International Design and Art Journal

IDA: International Design and Art Journal
ISSN: 2687-5373
Volume: 4, Issue: 1 / 2022

Research Article

Comparative study of aerial photography / (UAV)-drone vs 16th century cityscape art

Asst. Prof. Dr. Yoong Wah Alex Wong[1*], Sr. Lect. Ernesto Carlos Pujazon Patron[2], Sr. Lect. Jose Domingo Elias Arcelles[3]

[1]Sabancı University, Faculty of Arts and Social Sciences, Visual Arts and Visual Communication Design Program, İstanbul, Turkey.
ywalexwong@gmail.com

[2]University Technology MARA, College of Creative Arts, Kuala Lumpur, Malaysia.
hsecpp@gmail.com

[3]Pontificia Universidad Catolica del Peru, Faculty of Arts and Design, Lima, Peru.
jelias@pucp.edu.pe

*Corresponding Author

Received: 30.03.2022
Accepted: 22.05.2022

Citation:
Wong, Y. W. A., Pujazon Patron, E. C., Elias Arcelles, J. D. (2022). Comparative study of aerial photography / (UAV)-drone vs 16th century cityscape art. *IDA: International Design and Art Journal*, *4*(1), 57-75.

Abstract
Technology has predisposed us to various opinions on the current state of affairs. This article aims to investigate the historical approach and the development of aerial photography, namely a comparative study using drone (UAV) as a device vs 16th-century city and landscape mapping. This article also intends to explore how aerial photography with a drone (UAV) technology may provide a better understanding of how to improve the development of the metropolitan landscape. This study indicates that one can use a drone device to instantly visualise and better understand the cityscape from different dimensions and perspectives. The drone potentially previews and captures the live visuals, offering another representation of scale and reality that is impossible in the traditional city and landscape painting (mono composition). This study would employ an empirical method of observation and measurement of phenomena using verifiable evidence that the researchers experienced before reaching concrete outcomes. At the same time, this paper reviews the usage of the drone as a visualisation and representation tool to better construct an alternative reality (possibilities of different views). As a result, the most appealing aspect of utilising a drone (UAV) device for photography is the ability to shoot from a higher viewpoint. Most drones, particularly those meant for more advanced users, include built-in cameras that can spin and swivel to allow the operator to take photographs and videos from various angles. As a result, drone usage improves visual and cultural background documentation to provide alternate answers that would otherwise be incomprehensible.

Keywords: Camera Obscura-Pinhole Camera, Photography, Aerial Drone-Photography, Panoramic-View, Unmanned Aerial Vehicle (UAV).

INTRODUCTION

The simulation of depth, space, 3-Dimensions or the illusion of space in artistic works presented on a flat surface has been a challenge for artists ever since the first people walked the earth. Although mapping the ground to be represented is invariable, voluminous and located at various distances or graphic scales, these representations on the wall, paper, or canvases have been, by necessity, in two dimensions (Brooks, 2017:1). Throughout human history, artists, scientists, and explorers have attempted to imply the depth of space (landscape) by using various tools and techniques that exploit and explore the profundity of prominent monocular “pictorial cues”. Techniques such as “interposition” relative to object (item) size, linear position/perspective, aerial/atmospheric perspective, texture, gradient, and height in the visual field are interpreted through perception. The capacity to acquire, portray, and understand spatial data and utilise that data to analyse the physical and human components of the environment is a critical trait for the artist (Williams, et al., 2016: 2).

A Look Back at the History of Photography

The origins of photography as the device machine per se are somewhat of a mystery. However, it may have been a gradual development from the early invention of the “Camera Obscura” (Latin for a darkroom), where

people independently moved towards the same goal of capturing images, which has been revealed since the time of Leonardo. This device utilises the optical principle that light rays from a bright source pass through a small aperture or pinhole into a dark space (room, box), projecting an inverted image of that thing onto an opposite surface (Myers, et al., 2018: 169), easy for an artist to trace over. These images were sometimes known as light-drawing or light-painting. The term "photography" derives from the Greek word "phos-φως", meaning "light" or unit of illumination and "grapho-γράφω" meaning "writing". Unfortunately, the image reproduced inside the box could not be kept or protected for further development. From its earliest time, the "Camera Obscura" was a popular tool for drawing and recording the realistic landscape used in rendering any views or architecture (Myers, et al., 2018: 169). The "Camera Obscura" has been well-known since classical times. To photograph the living or non-living objects (thing) required the image to be fixed and reproduced on another surface (Forrester, 2020). Such an invention was not achievable until the 19th century following the discovery of certain light-sensitive silver compounds. Centuries of advancement in chemistry, physics, and optics, including the development of the "camera obscura" set the stage for the world's first photography. In the 17th century, Johann Heinrich Schulze (1687-1744), a German professor and polymath, showed that specific composites of silver nitrate and silver chloride blackened on exposure to sunlight (Forrester, 2020). Schulze, discovered that sunlight rendered the substance black in 1725 while producing a phosphorescent material by mixing chalk with nitric acid containing dissolved silver. He experimented with shapes and forms cut from paper and doused with a solution bottle. Still, he never created a lasting image.

The Spanish town of Toledo was the focal point of a massive endeavour to translate Arabic texts into Latin in the early 12th century. Scholars of Christianity, Judaism, and Islam came to the city, where they coexisted and collaborated to transcribe ancient knowledge into Latin and eventually into other European languages (Dowidar, et al., 2015). Arab astronomers such as Ibn al-Haytham (965 AD-1040 AD) was an 11th-century scientist, mathematician, astronomer and physicist of the Golden Age of the Islamic civilisation. He utilised a dark chamber dubbed "Albeit Almuzlim", which translates into Latin as "camera obscura" the instrument that forms the basis of photography to investigate the nature of light and vision. He saw that light passing through a tiny hole travelled straight and projected an image onto the opposite wall. Based on similar experiments, Ibn al-Haytham determined that vision is accomplished by rays entering the eye from external bright sources, rather than rays emanating from the eye, as was previously thought (Dowidar, et al., 2015). It was also used to observe the movements of the sun and the moon. Roger Bacon (1220-1292) was a medieval English philosopher and Franciscan friar who placed considerable emphasis on the study of nature through empiricism. Bacon described the use of a "camera obscura" for the safe observation of solar eclipses. This device introduced the optical principal to Europe, where photography would eventually be born. Leonardo da Vinci (1452-1519) in the 15th century was familiar with the works of Ibn-al-Haytham (Alhazen) in Latin translation, and used the same method to produce accurate drawings. After an extensive study on optics of the human eye, he described the first clear definition of the "camera obscura" in the Codex Atlanticus (c. 1502). Johannes Kepler (1571-1630) a German astronomer developed, at the beginning of the 17th century, an understanding of the optics of the "camera obscura" with a lens and its relation to the human eye. He also developed the first portable "camera obscura" in the form of a "tent" with sheets of paper inside which the camera image could be projected and drawn on.

It has been widely speculated that Johannes Vermeer, who was one of the brightest stars among the famous Dutch Masters of the 17th century, might have used such a device as the "camera obscura" to create most of his paintings. There is an incredible precision with which Vermeer rendered details, particularly his domestic interiors (Wolfgang, 2007). One of the compelling qualities of his pictures is the feeling of "reality" they convey (Jelley, 2013: 19). Maps, furniture, and framed paintings are precise in scale but not in details, mostly how a simple camera with a lens will work. It does not focus sharply at once on every aspect of the picture (Jelley, 2013: 19). Optical instruments are mentioned countless times in art treatises and manuals, yet few individual artists have left written documents on the actual use of such devices (Carson, et al., 2008: 24). In the 16th century, the "camera" was known as a "device" to help artists to draw more accurately. The device's abilities enhance an artist's awareness by prolonging the landscape's presence. Further study of the landscape details is possible by capturing the moment of the atmosphere, such as tones, colours, and shading of the landscape (Carson, et al., 2008: 24). It was a Frenchman, Joseph Nicéphore Niépce (1765-1833), an inventor and a pioneer in this field, who in 1827 discovered how to make an image permanent (Forrester, 2020: 3).

