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## PERSPECTIVE AS A CONVENTION OF SPATIAL OBJECTS REPRESENTATION

### PERSPEKTYWA JAKO KONWENCJA PRZEDSTAWIANIA OBIEKTÓW PRZESTRZENNYCH

#### Abstract

In this study perspective was presented as one of the conventions for recording 3D objects on a 2D plane. Being the easiest type of projection to understand (for a recipient) perspective, in its historical context, was presented from ancient times until today<sup>1</sup>. Issues of practice and theory were addressed and examples of precise compliance with the rules and their negation in the 20<sup>th</sup> century were presented. Contemporary practical applications in architecture were reviewed.

*Keywords: linear perspective, computer perspective visualization*

#### Streszczenie

W pracy przedstawiono perspektywę jako jedną z konwencji notowania trójwymiarowych obiektów na dwuwymiarowej płaszczyźnie. Perspektywę, jako najbardziej zrozumiałą dla odbiorcy rodzaj rzutowania, zaprezentowano w ujęciu historycznym (od antyku do czasów współczesnych). Odniesiono się do praktyki i teorii, przykładów ścisłego stosowania reguł i negowania ich w XX wieku. Przywołano współczesne zastosowania praktyczne w architekturze.

*Słowa kluczowe: perspektywa liniowa, komputerowe wizualizacje perspektywiczne*

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<sup>1</sup> In his work [21] Michał Sufczyński presents the development of the recording methods in architectural design (Chapter XI, p. 78). The analysis based on works [4] and [11] covers from earliest times up to today.

## 1. Introduction

Spatial objects are observed in three dimensions – we view them from different sides and directions. „For each look, new shapes of the dimensions sizes and lines are brought. Each look brings a new situation of shapes” [20, p. 212-216]. The process of observation takes place over a certain period of time and, as a consequence, observations made from various points sum up, and objectification of the object being observed takes place. For this reason, a drawing representation of an object is only a partial representation of its actual shape – a record made following a certain convention. An image of an object, a most precise one, can refer to its mirror reflection. Spatial and perspective illusions are then created<sup>2</sup>.

The use of perspective to record the space is one of the conventions by means of which we organize the reality. For an average spectator, it is the most understandable method of the record of space. It harmonizes with our way of viewing the world, even if it is not a precise representation or an objective reconstruction of the seeing process.

The reality changes during the observation process<sup>3</sup>, and for this reason the rules of perspective are insufficient. The rules of imaging using the perspective were defined over centuries (particular development of the perspective took place in the Renaissance period, in this period its major rules were shaped).

## 2. Perspective in the historical context

Foundations of the perspective as a discipline in drawing were created by Euclid (the author of the “Elements” and a treaty on the optics) approximately 300 B.C. However, the influence of his theory on artists remains unknown. In the ancient Greece, *scenographia* was used to create an illusion of the reality. One of the oldest paintings of perspective features were preserved in Pompeii. They are fragments of a landscape and views of buildings (Ill. 1). In medieval paintings buildings were represented schematically “in a simplified, general, shortened manner, without attention to proper proportions and style” [22, p. 14]. They played a symbolic function, filled the background and served as a placement of action or as attributes of characters. In the art of Byzantine painters, a dynamic, reversed perspective (the closer to the viewer edges of a building are smaller while the far ones are bigger) was used, which was created from numerous observation points. „Requiring a rational organization of the construction and building tasks, Gothic architecture brought about the emergence of a modern architectural drawing, thus making an architect a true author of a design” [5, p. 54]. Due to the fact that each design had to be approved by persons financing it, therefore “the drawing had to be clear and communicative, even attractive” [5, p. 55].

<sup>2</sup> **Aerial perspective**, also called **atmospheric perspective**, method of creating the illusion of depth, or recession, in a painting or drawing by modulating colour to simulate changes effected by the atmosphere on the colours of things seen at a distance. Definition after Encyclopedia Britannica on the website [26].

<sup>3</sup> J. Ballensted in his work [2, p. 29-30] writes: “Our vision range slightly exceeds 180° whereas the yellow spot vision range is less than 2°... While reading our eyes go over the words in a flowing movement. Each word and each letter has to go through the vision range of the yellow spot. Similarly, while looking at a landscape we spot only a tiny detail despite being convinced that – as we say – with one glimpse we cover the whole. In fact our eyes are performing thousands of small movements”.



