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Canaletto's Visual Cone (1697-1768): The Observational Drawing through the Filter of Kepler's Retinal Optics

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Abstract:
During the XVI century, Plater's scientific advancements replaced the crystalline lens theory that originated with Galeno, with a new theory focused on the retina as the biological center in the formation of the flat image. With this historical rupture, Kepler sought to articulate the Euclidian geometry, the Renaissance perspective and the new optical-physiological description through the concept of "pictura". The mathematical correction allowed for the resolution of errors and geometric variances between the visual stimulus and the representation. The reversal of the "Euclidean Visual Cone" for the "Keplerian Visual Double Cone" demonstrates a novelty in the geometry of observation. This change in the boundaries of biological vision that extend and correct, influenced the field of art, particularly through the camera obscura. The operation of the camera obscura approached the description of the mechanical eye, and allowed artists an instant projection of the visual scene. The dissemination of this optical instrument favored the accuracy of design, increased production speed and multiplied experimentation. It automated a uniformly varied observation. However, the probability of the drawing with the camera obscura depended on the draughts person's perception. The mimesis of exercise exceeded the physical projections of the visual scene. The modeling of attention, experience and motivation of the phenomenological observer produced a visual information management based on four operations: selection, compression, hierarchy and speed. Canaletto technically developed this cultural dimension. Known as a landscape painter, his vedute had, as an aid, the drawing of in situ observation. Canaletto's observation methodology pioneered in foreseeing photographic multiplication: i) carrying out successive drawings of a given site, ii) expansion of the details of a scene depicted with variability of the focal length, iii) the panoramic drawing by increasing the amplitude of the visual cone. The panoramic perspective multiplied visual cones to a high frequency distribution over the field of view, which corrected the deformation of the peripheral vision of the observer through linear perspective. The standardization of focus for camera obscura allowed acceleration in observation times and representation in the drawing. The image of the camera was influenced but the observational drawing as a customized product of Canaletto. He corrected in his drawings the scientific vision of optical geometry by way of differences in creative topography of the human vision, in which art seeks answers.

Keywords: *Observational drawing, draughts person, visual cone, optics, Canaletto, Kepler*

1. Introduction

Among the many studies made by Johannes Kepler (1571-1630) his work in the field of optics is of particular relevance due to the scientific transformations in traditional paradigms of the perception of geometry by the human visual system. An important figure in the XVII century scientific progress in mathematics and astronomy, Kepler was the precursor for change on the paradigm on physical cosmology (Linnik, 1975). He is known to have formulated the fundamental laws of celestial mechanics (planetary movements), and created the conditions through the works Astronomia Nova (1609), Harmonice Mundi (1619) and Epitome Astronomiae Copernicanae (1618-1621), for Newton's universal gravitational theory. In addition to this contribution, his first studies in optics are described in Astronomiae Pars Optica, in 1604 (Simon, 1975).

Kepler's interest in optics derives from observing the size of celestial bodies, specifically the Moon's diameter variability in solar eclipse. So, in Kepler, the study of optics consists of an auxiliary tool for the analysis of astronomy, and not an end in itself. The ongoing scientific revolution allowed for the investigation of the physical behavior of lenses and mirrors as visual extensions, aspects that were applied in different technical devices (Edgerton, 2009), such as the invention of the microscope or telescope by Galileo Galilei (1564-1642). In the XVII century, the development of optical science and modern observation, of which Kepler was an important precursor, made it possible to expand other fields of knowledge, and question the view of limits in different contexts be it philosophy, medicine or religion.

These consequences of the modern scientific domain were also felt in artistic production. Instruments to enhance the accuracy of observation and representation have been used by several artists (Hockney, 2006), placing the findings of optical science at the service of art. The development of the camera obscura and its consequent widespread use in drawing and painting, altered several traditional methods of representation (Kemp, 1990). In painting, machines of observation created new viewing conditions, namely the flat image, with the main function of understanding the possibilities of a uniform vision. Several prominent painters are known to have used these optical instruments as observational aids, including one of the most important of the XVIII century, Canaletto.