Niépce developed a technique called “heliographie” from the Greek “helios” meaning “the one above” or a personification of the “Sun” and “grapho-γράφω” representing “writing”, making the early photography of “View from the Window at Le Gras” (Figure 1, beneath). This technique captures the image with a “camera obscura” on a bitumen-coated pewter plate. The light-sensitive plate took several hours to record the image, as the sunlight illuminated both sides of the building. Later on, he partnered his development with Louise Jacques Mande Daguerre (1787-1851), a French artist and photographer, refining the process into Phys-autotype (Myers, et al., 2018: 169). Those impressions have an evidentiary power due to their indexical relation with the physical world.

Figure 1. Joseph Nicephore Niepce, “View from the Window at Le Grass”, c.1826.

In the early days, photography could be regarded as mirror art. This is because photography’s primary purpose was to record and document existence. Occasionally malfunctions and accidental circumstances while capturing a scene led to those half-tone images. Such unintentional results may convey the illusion of space and form. An utterly distinctive appearance that differs from any previously made – an image is now formed mechanically through such a device, unaffected by the values and selective human judgments inevitably contained in any drawing, painting or printmaking creative process. Despite its crudeness, those half-tone shades could transmit a more realistic, three-dimensional image than any print or picture previously (Crawford, 1992: 2-8). A new profession appeared on the horizon; photographers used cameras as skilled craftsmen, adapting lenses made by optical manufacturers to their new devices. On August 19, 1839, the daguerreotype, the first entirely feasible photographic technology, was presented to the French Academy of Sciences and was subsequently made accessible to everyone to use for free and for whatever they chose. Germany became the new pioneer in a veritable camera boom a few weeks later. Many cabinetmakers made their initial cameras as individual pieces and sold them to clients or dealers. Dr Richard Leach Maddox, an English surgeon, invented the bromide silver gelatine dry plate in 1871, which opened the door for industrial camera manufacture. Numerous manufacturers attempted to establish themselves in this new market, and lens expert ZEISS was also interested in joining this developing business (Oberkochen, 2020). Optical manufacturers like Zeiss (Founded in 1846), Leitz (Founder of Leica), and others began to create lenses specifically for cameras early in the timeline of the history of photography. In 1840, Voightlander AG went further and produced the first all-metal camera. The revolutionary lens was light-fast to reduce exposure time to around one minute.

Aerial Photography

Britannica online dictionary defines aerial photography as the technique of photographing the Earth’s surface, atmosphere or hydrosphere with the camera mounted on aircraft, rockets, or earth-orbiting satellites and other spacecraft (Britannica, T. Editors of Encyclopaedia (2019, March 7). aerial photography). The word “aerial” originated in the early 17th century, which is from the Latin “āereus- ἀέριος” originally from the Greek “ἀήρ” a masculine meaning for “air” *(“ἀήρ” – WordSense Online Dictionary (February 8, 2022)*. The main characteristics of aerial photography are mostly for terrestrial mapping features taken in an overlapping series from a flying object (Drone-UAV) following a flying pattern, commonly a fixed altitude. These snapshots include surveys of several control points and strategic locations. The extracted data is an invaluable method used in topography, geology, hydrology, soil and vegetation, meteorology, ocean currents, fish resources and

art. Aerial photography is also necessary during natural disasters, accidents, or emergencies, such as searching for surviving victims, damage assessment appraisal, construction progress report, property boundary, records, and clarification of zoning issues. Aerial photography is vital for military purposes, such as surveillance and intelligence gathering applications used with satellite technology and expert interpretation. In the 19th century, photographers such as Thaddeus S. C. Lowe (1832-1913), an American Civil war aeronaut, scientist and inventor, is considered the father of military aerial surveillance in the United States. George R. Lawrence (1868-1938) was a commercial photographer who took impressive pictures with a camera suspended in hot-air balloons or hung from kites, demonstrating two crucial points; a) the scenic landscape geography and b) the military value of this method. (Figure 2, beneath).

Figure 2. San Francisco in ruins, waterfront in the foreground, with sunset over Golden Gate in the background, looking from 2,000 feet (610 m), by George R. Lawrence using Kite aerial photography, May 28 1906. Market Street leads directly away from Ferry Building tower, centre foreground, towards Twin Peaks, centre-left background

Subsequently, with the development of aviation, "photogrammetry" became an important tool for map-making and landscape surveying (Britannica, T. Editors of Encyclopaedia (2016, October 21). Photogrammetry). Relaying in photogrammetry is important for the information provided by studying the physical objects and the environment through recording, measuring and interpreting images and patterns of electromagnetic radiant imagery and other phenomena. Taking photographs from two locations provides an "aerial triangulation". (Figure 3, beneath). However, references from drone-UAV for landscape coastal erosion surveying and monitoring are still scarce in the scientific literature (Gonçalves et al., 2015: 102). Most studies on military applications, state surveillance, and adapted for use as a weaponised device with expensive sensors might not be available commercially (Gonçalves, et al., 2015: 102). Several artists have interpreted drone-UAV devices to symbolise current preoccupations with governmental surveillance, privacy, artificial intelligence, or distant warfare. The preoccupations have led to a strong interest in this new technology, likewise, for the film and entertainment industries it opened unexplored fields filled with unlimited boundaries and possibilities (Figure 3, beneath).

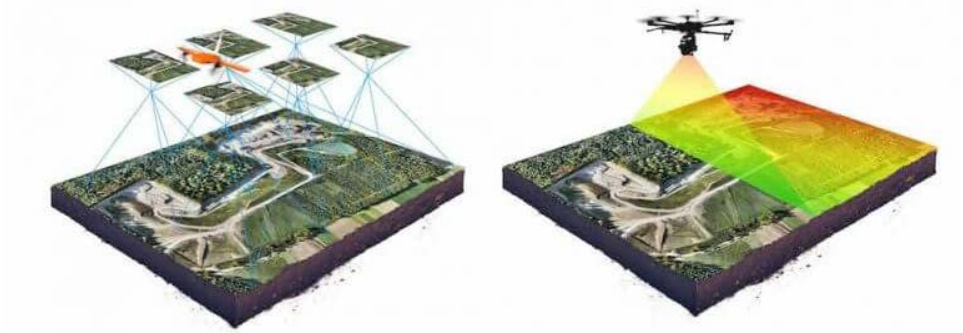


Figure 3: Photogrammetry using aerial triangulation

In photogrammetry, the formation of perfectly combined details is challenging to achieve. The cause is inevitable angular rotations and tilts produced by meteorological circumstances, such as air-pockets, air-currents, and human errors that cause an imperfection in attaching the camera to a flying device. There are, however, numerous devices that are light enough to be carried by a single camera with GPS link to a tiny computer processor for image-making (Gonçalves, et al., 2015: 102). As the First World War developed, aerial photography provided vital information and intelligence. Due to its importance, much of the sophisticated surveillance technology remains classified, aerial photography (Drone-UAV) and satellite photography function in a comparable pattern. The geographical land and camera speed are set or determined before entering the photographing area to guarantee the homogeneity of speed and altitude. The result is an image of a narrow strip that merges with overlapping photos of nearby strips to create a panoramic view known as a mosaic of photos. Single photography of an area could provide visual data. In the mid-1960s, the National Aeronautics and Space Administration (NASA) launched an attempt to design and deploy the first Earth-monitoring satellite to satisfy the demand of earth science and resources managers providing repetitive global coverage of the Earth's landmasses. The most well-known remote scanners are the Landsat series: 1,2,3,4,5,6,7 of satellites, which have been mapping vegetation and geological formations on the earth's surface since 1972. The satellite continued to function beyond 1 year of its designated life expectancy and finally ceased to operate on January 6, 1978. Under its application, the Landsat data has been used by government, commercial, industrial, civilian, military and educational communities in the United States and worldwide. It also provided data on global forestry, geological research, agriculture resources, mapping water quality and oceanography (USGS, fact Sheet 2015-3081. U.S. Department of the Interior & U.S. Geological Survey). Over the last 10 years, the Landsat programme has undergone significant changes, many of which have been made possible by activities taken by the two government Landsat partners: NASA and the United States Geological Survey (USGS) (Wulder, et al., 2015). The French Satellite Pour L'Observation de la Terre (SPOT) series was first launched in 1986, a commercial high-resolution optical Earth-imaging satellite system operating from space. It helps to facilitate better image visualisation and a wide panchromatic band with a high spatial resolution (Mhangara, et al., 2020: 2).

