aesthetic appreciation of natural beauty, which according to the modification in the methodology of the inductive sciences reassessed the direct exposure of the observer to nature,[151] and rediscovered the experience of natural beauty as a blend of sensory and reasoning processes leading to the veritable truth: "in your mind nurture the truth, translate it from your inside outside into beauty, so that not only the thought renders homage to it, but also the senses lovingly seize its appearance".[152]

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[146] See "De l'action de transformer ou de transposer, considerée comme moyen de l'imitation idéale", in Antoine Quatremère de Quincy, *Essai sur la Nature, le but et les moyens de l'imitation dans les beaux-arts* (Paris: Treuttel et Würtz, 1823), 323-331.

[147] "Que de créations enfin dont nous devons l'existence à cette imitation, non pas quelle qui se borne à nous montrer ce qui est réel, mais celle qui, à l'aide de ce qui est, nous montre ce qui n'est réellement pas!" (Quincy, Essai sur la Nature, 174-175).

[148] Ficinus, Optik, §10, §18.

[149] See Schickore. "The 'philosophical grasp'", 569-592.

[150] See Fiorentini. "Practices".

[151] See for instance Paola Barocchi, ed., *Gli scritti d'arte della Antologia di G.P. Vieussieux 1821-1833* (Firenze: S.P.E.S., 1975), Vol. II, 516; Giovanni Romano. "L'attenzione di Giovan Pietro Vieusseux e le distrazioni di Julien Sorel. Documenti figurativi, fonti letterarie e manuali tecnici per una storia della pittura di paesaggio tra Settecento e Ottocento," in: Giovanni Romano, *Studi sul paesaggio. Storia e immagini* (Torino: Einaudi, 1991), 87-197.

[152] "In der schamhaften Stille deines Gemüts erziehe die siegende Wahrheit, stelle sie aus dir heraus in der Schönheit, daß nicht bloß der Gedanke ihr huldige, sondern auch der Sinn ihre Erscheinung liebend ergreife". See Friedrich Schiller. "Über die ästhetische Erziehung des Menschen in einer Reihe von Briefen," in: Friedrich Schiller, *Werke und Briefe. Bd. 8: Theoretische Schriften* (Frankfurt am Main: Deutscher Klassiker Verlag, 1992), Brief 9, 586.