2. Kepler and the Geometrical Optics through the Functional Map of the Retina

2.1. The Retina and the Optic, Geometric and Physiological Description of the Image

In the early seventeenth century, the contributions of medical anatomy on the physiology of sight were important scientific basis for Kepler's ideas. The work De corporis humani structura et. usu (1583) by Felix Plater was one of the great influences in the anatomical and functional knowledge of the eye. Until then, it was accepted that the optic nerve connection was made to the lens, but Plater refuted this by demonstrating this connection to the retina (Lindberg, 1976). Plater makes a careful description of the components of the eye with references to muscles, membranes and nerves. He describes, among other structures and functions, the iris and the pupil as initial openings through which of light would enter, passing through the sclera, cornea and choroid, until it reached the retina (Ings, 2008).

With these new scientific facts, Kepler's optics reformulated the theory of vision proposed by Alhazen in De Aspectibus (1028-1038) and Vitellius in Perspective (1230 / 35-1275). The first five books - Ad Vitellionem Paralipomena - included in the general work Astronomiae Pars Optica (11 books), studied the geometric optics through nature, reflection and refraction of light, framed within the concept of the eye as a producer of images (Kepler, 2000). The first book De natura lucis deals with the elements and the nature of light. The second book De figuratione lucis studies the images of light through the analogy of the camera obscura. The third book De fundamentis catoptricis et loco imaginis deals with the light reflection and with convex and concave mirrors. In the fourth book De refractionum mensura, Kepler searches for the law of refraction by studying incidence angles. This pursuit extends to his later work Dioptrice (1611) but without attaining a pattern of relationships that could enable a general law (Crombie, 1991). In the fifth and final book in this series, De modo visionis, he explains the phenomenon of representation of image in the visual process. It includes the explanation of relationships between the anatomical, physiological and geometric components of optics. The purpose was to show how an image of an external object appears represented in the human eye.

Thus, there is a rupture with the established idea since Galeno, on the formation of the image in the crystalline lens. And it is this departure from the classical conception that brings modern optics to the field of mechanical science (Simon, 1975). The anatomical contribution enabled the understanding of retinal function as a representational map of the light stimuli received by the eye. The components and functions described in the new physiology were subject to a geometric demonstration by Kepler, which allowed the creation of a mathematical proof of the representation of an image on the concave surface of the retina (Görlich, 1975). The retina became, at this point, the center of the biological production of the flat image.

Kepler discovered the proper solution to the problem by an experimental technique that perhaps drew its inspiration from Albrecht Dürer Underweysung der Messung (Nuremberg, 1525) – namely, by stretching a thread through an aperture from a luminous source, or rather from a book meant to simulate a luminous source, to a surface on which the image was formed. Tracing out the image cast by each point of the book in this manner, Kepler could see the geometry of radiation in material, tree-dimensional terms and was able to formulate a satisfactory theory of radiation through apertures, based firmly on the principle of rectilinear propagation(Lindberg, 1976: 186-187).

Moreover, the mathematical correlation of the visual cone section with the image, and the direct relationship between the distributions of points in the visual field on the surface of the retina consented the adaptation of Euclidean geometry to a new optical-physiological description. This is an important change in the functional anatomy of the eye. Nevertheless, the theory of three humors (aqueous, lens and vitreous) continues to be followed with specific functions in the architecture of the eye with sectorial responsibilities in the formation of the final image (Linnik, 1975). Kepler questioned the theoretical bases of optics, and tried to organize the physiological, anatomical, geometrical and philosophical aspects known by the end of the XVI century, putting the retina as the light record-keeping plain of the real, excluding the brain processing from his visual theory.