The National Aeronautics and Space Administration launched the Magellan spacecraft from a space shuttle in 1989. It used synthetic aperture radar to obtain and map the Venusian surface through the clouds that permanently surrounded the plane (Logsdon, J. M. (2019, 5 March). *Magellan. Encyclopedia Britannica). The* Lunar Prospector was launched in 1989 from Cape Canaveral using a Lockheed Martin LMLV2 rocket. Their mission was to map the moon's surface composition, locate lunar resources, measure the magnetic and gravity fields, and study the Lunar outgassing. There were no cameras installed on this satellite, instead, there was a Gamma Spectrometer (GRS), Magnetometer (MAG) and Electron reflectometer (ER) (Lozier, et al., 1998). The Mars Global Surveyor (MGS) spacecraft was launched in 1996 to circle Mars and acquire photos of its surface using several instruments such as the Mars Orbiter Camera (MOC), the Thermal Emission Spectrometer (TES), and the Mars Orbiter Laser Altimeter (MOLA). The spacecraft aimed to monitor and research long-term trends in Mars' atmosphere, collect data on geologically significant locations on Mars' surface, and help future Mars missions (Figure 4, beneath). The Mars Global Surveyor, which communicated with scientists four times as long as initially expected, met the goals. In 1989, the Galileo spacecraft was launched from the shuttle Atlantis and began exploring Jupiter and its moons. This old spaceship was running low on fuel in 2003, battling radiation difficulties and other technical challenges. NASA opted to fly Galileo directly into Jupiter rather than leaving it in orbit, in case the probe inadvertently crashed onto Europa and destroyed potential life there (Howell, 2017).

Figure 4. The stunning panorama with 5,000 commands parameters shot a total of 142 images that were directed back to Earth where NASA stitched them together. NASA stitched it together tile by tile in a circular formation, starting with the horizon and ending with the rover

Investigating the Nature of the Landscape

As an intrinsic representation in the human interpretative approach, the landscape shows many contents for its methodological research approach. As a result, it is not only limited to the cultural realm or the physical manifestation of nature, it also reflects conceptual variables that express paradigmatic rules that manifest regulatory models as territory (Levrand, 2021: 1-17). Similarly, when natural riches and human buildings combine to improve the evaluative quality of the space included in the landscape (González, et al., 2021), they promote interest in historical and geographical topics as a teaching-learning approach context (Serrano, 2021). These traits enable us to dive deeper into its evaluative aspects in everyday contact. Humankind has designated cognitive, procedural, and attitudinal interpretation from an integrated viewpoint for the approach to landscape study (Muratore, et al., 2020). Even the fervently Positivist School of thought or the empiricists' philosophical theory holds that all genuine knowledge is either proper by definition or "positive" meaning a posteriori fact derived by the reason and logic from sensory experience. From the middle of the 19th century to the early 20th century, it was also postulated that, under a biological agency supported by a Darwinian perspective, the landscape inscribed in a territory shaped the morphology of its inhabitants and their temperament. The proclivity for work, the good spirit, and the advancement of civilisation, or, on the contrary, the inability to solve new civilising challenges, melancholy, and barbarism of primitive people, were channelled by the landscape in which they lived (Margaretucci, 2020). Geographic determinism, which was imposed on the inhabitants regarding their uses and customs, combined with the landscape, intellectually generated by Eurocentric academic circles (Aguirre, 2020), greatly influenced the interpretation of reality beyond the European continent in those centuries; for example, in South America, works such as "Facundo o Civilización y Barbarie" (1845) by the Argentine Domingo Faustino Sarmiento (1811-1888), where its narrative complements the historical and social overview of the southern area overlaid on the scenery. Sarmiento (1955: 189) concludes that the bountiful terrain of the Argentine terroir has created a local population (original) foreign to the civilising process and development, and so emphasises that European migration will be the saving medicine that reverses this evil for the welfare of the Argentine country. Even further from the period in which the positivist interpretation of the progress of reality embodied in the previous example is circumscribed, in the middle of the 20th century, Luis Alberto Sánchez (1958: 201) in El Peru: portrait of a country adolescent, points out the benefits and limitations, successes and failures towards national progress, possessed by city and provincial Peruvian inhabitants of the north, centre, and south of the country from a sociological perspective related and interrelated with the landscape, concluding that the adolescent stage in which Peru finds itself suffers from situational and attitudinal prerogatives that maturity grants. The landscape as a unit of study allows for revealing approaches to tangible reality, which, as previously stated, express paradigmatic examples that provide interpretations intrinsic to the human being; from a descriptive interpretation of the concrete to a symbolic interpretation of the sensible that the landscape evokes (Gómez, 2021). Both views are being reconfigured as component aspects of a primordial tradition or transcendent entity

that shelters the creative nature to be depicted or conveyed through pictures, manifested by the person who sees it. The problematic sense of the various variables converges the study and observation of the landscape.

On the other hand, it reveals how in the world of ideas, the reason is insufficient in wielding ideas that involve transcendental entities to explain the nature of the landscape in the metaphysical field (Justo, 2022). The warning to this prelude is made clear in "Critique of Pure Reason" (1781), by Immanuel Kant (1724-1804), where he claims said insolvency is to deal with issues about God, the soul and the world, as an event germ of creative nature. Kant's philosophical theories, which encouraged replacing knowledge with faith (González, 2020), produced an anti-rationalism that permitted romantic thinking to glimpse a naturalistic mysticism (Tillera, 2021). Similarly, Edmund Burke's (1728-1797) sublime category stimulated the perception that the human being showed in his interaction with the landscape. In nature, the landscape is neither beautiful nor ugly, but sublime (Godoy, 2019), assessments between order and chaos, the traditional posture of the classical canon already surpassed by romanticism. The portrayal of the landscape in Western art history demonstrates the application of many talents and skills typical of the Fine Arts (Bartolotta, 2017) since it might be represented on a sheet of paper, canvas, wood, or wall using sketching, watercolour, tempera, or oil methods. The observer should not assume that the environment was also wonderfully ornamented in painted pottery, which displayed the natural essence that materialised the artist's viewpoint. This portrayal interweaved into the stained-glass architecture of Western churches. Understanding linear perspective enabled the depiction of the landscape to be the outcome of a well-balanced study at the schools of Fine Arts and recorded with verismo. The hunt for precise tools in landscape depiction was never-ending, with the conical or linear perspective viewpoint accounting for it. With the introduction of the photographic camera, facilitated by the industrial revolution, artists turned to the study of colour. They were influenced by Isaac Newton's (1642-1727) and Michele Eugène Chevreul's (1786-1889) research on colour theory, and enthusiastically assumed the transfer of said knowledge to the handling of the physical pigment and the chromatic elaboration of their palette. They incorporated tools and technological findings typical of their time's basic and applied sciences. As a result, it is not surprising that contemporary artists use visual representation technologies to express themselves in their work. Digital tools encourage the exploration of various media in which they manifest the symbolic meaning of what is represented and describe the artist's feelings (Blanco-Barrera, 2021). In the communal imagination, these symbolic configurations depict the daily manifest in diverse ways mediated by technology (Marcial & Bessone, 2021). Due to the quest that the artist aims to achieve and the method he or she wishes to participate in realising their work, this mediation can be hybrid or fully digital (Renó, 2021).