III. 1. Pompeii paintings of the 1<sup>st</sup> century *Frescoes from the Villa of P. Fannius Synistor*, currently in Metropolitan Museum of Art, New York  
 (sources: [https://pl.wikipedia.org/wiki/Malarstwo\\_pompeja%C5%84skie#/media/File:Pompeii\\_Fresco\\_001.jpg](https://pl.wikipedia.org/wiki/Malarstwo_pompeja%C5%84skie#/media/File:Pompeii_Fresco_001.jpg); [https://pl.wikipedia.org/wiki/Malarstwo\\_pompeja%C5%84skie#/media/File:Pompeii\\_Fresco\\_002.jpg](https://pl.wikipedia.org/wiki/Malarstwo_pompeja%C5%84skie#/media/File:Pompeii_Fresco_002.jpg), online: 27.11.2015)

As one of the first artists, the classical rules of the perspective implemented Giotto di Bondone (1266–1337). A characteristic feature in his works was the assumption of one observation point, referred to as “point of view”. Architectural objects presented in perspective were serving merely as a background for characters which were represented in preternatural dimensions – to emphasize their importance in the religious and symbolic sense (III. 2a). On a wall painting in Siena, Ambrogio Lorenzetti (1290–1348) assumed numerous observation points. He unfolded a vision of a late medieval city, being an architectural fantasy (III. 2b).

In the 15<sup>th</sup> century, artists were trying to faithfully portrait the reality following the rules of the perspective. A subject of particular interest was urban development in relation to the economical and political growth of cities during this time. Painters were creating virtually portraits of the architecture, which became a valuable source of historical forms of various objects [12]. Piero della Francesca (1420–1492) was the leading perspectivist, theoretician and painter of the Renaissance period. He wrote several treaties where he explained the assumptions of the perspective. He presented the method of the intermediate perspective, which nowadays is referred to as the architectural perspective. His fluency in operating this convention is visible in his works (III. 3a). Another leading artist of Renaissance, who was fascinated with optics, was Leonardo da Vinci (1452–1519). He determined the rules of perspective, based on the laws of optics. Aside from linear perspective, he developed the aerial perspective, which employs variations in the intensity and sharpness of outlines, as well as curvilinear perspective,

a)



b)



### III. 2. Perspective in paintings of the 14<sup>th</sup> century:

- a) Giotto di Bondone, *St Francis Renounces His Fathers Goods and Earthly Wealth*, fresco in the church of St. Francis in Assisi (ca. 1300) (source: [https://en.wikipedia.org/wiki/Giotto#/media/File:Giotto\\_di\\_Bondone\\_-\\_Legend\\_of\\_St\\_Francis\\_-\\_5.\\_Renunciation\\_of\\_Wordly\\_Goods\\_-\\_WGA09123.jpg](https://en.wikipedia.org/wiki/Giotto#/media/File:Giotto_di_Bondone_-_Legend_of_St_Francis_-_5._Renunciation_of_Wordly_Goods_-_WGA09123.jpg), online: 27.11.2015),
- b) Ambrogio Lorenzetti, *The Allegory of Good Government*, Palazzo Publico in Siena (1339) (source: [https://en.wikipedia.org/wiki/The\\_Allegory\\_of\\_Good\\_and\\_Bad\\_Government#/media/File:Ambrogio\\_Lorenzetti\\_-\\_Effects\\_of\\_Good\\_Government\\_in\\_the\\_city\\_-\\_Google\\_Art\\_Project.jpg](https://en.wikipedia.org/wiki/The_Allegory_of_Good_and_Bad_Government#/media/File:Ambrogio_Lorenzetti_-_Effects_of_Good_Government_in_the_city_-_Google_Art_Project.jpg), online: 27.11.2015)

which utilizes the natural curvature of the human field of view. Through saturation and colour dynamics, he was able to obtain an impression of moving away and closing in. Creation of a painting was most often preceded by drawings and handmade sketches serving the study of the building elements of a given painting. These works were not published by the artists and even purposefully destroyed. Currently sought and discovered, they are a rich source of information on the artist's workshop. An example here can be the sketch „Perspective Study For the Background of the Adoration of the Magi” (Ill. 3b). Leonardo da Vinci used the works of the Italian architects, perspectivists, such as: Filippo Brunelleschi or Leon Battista Alberti<sup>4</sup>. He used *i.a.* the introduced by them grid of squares, the so-called – perspective grid.