2.2. Kepler's "pictura" between Linear Perspective and the Visual Double Cone Theory

For Kepler, the image on the retina is the representation of the illuminated object with refraction introduced through the eye. Kepler uses the term "pictura" (painting) to designate the represented image on the retina (Ut pictura, ita visio). This way he explains the variation between the retinal image and the actual physical image (Alpers, 1983). He establishes a distance between the image we see represented, what we represent and the exact copy of the object. The image or "pictura" is not the object, it is the action of light and it is this action that makes the representation possible. The speed of light is instantaneous, since it contains no weight and no material body. The light crosses without awareness of contact (Malet, 1990). Therefore, its action is understood as refractions produced in the eye until creating the final image. Refraction is the geometric representation of the action of light, and is of particular importance in Kepler's theory, because that is what unites the concept of "optical geometry" and "pictura". This idea suggested by Kepler of painting as a printed representation and the retina as a refraction process sequence will largely influence painting of the XVII and XVIII centuries, particularly in the handling of optical apparatus for creating the flat image (Kemp, 1990).

On the other hand, the Keplerian "pictura" registered in the retina has a direct analogy to the Renaissance perspective. Because the geometric changes arising from the position of the observer and the vanishing point represent the painter's vision in a correspondence between eye movement and the bio-physiological registration of the light pattern on the retina. The linear perspective discovery by Renaissance artists, through the Brunelleschi tavolleta and the De pictura (1435) by Alberti, is the theory of vision based on the representation of volume and space on the canvas (Edgerton, 2009). The laws of perspective describe the possibility of a geometric structure to the visual sensation. With the Keplerian "pictura", the scientific knowledge on the physiological structures of the human eye was articulated with the techniques and methodologies of art history. But Kepler breaks with tradition (Euclid, Ptolemy, al-Kind, Galeno, Alhazen, Vitellius, etc.) that considered a visual cone formed with the base at the object and the vertex in the eye. He proposed the theory of "Visual Double Cone" where cones have their basis on the crystalline with the first cone vertex on the object and the second cone vertex on the retina. Thus, of the endless visual rays starting from a given point on the object, some enter the pupil and pass through the different structures of the eye with the refractions from the cornea to the crystalline and from there onto the retina, where the image is formed (Görlich, 1975). Kepler manages a radical transformation, because he reverses the visual cone. The “Keplerian Visual Double Cone” thus replaced the “Euclidean Visual Cone". In Dioptrique (1637), Descartes illustrates Kepler's dual refraction mechanism in the processing of sight, which puts the XVII century as the historical period of the substitution of the crystalline theory for the retinal theory (Sabra, 1981). And it is the prior knowledge of Kepler’s work that allowed Descartes to successfully formulate the laws of refraction.

Kepler defines the subject and the disciplinary field of optics, between elements of physical anatomy, functional physiology and visual geometry, removing from the discussion the psychological and cognitive aspects, such as feeling or perception, that occur after the optic nerve. He does not diminish the importance of the cognitive processes; he just does not include them in the formation of the retinal image (Simon, 1975).

However, Kepler was largely aware of the errors and deviations from the processing of vision. He suggested that the retinal image was later corrected in the brain by activity of the soul (Crombie, 1991). Because the eye was understood as a mechanical component of the body, a sensor with the possibility of geometric translation of the observed scene, its operation modifies the visible information. This mechanical and geometric translation serves to describe the successive refractions of light information in the eye (Lindberg, 1976). The explanation based on the fusion between human physiology and mathematic geometry was what allowed the correction of mistakes arising from the passage of light through the eye. These successive refractions questioned the verisimilitude. The idea that vision represented a copy of the real object was disproved scientifically, with repercussions in philosophy and theology. The image that we see was a version of what exists, and was subject to mistakes, errors and corrections (Kepler, 2000).

Kepler also excludes "visual spirits" in the study of optics, which until then were responsible for transmitting the image and the production of vision. He refers to the study in philosophy, the retinal image transfers into the brain through spirits present in the eye (Malet, 1990). He also raises the possibility that this process is reversed, with the spirits coming down to the eye from the soul. These explanations would solve the problem of memory as a persistence of the independent image of an object.