The First Bird's-Eye View

Gaspard-Felix Tournachon (1820-1910) was born in Paris to a printer and shopkeeper; although he was better known under the nom de plume "Nadar". He combined his interest in aeronautics, journalism and photography, becoming the first to capture an aerial-view in photography in a tethered artificial balloon called "Le Géant" over Paris in 1868 (Sodomo, et al., 2020, 3). This photography provided the first opportunity for humankind to view the landscape from an aerial perspective. 1863, his studio became the home of the "Society for the Encouragement of Aerial Locomotion utilising Heavier-than-Air Machines". Jules Verne (1828-1905) was secretary, and Nadar was honorary president. Charles Louis Napoléon Bonaparte (Napoleon III, 1808-1873) requested Nadar take aerial photographs for the French government during the war against Italy, however, he refused. During the war with Prussia, Nadar helped to break the blockade of Paris by carrying mail by air balloon from Paris to Normandy. Nadar was also an essential person in the history of painting. He held the first impressionist exhibition in his studio in 1874, providing a forum for the controversial art of Manet, Monet, Renoir, Degas, Cezanne, Pissaro, Sisley, Boudin and others. He championed exhibitions for many artists he believed in.

Presenting Two Stereography Projections - 16th Century Aerial Image of A City Map and Current Photography Utilising Drones-UAV

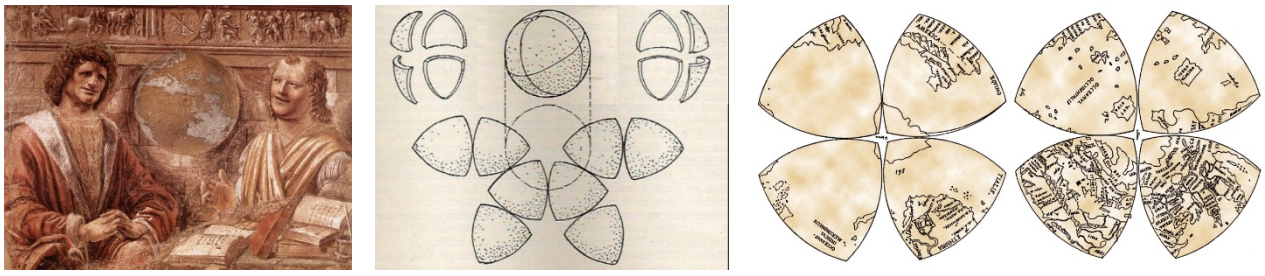
Example 1

Leonardo da Vinci (1452-1519) is known to the Western world for his contribution to art and his technological ingenuity captured in his surviving working books. He is the polymath of the High Renaissance, who viewed

the world from the perspective of an active painter, engineer, scientist, theorist, sculpture and architect (Kent, 2021). His immense output and creative genius transcended the boundaries of science and art. However, he is less known among cartographers and land surveyors (Pucekovic, 2013: 34). Nevertheless, he was installed at Imola, Italy, as Cesare Borgia's military engineer. He was in charge of enabling Borgia to be aware of the town's layout. He made a ground-breaking map that combined cutting-edge surveying techniques with his artistic imagination. In August 1502, Leonardo was appointed as the "General Architect and Engineer" and marshal of the Papal troops, giving him powers to requisition men for surveying and improving fortifications. Leonardo offers a view of the Earth as a living, yet measurable, organism seen through the lens unblemished by the tensions of the art-science, a dualism that took hold in the Enlightenment. In his holistic approach, he paced the lengths of the streets, as recorded on an annotated sketch of each quarter of the town, took bearings from the tower of the "Palazzo Comunale" at the central crossroads and presumably worked out the layout by geometry as no construction lines are visible (Heydenreich, et al., 1988: 154) (Figure 5, beneath).

Figure 5. Leonardo da Vinci, *Aerial view of a map of Imola*, 1502, red chalk, stylus lines, pen, ink and coloured washes on paper, 44.0x60.2 cm.

Another critical aspect to highlight of Leonardo da Vinci was when he became interested in global geography, especially in map-making. It may have been in the early 1500s or perhaps after Columbus discovered the Americas (Tyler, 2017: 263). It is one of the aspects that doesn't garner much attention in Leonardo's life achievements. Da Vinci's connection to world mapping (painting) is furthered by his companion Donato di Pascuccio d'Antonio (1444-1514), also known as Bramante Lazzari, an Italian architect and painter, during his early years in Milan. The picture represents the Greek philosophers Heraclitus and Democritus, who symbolise pessimism and optimism, respectively, flanked by a geographically realistic world representation. The two figures are often assumed to be portrayals of Leonardo da Vinci on the left side and Bramante himself on the right side (Figure 6a, beneath). Their involvement with the globe appears to represent a common interest in the largescale vision of the region they lived in, which is compatible with the assumption that da Vinci took his global interests from Florence to Milan when he moved there in 1482 (Tyler, 2017: 265).



a b c

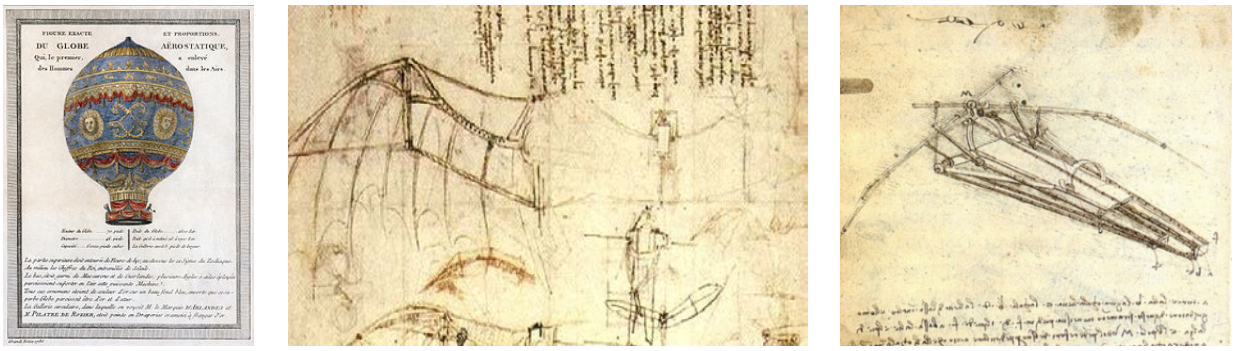
Figure 6. Donato Bramante (1444-1514), Left-right: "Crying Heraclitus and Laughing Democritus", c.1486, Fresco transferred to canvas, 102x127cm. (a), development of Cahill-butterfly's quasi-octant projection (b), Leonardo da Vinci, Octant projection with Reuleaux triangle's shape (c)

Leonardo provided his unique solution to the sphere rounded map that used to be produced during the early days of the Renaissance cartography, created by far the most isometric mapping geometry obtained from eight octants' petals projection (Figure 6b and 6c, above). These maps were produced based on the information gathered by travellers coming back from long journeys finding new destination routes for economic purposes. They also served two main functions: a) they are a spatial database for further travels; and b) as communication tools indicating records of features, landscape, flora-fauna, cities and places that may not exist anymore or have dramatically transformed through time.

Example 2

Da Vinci lived in a time when aeronautics was understood by few, if any. Simply by empirical observation and the development of his mechanical knowledge of his blueprints that nature manifested to him, he was able to design inventions that could fly. Da Vinci researched and noted how birds enact a circular flying path by altering their wings geometry in many of his manuscripts (Goodheart, 2011: 34). Originally Leonardo wished to emulate birds and bats; he said: "a bird is an instrument working according to a mathematical law, which instrument it is within the capacity of man to reproduce with all its moments…" Therefore, he designed a contraption device to let its wearer flap their wings to create thrust. An ornithopter derives from the Greek word "ornis, ornith", which means "bird" and "pteron", which means wing; it is an aircraft designed to fly by mimicking the flapping motion of a bird's wings. Nevertheless, most of his designs were not constructed until hundreds of years later. (Goodheart, 2011: 34) (Figure 7b and 7c, beneath).