The discovery of geometrical perspective allowed an unequivocal method for presenting architectural designs to be developed. Not only could an architectural form be presented in its real dimensions with the use of orthogonal drawings, but also in its precise perspective [5, p. 56].

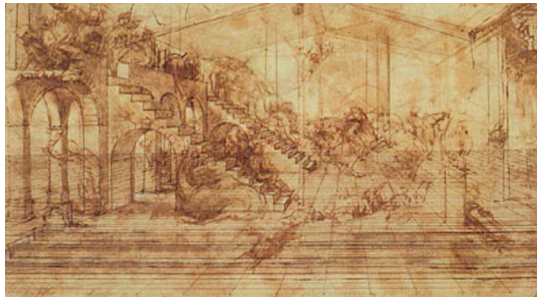
Baroque was a period in which the methods of drawing of various perspective views were developed, for instance, with several points of view, from underneath, from a side, from bird's eye view. Investigated and applied were the phenomena of the perspective illusions. For example, in vault paintings, a fictional floor being a continuation of the existing interior elements used to be created (Ill. 4a). At the end of the 17<sup>th</sup> century, Andrea Pozzo (1642–1709), who practiced architecture and painting side by side, wrote an extensive work on perspective [16]. Being a skilful drawer, Pozzo created exquisite copperplates which illustrated two types of projections discussed in the book [4, p. 549]. There was another book written by Johann Jacob Schübler [19] and published in 1719 which surpassed that of Pozzo. Richly illustrated,

<sup>4</sup> L.B. Alberti is the author of the treatise on perspective *De Pictura* which he most likely wrote in 1435. This work has been digitalized and is available on-line at the Research Library website <https://archive.org/stream/dellapitturaedel00albe#page/134/mode/2up>.

a)



b)



### III. 3. Perspective in paintings of the 15<sup>th</sup> century:

a) Piero della Francesca *The Flagellation of Christ* (1460) – Gallery Nazionale delle Marche, Urbino (source: [https://en.wikipedia.org/wiki/Piero\\_della\\_Francesca#/media/File:Piero\\_-\\_The\\_Flagellation.jpg](https://en.wikipedia.org/wiki/Piero_della_Francesca#/media/File:Piero_-_The_Flagellation.jpg), online: 27.11.2015),

b) Leonardo da Vinci *Perspective Study for the Adoration of the Magi*, (~1481), Gallery degli Uffizi, Florence (source: [https://pl.wikipedia.org/wiki/Leonardo\\_da\\_Vinci#/media/File:Studium\\_perspektywiczne\\_do\\_Pok%C5%82onu\\_Trzech\\_Kr%C3%B3li.jpg](https://pl.wikipedia.org/wiki/Leonardo_da_Vinci#/media/File:Studium_perspektywiczne_do_Pok%C5%82onu_Trzech_Kr%C3%B3li.jpg), online: 27.11.2015)

a)



b)



### III. 4. Perspective views in 17<sup>th</sup> and 18<sup>th</sup> centuries:

a) Andrea Pozzo, *Apoteose de Sante Inacio cropped* Roma, (ca. 1694) (source: [https://upload.wikimedia.org/wikipedia/commons/8/84/Andrea\\_Pozzo\\_-\\_Apoteose\\_de\\_Santo\\_Inacio.jpg](https://upload.wikimedia.org/wikipedia/commons/8/84/Andrea_Pozzo_-_Apoteose_de_Santo_Inacio.jpg), online: 27.11.2015),