3. The Visual Cone and the Geometry of Observation as a Probability of Drawing

3.1. The Camera Obscura and the Uniformly Varied Observation Phenomenon

Kepler describes in his optical treatise, the image formation in the camera obscura, and stresses the analogy between the functioning of the camera obscura and the human eye (Linnik, 1975). The visual operations resulting from the action of light are similar (inversion and refraction) as is the path (entrance through an orifice and geometry of the cone) and the visual product (projection). But there are differences. The projection surface is flat and the retina is concave. And on the other hand, the image is flattened without hierarchy information, which does not occur in the retinal cell biology.

The camera obscura is an optical tool that produces a two-dimensional representation of the visual scene, technologically surpassing the windows previously used in drawing, such as Alberti’s veil, Leonardo’s frame or Durer’s grid. The camera obscura is a closed box containing an opening on one side with a lens that allows light to pass and thus create on the opposite face a projection inside (Tsuji, 1990).

The optical phenomenon of the camera obscura was known (Pastore & Rosen, 1984), at least since the late X century, explained by Alhazen (965-1038), and even appearing in scattered references in China the IV century BC and the West by Aristotle (384-322). It is however, the Renaissance and with Leonardo who recover the analogies with the workings of the eye with the camera obscura, in an attempt to find an integrated visual theory. Giovanni della Porta indicates the camera obscura as a resource to draw for the first time in Magiae naturalis (1558), from the context of the construction of scientific image and not of artistic production (Gernsheim & Gernsheim, 1969).

As the methods for producing a correctly oriented image, della Porta mentions – albeit in slightly vague terms – the use of plane mirrors at angles and an alternative technique involving convex lenses and concave mirrors in combination (…)

Kepler introduced a method for correcting the image in a camera which, rather than involving mirrors, instead used two convex lenses in combination, spaced a suitable distance apart (Steadman, 2001: 10).

From then on, it is historically known the dissemination and use of the camera obscura as a resource for the visual representation on the plane. Several publications, editions and translations spread over the following centuries (Hammond, 1981). The Encyclopedia of Diderot y D'Alembert had several models of these cameras. It allowed crossing of different models with methodologies and operating procedures, whose successive portability and recognition among painters and draughtspersons and allowed for a greater application of this mechanism in graphic production. The camera obscura made possible the investigation of the organization of the visual scene in

relation to the view taken by the subject with successive records that revolutionized production speed and experimentation (Pirenne, 1970). The box mediated vision and representation, making the observation autonomous and uniformly varied. The technologically stabilized image increased the observer-draughtsperson standardization process.
Later, the source idea of the darkroom as a possibility of "drawing with light" gave rise to the pinhole camera used in the invention of photography by Niépce, Daguerre and Talbot (Geider & Westgeest, 2011). Photography as chemical fixation of a real model and all its technical apparatus from the nineteenth century comes from drawing mediated by the camera obscura in previous centuries. With photography, the search for standardization of vision reaches its goal. Similarly, the possibility of instantaneous speed in image production becomes apparent.