His contributions, however, had little impact over the following three centuries and remained obscure until 1797. (Wragg, 1974). His sketches are reasonable, but they lack the facts of respectable math and maybe scientific in their own way. It is essential to recognise and comprehend how the design of such early aviation machines contributed to art, science, and engineering. Such an innovation aims to view and understand the height, scale, and weather (atmospheric pressure, temperature, humidity, cloud formation, rain, and wind) in the air, from a high vantage point that humankind cannot readily reach. Later, in the 18th century, the hot air balloon was constructed and completed the aforementioned aeronautical exploration objective. When staring directly down from a high vantage point, the viewer's chance of forming a vertical image increases, introducing a second mode (a reverse surface). Before the invention of flight machines, the vertical aerial view was virtually always attainable from a steep mountain top or a high tower vantage point. The "camera obscura" functioned as the closest representative device during the construction of the early flying devices by Joseph-Michel & Jacques-Etienne Montgolfier. In 1783 they displayed their first unmanned hydrogen hot air balloon (Globe aerostatique) (Figure 7a, beneath), in Paris (Jeyan, et al., 2019: 954). This hot air balloon was tied to the ground and controlled by individual ropes preventing it from flying away. Heavier-than-air planes were not used as a strategic connector for the camera until World War I.



a b c

Figure 7. A depiction of the Montgolfier brothers Hot Air Balloon, 1786 (a), Codex of the flight of birds, c.1505, Royal Library of Turin, Italy (b), Codex Atlanticus Folio 846v, Manuscript B, f, 75r. "Wingspan Design", c.1486- 1490, Biblioteca Ambrosiana (c)

In his Treatise on Painting, Leonardo da Vinci conceived the concept of aerial perspective. “Colours get dimmer in proportion to their distance from the person gazing at them” he observed (Britannica, T. Editors of Encyclopaedia (2016, June 6). aerial viewpoint). Throughout the Renaissance, amazing mural paintings were based on mythology in the Christian world. Aerial perspective, also known as atmospheric perspective, provides the illusion of depth or recession in a picture by altering the colour to approximate effects caused by natural occurrences such as a wet, foggy, overcast, and bright day from a distance. The mural paintings depicting the Assumption of the Virgin Mary (Fig 8a, 8b beneath) were created by Antonio Allegri da Correggio (1489-1534) between 1526 and 1530 inside the dome of the Cathedral of Parma, Italy. The mural paintings displayed an in-depth examination of atmospheric perspective (Collins, Encyclopedia of Art Education, 2000). Correggio’s Assumption of the Virgin).

Figure 8. Antonio Allegri da Correggio: Assumption of the Virgin Mary, Cathedral of Parma, Fresco (1526-1530), 1093x1195cm.

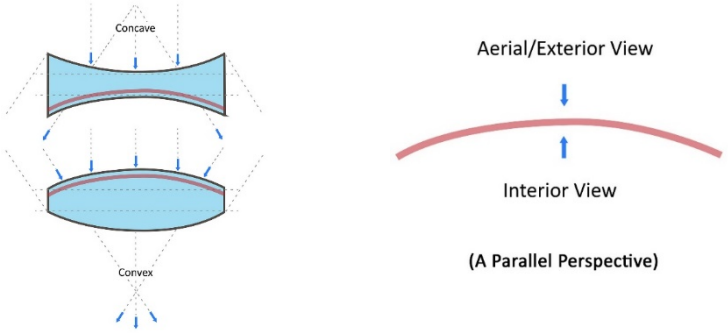


Figure 9. A parallel perspective view

Even though the mural painting in the cathedral is not directly (top-down) created with an aerial vantage point, such an atmospheric perspective and point of view is the direct opposite surface of Example 1 (Figure 6a, above). The internal perspective of the opposite surface is directly mirrored when viewed from a high vantage point (globe outside) (globe interior). It is analogous to observing and investigating the concept of concave and convex (Figure 9a and 9b, above), which may be perceived as a parallel viewpoint. Without a doubt, the notion and impression of aerial or atmospheric perspective illuminated many of the 16th century cathedrals’ dome fresco designs and paintings, such as those in the Medici Basilica of San Lorenzo (project begun in 1419), Duomo di Milano (c. 1386), Seville Cathedral, Cattedrale di Santa Maria del Fiore (completed 1436), Cattedrale di Santa Maria Assunta (c. 1217), Saint Peter’s Basilica (completed 1626), Granada Cathedral (completed 1561), St John’s Co-Cathedral Valletta (completed 1577) among others (Figure 10, beneath).

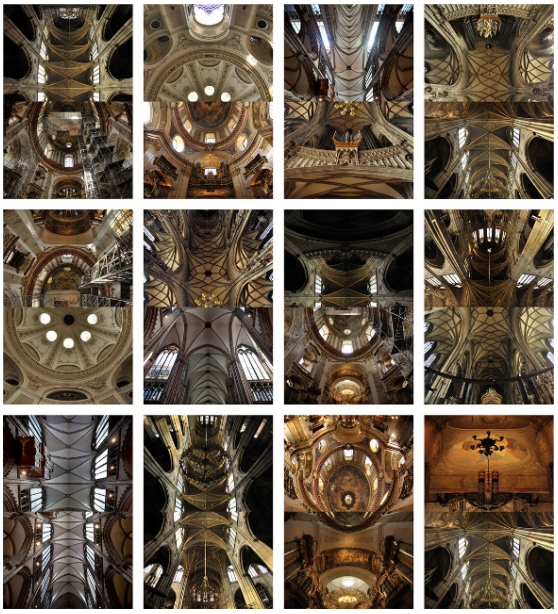


Figure 10. Stereoscopic photography, Camera DJI Phantom 3 Pro, C-Print, 90x60cm

AIM

This article aims to investigate the historical approach and the development of aerial photography. At the same time, to review the early principles of aerial perspective applied to painting during the 16th century and the aerial view photography produced using modern devices such as unmanned aerial vehicle (UAV) drones. Aerial photography is currently a widely used method to record the progress of the earth's surface. Such observation and recording are not always easily trackable, likewise, monitoring the landscape changes over time, discovering new surface features using topsoil characteristics, or stereoscopic image examination. Thus, aerial photography does have an advantage over maps because its purpose is to provide a current visual perspective of the ground (surface) that no map can match. Other issues may include photo-surface analysis, interpretation, and the aerial-photograph of the earth's curvature.

METHODOLOGY

This study would employ an empirical method of observation and measurement of phenomena using verifiable evidence that the researchers experienced before reaching concrete outcomes. Additionally, it presents a significant focus on two specific areas of discussion, a) the manipulation of a photographic camera reproducing an aerial view (Images) which is mounted to a drone-UAV device, and b) the advantages and disadvantages of creating landscape mapping images for aesthetic acknowledgement. Before drawing any conclusion, it is critical for this study to comprehend the definitions and technical descriptions of those gadgets and devices such as drone-UAV. This paper offers a thorough analysis and a concise historical account of the early recording technologies such as the "camera obscura" device, aerial photo-camera balloons, and the current aerial-camera technology drone-UAV.

RESULT AND DISCUSSION

Given the strength of the instrumentalist paradigm in which aerial photography is viewed as a process of objective documentation - that is, given the value of the medium's practical applications - it becomes difficult to find authors who specifically approach aerial photography from an artistic or cultural perspective (Fraser, 2010: 72). Aerial photography serves multiple functions within the photography discipline such as archaeology, cartography, commercial advertising, conveyancing environmental studies, espionage, land-use planning, movie production, state surveillance, and other fields. Such application provides new perspectives

on understanding and practice. Not everyone has access to nor is capable of producing aerial photography. Modern photography (camera) can obtain more information in a colour format rather than a panchromatic (black and white) image. Colour may aid in providing more positive and accurate data for use in aerial landscape photography. Examining drone art helps us think about how society behaves, reacts, and incorporates technology into its cultural language. Drone-UAV art is also a case study in how artists utilise new transformational technologies to communicate, sometimes to resist this technology itself and other times to promote it. This proliferation has inspired a dynamic response for the art world. Aerial photography also provides positive information or evidentiary material in court. Experts classify aerial photography into numerous forms based on the camera axis (photo angle), picture size (proximity to the ground and breadth of the region photographed), lens, film, digital sensor, and filter employed (Figure 11a, beneath). The advantages of having good weather conditions are that they may contribute to the following positive outcomes:

a) Provide a graphical representation of the ground, which no chart can match.
b) It is readily retrieved due to quick digital processing for viewing.
c) It is designed for hard-to-reach or inaccessible terrain.
d) It provides observation for military purposes.
e) It can provide day to day information for assessment and comparable objectives.
f) Information received through photographs is objectively recorded in perpetuity (Figure 11a, beneath).

a b

Figure 11. Aerial Photography, 2016, Sertar, Sichuan Province, China (a), Aerial Photography, 2018, Lake Baikal, Russia (b)

The main factor contributing to a significant shortcoming is that the weather condition can change drastically and even cancel the photo session. This can result in the following negative outcomes:

a) Ground features such as buildings, electrical towers, canals, rivers or streams may be difficult to recognise due to limited visibility or a lack of symbols.
b) The position on the ground may approximate the elevation.
c) Inadequate contrasting of colours for ground recognition.
d) Insufficient marginal data.
e) Detail variation of ground structures can only be comprehended by overlapping other stereoscopic images (Figure 11b, beneath).