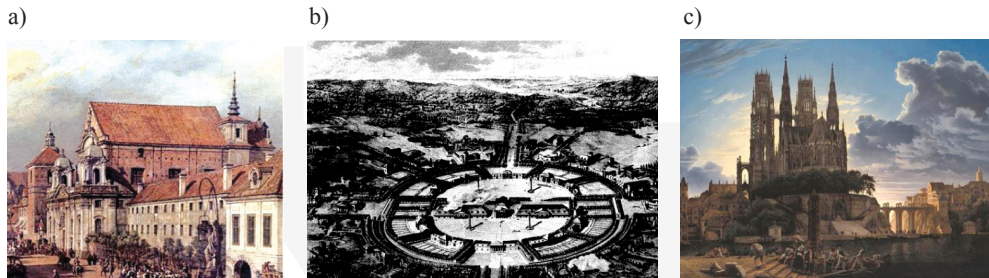
b) J.J. Schübler, *Proposals for baroque architecture and inside decoration. A study* (ca. 1730) (source: [https://de.wikipedia.org/wiki/Johann\\_Jacob\\_Sch%C3%BCbler#/media/File:Schuebler\\_Studierzimmer.jpg](https://de.wikipedia.org/wiki/Johann_Jacob_Sch%C3%BCbler#/media/File:Schuebler_Studierzimmer.jpg), online: 27.11.2015)

the work bears witness to the author's craftsmanship in developing views from different perspectives. Schübler presents the principles of the bird's-eye perspective with its several spectacular exemplary drawings (III. 4b). K. Bartel considers the work as one of the most beautiful in the subject literature [4, p. 552].

A masterful use of perspective is visible in the 18<sup>th</sup> century paintings. During this period, "portraits" of architecture were created. Bernardo Belotto known as Canaletto (1721–1780)

would use a darkroom referred to as “camera obscura” to construct perspective, achieving an unusual precision and accuracy in reproduction of details of building objects. His panoramas, in particular the one of Warsaw, were used in the post-war period, during reconstruction of the destroyed historical objects (Ill. 5a).

Equally perfect craftsmanship in mastering linear perspective is evident in the works of architects of that period. A design of an industrial city drawn by a French architect Claude Nicolas Ledoux (1736–1806) (Ill. 5b) was quoted as an example. Karl Fridrich Schinkel (1781–1841) was yet another well-known architect of that period. He studied art and, like other artists, travelled all over Europe creating outdoor paintings and drawings (Ill. 5c).



Ill. 5. Perspective views from the turn of the 18th and 19th century:

- a) Bernardo Belotto known as Canaletto, *St. Anne's Church in Warsaw* (1774) – Royal Castle in Warsaw (source: [https://pl.wikipedia.org/wiki/Bernardo\\_Bellotto#/media/File:Canaletto\\_Ko%C5%9Bci%C3%B3%C5%82\\_%C5%9Bw.\\_Anny.JPG](https://pl.wikipedia.org/wiki/Bernardo_Bellotto#/media/File:Canaletto_Ko%C5%9Bci%C3%B3%C5%82_%C5%9Bw._Anny.JPG), online: 27.11.2015),
- b) Claude-Nicolas Ledoux, *Projet pour la ville de Chaux* (1804) (source: *L'Architecture considérée sous le rapport de l'art, des moeurs et de la législation*, <http://gallica.bnf.fr>, online: 27.11.2015),
- c) Karl Fridrich Schinkel *Medieval Town by Water*, (1815) (source: [https://upload.wikimedia.org/wikipedia/commons/c/ca/Karl\\_Friedrich\\_Schinkel\\_-\\_Medieval\\_Town\\_by\\_Water\\_-\\_WGA21002.jpg](https://upload.wikimedia.org/wikipedia/commons/c/ca/Karl_Friedrich_Schinkel_-_Medieval_Town_by_Water_-_WGA21002.jpg), online: 27.11.2015)

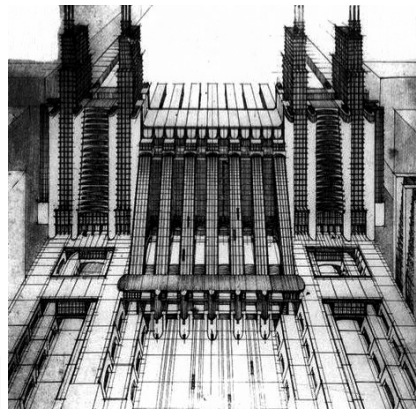
In the following century, a departure from the strict application of perspective rules takes place. Impressionists were using, most often, the colour and aerial perspective to reproduce the space (Ill. 6a).