3.2. Mimesis, Drawing and Visual Selection Mediated by Projection and Geometric Optics

The direct copy over the resulting projection of the camera obscura allows the drawing of the flat image. However, this exercise of mimesis is not literal. The gathering of elements to sustain and its transformation into graphic mark (line or stain) requires a process of visual attention and selection. This operation allows the final design to not be an unordered set of lines (by excess or defect), and to collaborate towards the unity of the extracted image (Alpers, 1983). The visual markers used by draughts person depend on their thematic orientation, objectives and experience in drawing. Of all the available information, the draughtsperson marks the protrusions that allow the construction of a coherent scene with a three-dimensional view and not only with the flattening of vision. The marking of volumetric contours in the projected color image, which allow deciphering of the rules of perspective, was the most used strategy with camera obscura. This strategy allowed the collection of visual data for further representations, and worked like a guide for corrections (Kemp, 1990).
This process of “taking from the projection” produces a compression of the available visual information. The details in morphology seen in simultaneous with the variability of light (color, reflection, contrast, light and dark) are reduced to the apparent contour of volumetric borders (Hambly, 1989). The visual hierarchy is subtracted, with consequences in the distribution of information and its correspondence with the experience of three-dimensional view. This experience intersects with the passage of time and movement, and its introduction in the drawing is accomplished through small graphic details that represent the physical and phenomenological protrusions of the visual maps, and not by fixing the projected image. Therefore, the camera obscura should be understood as a machine for visualization, not for viewing.
However, the use of camera obscura is not new in the use of instruments to increase the accuracy of representation. Hockney (2006) argues that throughout art history, especially between the invention of perspective and the invention of photography, several artists used various optical artifices as aids for visual accuracy. The use of lenses and mirrors were common practice, and artists such as Van Eyck, Caravaggio or Velasquez collected information from natural reflective surfaces. There are strong indications of technical articulation of these lenses with the apparatus of the camera obscura by several painters such as Vermeer (Steadman, 2001). The lens orifice of the camera obscura allowed focusing and sharpening of the image such as the description of the details of the morphology of objects, draperies, faces and their glows. Some details appear blurred, typical of a direct representation of the lens margins (Hockney, 2006). Parts, conditioned by the extent of the visual field that size of the lens allowed to register, mounted the final scene. In the same composition, perspective emerged at different angles because of juxtapositions. The direction and intensity of light were particularly fitted to match the maximization of optical phenomena of the projection. Therefore, the changes in observation that occurred with the camera obscura were already familiar in art history (Pirenne, 1970). The principles of visual information management (selection, compression, hierarchy and speed) with fragmented and dispersed visual cones, in order to create a comprehensive and objective composition, were a shared practice.

4. Canaletto and the Draughtsperson’s Visual Cone in the Transformation of the Visible

4.1. Canaletto in Eighteenth-Century Landscape

Giovanni Antonio Canal (1697-1768), known as Canaletto, was a painter specializing in the representation of the urban landscape, the vedute, in particular his hometown Venice. This genre has background in seventeenth-century Dutch painting and reaches prestige in European Baroque, mainly by the study it does on perspective, color and light/ shadow (Links, 1994). It had followers in later centuries, notably in the Impressionists and Naturalists of the nineteenth century.
Part of their learning had been guided by his father Bernardo Canal (1674-1744), who was a acknowledged and prestigious Venetian stage designer. With his father, he worked in the construction and painting of operas scenarios in Italian theaters (Baker, 2007). From this activity he inherited the teachings on perspective, which proved very useful in his drawings. Likewise, the books of architecture and perspective of Galli Bibiena (1657-1743), e.g. L'architettura civile preparata su la geometria e ridotta alle prospettive (1711), were important lessons in Canaletto route (Berto & Puppi, 1968).
The most emblematic body of Canaletto's work is the Venetian landscape, the representation of the palaces, the relationship of the buildings with the water channels, the ratio of urban views, the chromatic richness, the reflections of light and the description of everyday identity. This interest will come from the contact with the work of Panini (1691-1765) during his trip to Rome. Panini specialized in the Roman landscape and will have been an influence in the Canaletto’s path (Martineau et al., 1994). Painters such as Luca Carlevarijs (1663-1730) or Caspar van Wittel (1652-1736) also contributed to a better understanding of landscape painting. However, also the English urban landscape, especially the city of London, to where he traveled in 1746, provides a strong example of the exercise of representation with a meaningful collection of drawings (Roberts, 1987). This trip that lasted nearly 10 years, can be

understood as a shift in contacts he had with English painters during these trips to Italy, framed in the cultural movement of the Grand Tour.