Drone-UAV Technology Has Mediated the Landscape

The use of drones by artists to collect photographic images shows the interest in discovering and producing new visual areas of study in the depiction of the landscape, which may combine daily behaviours in the socialisation of its message or the content of the landscape. Similarly, the viewer will be able to follow a

complicated slope of visual representation that externalises the specific characteristics of the operation of the technical instrument known as the drone-unmanned aerial vehicle (UAV). Thus, in addition to the appropriate knowledge conveyed through photographic experience and skill, the artist must also develop competence in flying the drone that favours its movement in space, in the landscape setting and a favourable learning curve of that technical instrument by the user. The captured image is achieved through the photographic lens inserted in the camera and attached to the drone. This method provides unusual perspectives in which the geographical horizon line is positively subordinated to the artist's personal decision, in the selective choice that he or she executes based on compositional concepts of the observed image, based on aesthetic and evocative disciplinary criteria for the visual arts. The photography product's ultimate result is a collection of compositional methods. The depth of the component stands out in the variables' size of the pieces that arrange the landscape and buildings. At the same time, the artist structures their placement in position at a distance, creating textures that generate different size dimensions, appearing smaller and motley from a distance. The overlapping compositional landscape elements indicate which subjects are located in front of them and behind them, implying depth and three-dimensional character through their projected shadows. Careful examination of the image captured by the drone lens reveals that the photographer or artist is the one who is in control and chose the appropriate way to compose the environment that makes us perceive the grandeur of the landscape, intelligently portrayed by the artist through a visual precision technological tool (Curto, 2021).

The photographic image obtained from a drone demonstrates the executing artist's photography skills; they must pick the suitable placement of the drone by accurate or intuitive coordinates, which enables them to capture the qualities of depth exhibited in the landscape in a snapshot. Based on the spectator's interpretation of this photography snapshot, the static image of that natural environment that embodies the essence of the landscape displays a three-dimensional quality (Rius, 2021). The two-dimensional image captured in the photograph will evoke previous and interpretive experiences of how the viewer approaches the message's content perceived in the landscape. The concept of what it is to understand the three-dimensional elements of depth, and, most importantly, the perception of the atmospheric environment in which the landscape lies (Acosta, et al., 2018). These variables, taken together, will suggest the depth and distance of each of the elements composed in their organic nature and distributed within normative compliance in the photographic shot. That alludes to the three-dimensionality of the landscape even if the printed representation in the photograph materialises two-dimensionally. The aerial photography exercise integrates art and technology because this interdisciplinary mix is offered from a visual perspective. The human being moves away from everyday life and observes, with new eyes, what was always within his geographical reach (Pacheco, 2017). But from the point of view of aerial perspective, revealing the theme of the landscape from a humanistic stance. In the light of human knowledge of the landscape, qualities that enhance their visual senses to capture the natural environment from the air increase. The time has come to witness the birth of the technological human being, who can extend their senses and perceptions of the habitat surrounding them to transcend to a later stage of development and knowledge. However, this argument is similar to transhumanist thought in terms of the concept of the super-human amalgamated with high-tech components. Such an act and search sharpen a person's senses and reconstruct themself at will to enhance their abilities and skills in the human habitat (Acosta, 2021). The recognition of human finitude in the face of the awareness of how sublime the landscape is from an aerial perspective becomes apparent when contemplating the set of components that comprise the nascent human habitat. The landscape that shelters nature in all of its generative manifestations occasionally reveals the civilising presence as the germ of progress today. At the same time, as an occasional or fervent vestige in the urban presence of finite humanity, it essentially manifests the excellence of a creative constant in the genesis of the aerial landscape.

The Essence of Drone-UAV Photography

Drone photography has grown in popularity over the last 10 years. In the recent past, aerial images could be captured only by using hot air balloons or aeroplanes. We can now capture photographs from an aerial perspective due to the availability of low-cost consumer drones. Nonetheless, all drones flying in other nations are subject to international norms, regulations, and prohibitions. The benefits and drawbacks of employing drones to capture dramatic photos are similar to any other photography genre. Technically, the bigger the sensor in today's digital photographic technology, the more likely it will produce higher-quality images. The

larger the gadget sensor and the more light it takes, the more information and less noise it records. The light intensity, direction, and time of day (sunlight) all play essential roles in producing such outstanding photographic results.

The best hours of photographing with a drone depend on the weather conditions and the purpose of flying it. Although one could fly a drone at any time of the day, the ideal situation for photography would include the warmer light in the morning and late evening (Figure 12a and 12b). Such hours provide better contrast and defined shadow. The blue hour - before sunrise (dawn) and after sunset (dusk) (Figure 12c) and night photography with moonlight can be stunning since the drone is able to do a long exposure and time-lapse in the air (Cladera, 2022). It is a misperception and misunderstanding to believe that to achieve good outcomes, the drone must be flown as high as possible. Instead, regardless of the drone's height, photographers should seek unusual compositions such as fascinating shapes, symmetry, lines, patterns and repetition, texture, contrast, abstract forms, shadows, and so on. RAW file settings could help the photographer improve their exposure, contrast, detail, colour balance, and dynamic range. Photographers may continue modifying the perfect image to their satisfaction during post-production with a RAW file.

a b c

Figure 12. Aerial Photography, 2019, Marble City, Malta (Sunrise) (a), Aerial Photography Earth Veins, 2018, Iceland (Sunset) (b), Aerial Photography Calving Iceberg, 2020, Ilulissat, Greenland. (Dusk, blue hours) (c)

Consumer drones (from beginner to intermediate user) such as DJI Mavic, Air, and Phantom typically come with fixed lenses that the photographer operator cannot alter, change or modify. These drones (UAV) come with a zoom or fixed lens. Professional drones, such as Yunnec Tornado, Mavic 2 PRO, DJI Inspire 2, allow the photographer operator to change lenses. Most drones (UAV) within this category are costly for the average freelance photographer. Professional photographers neither want to utilise, limit or be restricted by a default drone camera. In such circumstances, the photographer could opt to mount an additional camera or similar device to the drone (such as a cellphone, action camera, or Insta360-One-X2). Doing so allows the photographer to acquire innovative and diversified aerial images instantaneously. This range of drones (UAV), industrial, business and agricultural drones are developed for various multitasking uses.

CONCLUSION

In the earliest period of camera's creation, its purpose was not to capture images but rather to study optics. The pinhole camera's purpose was to show how light could be cast-off to project an image onto a flat surface. Humans have created many devices to study and improve their lives through their creativity. The Unmanned aerial vehicles (UAVs) enable today's scholars to accomplish new objectives that previous generations of academics could only dream of and hope for. Today's drone-UAV survey technology is used by researchers worldwide to increase human understanding as they seek answers to the world's most pressing challenges. Drones can navigate any locations that humans could not access easily, making them a valuable alternative for risky search and rescue missions and capable of delivering supplies to remote areas during an emergency. Drones are utilised for purposes other than imaging production, such as tourism, building, and undersea investigation, to promote the long-term growth and the improvement of humanity. Drones frequently get praised for their potential to provide a fresh and alternative perspective on the landscape (Earth), displaying the beauty of our planet from above and below. However, they are merely the most recent advancement in a lengthy history of aerial photography.

Authors' Contributions

The authors contributed equally to the study.

Acknowledgements

We would like to thank, Mr. Kent Tan for his interest and conversation that encouraged us to write an article in this subject.

Competing Interests

The authors declared no potential conflicts of interest concerning this article's research, authorship, and publications.

Ethics Committee Declaration

The authors declared no potential conflicts of ethics and genders, concerning this article's research, authorship, and publications.

REFERENCES

Acosta, G., McClung, E., Jiménez, G., & Hugo García, V. (2018). El empleo de fotogrametría mediante vehículos aéreos no tripulados (VANT/dron) como herramienta de evaluación del patrimonio en riesgo: chinampas arqueológicas de Xochimilco. *Revista Española de Antropología Americana*, *47*, 185-197. https://doi.org/10.5209/REAA.61978

Acosta, M. (2021). El camino hacia el transhumanismo: Génesis y evolución de un fenómeno posmoderno a partir del "Mito del Hombre Nuevo" de Dalmacio Negro. *Persona y Derecho*, *81*(1), 133-156. https://doi-org.ezproxybib.pucp.edu.pe/10.15581/011.84.007

Aguirre, G. (2020). Civilización y barbarie desde los fundamentos de la tectónica de placas. *El Futuro Del Pasado*, *11*, 659-674. https://doi.org/10.14516/fdp.2020.011.022

Alexander J. K. (2021). Towards a cartography renaissance: Leonardo's maps and their approaches to art and science. International Cartography Association. *30th International Cartography Conference (ICC 2021).* Vol. 3, 14-18. https://doi.org/10.5194/ica-abs-3-146-2021

Bartolotta, M. C. (2017). Teoría del color en el arte contemporáneo. Su vinculación con la textura y el material. *Arte E Investigación*, (13), 40-48. http://papelcosido.fba.unlp.edu.ar/ojs/index.php/aei/article/view/515

Bedini, S. A. (1988). *The unknown Leonardo*. Abradale Press. Harry N. Abrams, INC. Publisher.

Benjamin, F. (2010). The ills of aerial photography: Latin American from above. *Chasqui*, *39*(02), 70-84. https://www.jstor.org/stable/41340870

Benjamin J. G. (2011). Thacing the history of the ornithoper: Past, present, and future. *Journal of Aviation/Aerospace, Education & Research (JAAER), 21(*1), 31-43. https://commons.erau.edu/jaaer/vol21/iss1/8/

Blanco-Barrera, R. (2021). Transgrediendo lo artístico y material: la transición del arte hacia lo virtual y social. *Periférica Internacional. Revista Para El análisis De La Cultura Y El Territorio*, (22), 386-396. https://doi.org/10.25267/Periferica.2021.i22.34

Branko Pucekovic. (2013). Leonardo da Vinci and his contributions to cartography. *Kartografija i Geoinformacije, 12*(20), 34-52. https://kig.kartografija.hr/index.php/kig/article/viewFile/619/1174

Britannica, T. Editors of Encyclopaedia. (2016, 6 June). *Aerial perspective*. Encyclopedia Britannica. https://www.britannica.com/art/aerial-perspective (10.01.2022).

Britannica, T. Editors of Encyclopaedia. (2016, 21 October). *Photogrammetry*. Encyclopedia Britannica. https://www.britannica.com/science/photogrammetry (10.01.2022).

Britannica, T. Editors of Encyclopaedia. (2019, 7 March). *Aerial Photography*. Encyclopedia Britannica. https://www.britannica.com/technology/aerial-photography. (10.01.2022).

Brooks, K. R. (2017). Depth perception and the history of three-dimensional art: Who produced the first stereoscopic images? *I-Perception, 8*(1), 1-22. https://doi.org/10.1177%2F2041669516680114

Carson, J., Shafer, A. (2008). West, copley and the camera obscura. *American Art*, *22*(2), 24-41. https://www.jstor.org/stable/10.1086/591168

Cladera, A. (2022). *Drone photography: The definitive guide.* Photopills. https://www.photopills.com/articles/drone-photography-guide#step3 (25.01.2022).

Collins, N. (n.d). Assumption of the Virgin by Correggio. Analysis of High Renaissance Fresco Painting in Parma Cathedral. *Encyclopedia of Art Education.* http://www.visual-arts-cork.com/famous-paintings/assumption-correggio.htm (13.02.2022).

Crawford, A. (1992). Landscape photography as Art. *Landscape Research*, *17*(1), 2-8. https://doi.org/10.1080/01426399208706351

Curto Vivas, J. (2021). La fotografía y el mercado del arte hoy. *Periférica Internacional. Revista Para El análisis De La Cultura Y El Territorio*, (22), 86-90. https://doi.org/10.25267/Periferica.2021.i22.09

David, W. W. (1974). *Flight before flying* (First Edition). Osprey Publishing.

Dowidar, H., Salim, A. (2015). How an ancient Muslim scientist cast his light into the 21th century. *Celebrating optics pioneer Ibn al-Haytham – and promoting Intercultural Collaboration for the International Year of Light.* https://www.elsevier.com/connect/how-an-ancient-muslim-scientist-cast-his-light-into-the-21st-century (02.01.2022).

Forrester, R. (2020). History of photography: From camera oscura to the kodak camera. 3. https://www.academia.edu/41822274/History_of_Photography_From_Camera_Obscura_to_the_Kodak_Camera (14.02.2022).

Godoy, M. (2019). Lo sublime en la anti-sublime estética de lo cotidiano. Claridades. *Revista de Filosofía, 11*(2019), 33-56. https://revistas.uma.es/index.php/claridades/article/view/4882/6230

Gómez, S. (2021). La Imagen Como *Makruma* (Don): Fotografía Etnográfica Entre Los Arhuacos De La Sierra Nevada De Santa Marta. *Antípoda. Revista de Antropología y Arqueología*, *44*(2021), 95-118. https://doi.org/10.7440/antipoda44.2021.05

Gonçalves, J. A., Herinques, R. (2015). UAV photogrammetry for topography monitoring of coastal areas. *ISPRS Journal of Photogrammetry and Remote Sensing, 104*, 101-111. http://dx.doi.org/10.1016/j.isprsjprs.2015.02.009

González Díaz, J. A., González Díaz, B., & Rosa García, R. (2021). Revisión de los objetivos de los espacios protegidos: El parque natural y reserva de la biosfera de redes. *Espacio Tiempo Y Forma. Serie VI, Geografía*, (14), 67-88. https://doi.org/10.5944/etfvi.14.2021.28843

González, M. (2020). El pecado original y la justificación. Una confrontación entre Kant y Lutero. *Teología y vida*, *61*(2), 217-241. https://dx.doi.org/10.4067/S0049-34492020000200217

Howell, E. (2017). Spacecraft Galileo: To Jupiter and Its Moons. Space.com https://www.space.com/18632-galileo-spacecraft.html (09.01.2022).

Jelley, J. (2013). From perception to paint: The practical use of the camera obscura in the time of Vermeer. A*rt and Perception, 1*(2013), 19-47. http://www.printedlight.co.uk/uploads/2/8/3/8/2838494/perception_to_paint.pdf

Justo, E. (2022). El carácter personal de la verdad en un contexto nihilista. *Scripta Theologica*, *54*(1), 149-170. https://doi-org.ezproxybib.pucp.edu.pe/10.15581/006.54.1.149-170

Kant, I. & Castaño, A. (1963). *Por qué no es inútil una nueva crítica de la razón pura: Respuesta a eberhard.* Aguilar.

Levrand, N. E. (2021). El paisaje como un objeto de regulación jurídica en Argentina: Matriz de análisis legal y jurisprudencial. *Revista Justicia & Derecho*, *4*(3), 1-17. https://doi.org/10.32457/rjyd.v4i3.1668

Logsdon, J. M. (2019, 5 March). *Magellan*. *Encyclopedia Britannica.* https://www.britannica.com/topic/Magellan (24.01.2022).

Lozier, D., Galal, K. Folta, D. C., Beckman, M. (1998). Lunar prospector mission design and trajectory support. *AAS98-323, 100*, 1-15.