4.2. The Multiplication of the Visual Cone: the Temporal Cut in Canaletto's Observational Drawing

Canaletto used the landscape observational drawing as a survey of structure, morphology and light of the city. Working memory storage, with graphic and alphanumeric notes - the scarabotti. Designation given by Canaletto to his preliminary sketches, which can be translated by scribbling, and given the role of helping to build his works of painting (Baker, 2007). The final work was done in studio. The drawing was the field of work, and had a direct relationship with the project activity. His Quaderno Veneziano is an example of his continuous visual research, through sketches with functions for different phases of the work: first as collection, then as selection and detailing, and finally as placement test in the conclusion stage. This book belongs to the collection of Gabinetto dei Disegni and Stampe delle Gallerie D'ell Academy di Venezia, and contains more than a hundred drawings made directly in situ (Gioseffi, 1959).

Amongst Canaletto's many drawings there is a category of design which is best explained by supposing that it is based on a camera image. One sketchbook contains setsof two to four drawings which join up to produce a continuous vista (…) such a serial compilation of a wide-angle view from successive 'shots' corresponds to one of the characteristic ways of using optical aids. I think it is virtually certain that these and similar drawings by Canaletto were transcribed from a camera image, either directly – if he used a tent-type camera (pl. 391) – or by one of the many methods of transfer. The line possesses an unusual quality; it traces the perspectival outlines in a summary, free-hand manner with virtually no auxiliary construction lines. Between such drawings and the final paintings, there remained a considerable effort of perspectival, tonal and colouristic organization (…) (Kemp, 1990: 197).

The Canaletto work is a pioneer of the idea of the sequence facilitated by the photographic record, for the following reasons: i) carrying out successive drawings of a given site, ii) expanding on details of the scene depicted with variability of the focal length, iii) the panoramic drawing by increasing the amplitude of the visual cone. A pre-photo of the views is completed over several pages of drawings in continuous format and with extreme precision in marking scale and proportion (Constable & Links, 2004). This panoramic view is a multiplication of visual cones of high frequency distribution over the field of vision, seen as the whole view of a surrounding area, at an angle of 180 to 360 degrees, serving to record the articulated visual sequences. It worked as a planning and annotation of the depth of field. Besides representing buildings located at lateral positions without perspective deformations characteristic of the borders of the representation (Moschini, 1969), the view unfolded with multiplication of visual cones in linear path and not by central pivot, is a deformation of the visual position of the subject. These aspects move towards the possibility of Canaletto having used the camera obscura for the production of his drawings due to the features of the produced images.

Canaletto proved to be an active observer, and the use of camera obscura tuned his vision. In addition to having been influenced by the machine, his trained gaze also changed the machine's images. His experience and knowledge enabled him to see the structure of the projected image, and thus make use of the projection and not only its decal or overlay (Links, 1994). Canaletto is aware of painting as a construction seen by the observer who sees it, included in it and not as the distance of the observer to the frame. A simple mimesis such as scientific, mechanical or algorithmic precision does not meet the cultural and permanent truth between the artist, the scene and the observer.

Canaletto's visual operations on the projected image were a lesson on how science and art can communicate. The cutouts that he made of his drawn records, the arrangements and combinations that he produced and the additions which he allowed (Levey, 1994), turned the initial images and corrected the scientific vision to make it closer to human vision. The planned methodology of rigorous collection of geometric perspective would be subject to distortions and corrections to make an artistic, cultural and natural product. Therefore, trying to pass the visual contradictions arising from perspective as a science. The invention, replacement and creative composition introduced in the material truth of the scene, which was called Canaletto capricci(Links, 1977), while the view of the imagination (vedute ideate) in contrast to the exact view (vedute esatte).