Marcial, L. N., & Bessone, C. (2021). La fotografía en los procesos de activación y gestión patrimonial. Estudio Sobre Fotografía Tehuelche En Santa Cruz. *Informes Científicos Técnicos - UNPA*, *13*(3), 36–55. https://doi.org/10.22305/ict-unpa.v13.n3.832

Margarucci, I. (2020). La ideología anarquista de manuel gonzáles prada en la prensa libertaria peruana de comienzos del siglo XX. *Izquierdas*, *2020*(49), 312-329.

Muratore, M., Elisondo, R. (2020). Innovar Viajando: Perspectivas De Docentes Y Estudiantes Con Respecto A Los Viajes Educativos. *Journal Educational Innovation / Revista Innovación Educativa. Instituto Politécnico Nacional*, *20*(84), 77-10.

Muruga Lal Jeyan, J. V., Thomas, T. (2019). A lecture notes on historical evaluation of aircraft considering ancient aviation science. *Journal of Emerging Technologies and Innovation Research (JETIR)*, *6*(3), 954-960.

Myers, J. S., Fudemberg, S. J., Lee, D. (2018). Evolution of optic nerve photography for glaucoma screening: a review. *Clinical and Experimental Ophthalmology*,*46*(2), 169-176. https://onlinelibrary.wiley.com/doi/10.1111/ceo.13138

Oberkochen. (2020). *Camera from Zeiss, a look and the history of cameras.* ZEISS Consumer Products.https://www.zeiss.com/consumer-products/int/home/content/newsroom/articles/cameras-from-zeiss.html#:~:text=It%20is%20common%20knowledge%20that,the%20turn%20of%20the%20century (23.01.2022).

Pacheco Prado, D. (2017). Drones en espacios urbanos: caso de estudio en parques, jardines y patrimonio edificado de cuenca. *Estoa. Revista De La Facultad De Arquitectura Y Urbanismo De La Universidad De Cuenca*, *6*(11), 159-168. https://doi.org/10.18537/est.v006.n011.a12

Paidamwoyo, M., Willard, M., Naledzani. (2020). Comparison of image fusion techniques using satellite pour l'observation de la terre (spot) 6 satellite imagery. *Journal of Applied Sciences (MDPI)*, *10*(5), 1881. https://www.mdpi.com/2076-3417/10/5/1881

Renó, D., Tymoshchuk, O., Almeida, A., Pedro, L., Ramos, F. & Silva, P. (2021). Las humanidades digitales y la conexión con las raíces culturales a través de la iniciativa portuguesa Aldeias do Xisto. *La Trama de la Comunicación, 25*(1), 015-029. https://doi.org/10.35305/lt.v25i1.756

Rius, N. (2021). Experiencias inmersivas y nación: la fotografía estereoscópica amateur en Cataluña 1900-1936. *Espacio Tiempo Y Forma. Serie VII, Historia Del Arte*, (9), 161–188. https://doi.org/10.5944/etfvii.9.2021.30842

Sánchez, L. A. (1958). *El Perú: Retrato de un país adolescente.* Ediciones Cintinente.

Sarmiento, D. F. (1955). *Facundo o civilización y barbarie.* Sopena.

Serrano Gil, Ó. (2021). Hitos del paisaje urbano en una ciudad declarada patrimonio mundial de la humanidad (Cuenca): Itinerario didáctico y trabajo de campo con alumnos universitarios. *Didáctica Geográfica*, (22), 145-169. https://doi.org/10.21138/DG.607

Schulze, J. H. (2022). Science and its times: Understanding the social significance of scientific discovery. Encyclopedia. https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/johann-heinrich-schulze (04.01.2022).

Sodono, S., Zen, A. P., Yuningsih, C. R., Trihanondo, D., Wiguna, I. P. (2021). Green areas mapping of Telkom University as support towards green campus. *The 5th Annual Applied Science and Engineering Conference (AASEC 2020). IOP Publishing Conference Series: Materials Science and Engineering, 1098*(5), 1-7. https://iopscience.iop.org/article/10.1088/1757-899X/1098/5/052012/pdf (20.02.2022).

Tillería Aqueveque, L. (2021). Kant: Lo sublime teológico. *Letras (Lima)*, *92*(135), 203-213. https://doi.org/10.30920/letras.92.135.15

Tyler, C. W. (2017). Leonardo da Vinci's world map. *Cosmo and History*, *13*(2), 261-280. http://openaccess.city.ac.uk/ (03.02.2022).

Usgs, Landsat-Earth Observation Satellites. (2015). Fact Sheet 2015-3081. U.S. Department of the Interior & U.S. Geological Survey. https://pubs.usgs.gov/fs/2015/3081/fs20153081.pdf (13.02.2022).

Williams, R., Tooth, S., Gibson, M. (2016). The sky is the limit: Reconstructing physical geography from an aerial perspective. *Journal of Geography in Higher Education*, *41*(1), 134-146. https://doi.org/10.1080/03098265.2016.1241986

Wolfgang, L. (2007). *Inside the camera obscura-optics and art under the spell of the projected image.* Max Planck Institute for the History of Science.

Wulder, M. A., Loveland, T. R., Roy, D. P., Crawford, C. J., … Zhu, Z. (2019). Current status of Landsat program, science, and applications. *Remote Sensing of Environment*, *225*, 127-147. https://doi.org/10.1016/j.rse.2019.02.015

WordSense (n.d.). "ἀήρ" WordSense Online Dictionary. https://www.wordsense.eu/%E1%BC%80%CE%AE%CF%81/ (08.02.2022).

Figure References:

Figure 1: Joseph Nicephore Niepce (1826-1827). V*iew from the Window at Le Grass*. History of Information. https://www.historyofinformation.com/detail.php?id=3665 (18.02.2022).

Figure 2: Gioia, J. (2020, 23 December). *San Francisco in ruins, by George R. Lawrence using Kite aerial photography, 28 May 1906.* Magellan TV. https://www.magellantv.com/articles/big-balloons-to-tiny-drones-an-overhead-view-of-aerial-photography- (25.02.2022).

Figure 3: Wingtra. (2021, 16 March). *Drone photogrammetry vs. LIDAR: what sensor to choose for a given application*. Wingtra. https://wingtra.com/drone-photogrammetry-vs-lidar/ (ACCESS DATE).

Figure 4: Albawaba. (2021, 27 February). *Would you like to have a free tour on mars?* Albawaba. https://www.albawaba.com/editors-choice/would-you-have-free-tour-mars-1413547 (19.03.2022).

Figure 5: Leonardo da Vinci. *A map of Imola 1502.* Red chalk, stylus lines, pen, ink and coloured washes on paper. Royal Collection Trust. https://www.rct.uk/collection/912284/a-map-of-imola (24.03.2022).

Figure 6a: Donato Bramante. (1486). *Left-right: "Crying Heraclitus and Laughing Democritus"* Fresco transferred to canvas. Wikimedia. https://commons.wikimedia.org/wiki/File:Donato_Bramante_-_Heraclitus_and_Democritus_-_WGA3054.jpg (21.03.2022).

Figure 6b, c: Wikiwand. (n.d.). *Development of Cahill-butterfly's quasi-octant projection*. Wikiwand. https://www.wikiwand.com/en/Octant_projection (10.03.2022).

Figure 7a: Radeska, T. (2016, 29 November). *Montgolfier brothers- the inventors of the hot-air balloon.* The Vintage News. https://www.thevintagenews.com/2016/11/29/montgolfier-brothers-the-inventors-of-the-hot-air-balloon/?chrome=1 (9.03.2022).

Figure 7b, c: Leonardo da Vinci. (1505). *Codex of the Flight of Birds*. Royal Library of Turin. Italy. https://www.leonardodavinci.net/flyingmachine.jsp (11.03.2022).

Figure 8: Antonio Allegri da Correggio: *Assumption of the Virgin Mary*, Cathedral of Parma, Fresco (1526-1530). https://smarthistory.org/correggio-assumption-of-the-virgin/ (17.03.2022).

Figure 10, 11a, b: Y. W. Alex Wong. Camera DJI Phantom 3 Pro, C-Print, 90x60cm.

Figure 12a, b, c: Y. W. Alex Wong. DJI Mavic 2 Pro, C-Print, 90x60cm.