Canaletto not only uses the linear perspective, but also complements it with atmospheric perspective. He uses it as the depth registration method for change of tone between the first plans and plans apart. Light and the shadow lose intensity as they move away from the observer, with changes in the contour's morphology (Berto & Puppi, 1968). The reduction of visual information along the depth axis, allows greater perceptual fidelity. Moreover, the introduction of reflections and own and projected shadows complete the spatial feeling, marking tonal contrasts and marking volumetric scales. Canaletto makes use of a drawinggrammar, which projects the precision of the contour line with the use of hatches in the shadow that delineate the direct and reflected light. He often uses the straight line 45º to build the hatch. The material he used to draw more with was graphite, on which he traced the final line in ink (Baker, 2007). The tonal variations were often marked to watery.

Ruskin says that in his view Canaletto 'professes nothing but coloured daguerrotypism...' The daguerreotype, named after its inventor Louis-Jacques-Mandé Daguerre (1789-1851),was one of the earliest forms of photographic reproduction, which at this time was a relatively recent technical innovation. Comparing Canaletto's pictures to photographic subsequently became a theme often taken up by commentators on his work – the association could either be used to illustrate his skills as an observer and recorder of reality, or, depending on your point of view, to underline his lack of imagination. Such discussions parallel the debate over his use of the camera obscura (Banker, 2007: 25).

5. Conclusion

From the sixteenth century, the retina becomes the main component of the eye with the image registration function brought by the light from outside. A model that put the retina as the physiological structure of the image formation replaced models by Alhazen, Vitellius and Galeno, which placed the crystal as the main responsible of vision. With the findings of Plater, Kepler reformulated optical knowledge and proposes a theory that unifies anatomy, geometry and visual sensation. These new scientific discoveries in the field of vision, on the physiological and geometric operations in the production of biological vision, were a productive field to consider new proposals on the possibilities to draw what is seen.

The Kepler's "pictura" as the "retinal drawing" is a transformation of the real undergone geometric processing from successive refraction of light stimuli (Malet, 1990). The biological geometry and linear perspective, articulated with the Kepler's mechanical eye, lead the history of art to a uniformly varied observer. The camera obscura served as a physical structure for this speed uniformity and vision autonomy. Its use in drawing, as an artistic methodology, increased accuracy in the description of the real (Kemp, 1990). The decal of the projection potentiated in many painters the presence of a virtual skill. The ensuing visual knowledge changed the experience of vision, and modified the strategies of artists in the production of the flat image. Drawing as a physical structure, increasingly approached the visual correspondence between the observed and the represented, which preceded the desire for photography.

One of Canaletto's observation methodologies focused on these planning apparatus. With the camera obscura, Canaletto standardizes focus. This information allows the pictorial work to show accelerations in the times of observation and image production. A new distribution of the observer's visual cone on the scene was one of Canaletto's strategies for recording a panoramic view. A succession of visual cones, wherein the overlapping boundaries of the visual field were combined in linear perspective. The important thing for Canaletto was to find the similarity of seeing from the perspective perception of a place and the visual sensation in the painting (Links, 1977). But it goes beyond mimesis, making observation into a cultural product, distancing the mechanization of camera obscura by correcting errors and visual deviations that occur in geometric and scientific vision. The strength of his drawings lies in this overdrive that Canaletto consciously does by placing it at the same time in the preview of the objectivity of landscape photography and in light of studies in Impressionist landscape painting (Constable & Links, 2004). For if on the one hand the volumetric perception in Canaletto's observational drawing is produced by the correction of contour-perspective, its composition is determined by the application of light through the frame, the shadow and the reflection (characteristic in Venice).

Out of curiosity, it should be noted that the Kepler himself would have used the camera obscura to draw (Alpers, 1983). Near his Austrian home, where he performed astronomical observations, he will have used a black box, with capacity to accommodate one person. Easily mobile and mediated by the use of lenses, he would receive the external projection on a sheet of paper on which he would draw the lines. It should be noted that Kepler considered his venture as a draftsman than as a painter, but as a mathematician.

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