In the 20<sup>th</sup> century, the convention of realistic pictorial representations is abandoned. Paintings and realistic drawings are replaced by photography and film, which record the three-dimensional reality in accordance with the rules of the perspective. Painters of this period were experimenting with new representations of the space, with different perspectives. For example, cubists (Pablo Picasso, Georges Braque) were constructing another space by representing an object simultaneously from several points of view (P. Picasso *Dora Maar Seated*, 1937 – Musée Picasso in Paris). They rejected the rules of the traditional perspective. They would subject the forms to geometrization. In turn, the futurists were presenting a space in which everything is in motion, the objects run or spin. The major theme of their works was the city in a geometricalized form (Umberto Boccioni *The noise of the street enters the house*, 1911 – Sprengel Museum in Hanover). Expressionists (Vincent van Gogh, P. Gauguin) were deforming the shapes and colours, breaking up with the objectivism and presenting in this way subjective visions (Paul Gauguin *Yellow Christ*, 1889 – Albright-Knox Art Gallery, Buffalo, New York). Surrealists (Salvador Dali, Rene Magritte) were painting objects in a trompe l'oeil form, they were arranging them in unusual combinations,

a)



b)



III. 6. Perspective images of architecture in XIX and XX century:

- a) Alfred Sisley *Kanal Saint-Martin*, (1872) – Museum d'Orsay Paris (source: [https://pl.wikipedia.org/wiki/Alfred\\_Sisley#/media/File:Alfred\\_Sisley\\_001.jpg](https://pl.wikipedia.org/wiki/Alfred_Sisley#/media/File:Alfred_Sisley_001.jpg), online: 27.11.2015),
- b) Antonio Sant'Elia *Stazione d'aeroplani e treni ferroviari con funicolari e ascensori su tre piani stradali* (1914) (source: [https://en.wikipedia.org/wiki/Futurist\\_architecture#/media/File:Santelia03.jpg](https://en.wikipedia.org/wiki/Futurist_architecture#/media/File:Santelia03.jpg), online: 27.11.2015)

achieving in this way surprising impressions (S. Dali *The Temptation of St. Anthony*, 1946 – Royal Museum of Arts, Brussels). Thus, the breaking up with the objectivism and copying of the nature took place. Unconventional approach towards the perspective (assumption of several points of view) and its application to produce unrealistic representations of the reality can be observed in the works of Maurits Cornelis Escher, Giorgio de Chirico, Rene Magritt, Carlo Carra, and others (G. de Chirico *The Disquieting Muses*, 1917 – Mattioli Collection, Milano).

The 20th century is considered a golden era of traditional hand-made architectural drawing [7, p. 7]. Perspective drawings of that period were made to delight and charm investors. To that purpose, not only was the drawing craftsmanship harnessed, but also other means which are used by artists to make their works become artworks. Hence architectural drawings are made with the use of a variety of techniques and materials. Many architects perceive designing as art and search inspiration in painting. Born in 1950, Zaha Hadid found her inspiration in the works of vanguard artists. The works of Frank Lloyd Wright (1867–1959) manifest his fascination with Japanese art and one of his perspectives *La Miniatura Mrs. George Madison Millard House*, bears resemblance to Claud Monet's paintings [7, p. 70].

In the 50's of the last century, hand-made sketches were included as a means for presenting architectural concepts, which served designers for communication. From that period came famous sketches of Le Corbusier (1887–1965), in which the new Modulor-system-based proposals were introduced.

At the end of the 20th century, the development of computer technologies, and consequently, relevant graphic computer software resulted in computer-assisted architectural design, whereby architects were equipped with a tool that opened for them new possibilities of presenting their concepts.

It is worth highlighting here that, amongst architectural designs, there are several examples of so-called ‘drawn architecture’ that have never materialised. However, these had their share in the development of theoretical thought and inspired the imagination of many artists [13, p. 40]<sup>5</sup>.

### 3. Perspective, as one of the conventions for the record of spatial objects

Nowadays, we know that linear perspective is only one of numerous possibilities to structure the space on an image, and that it contains certain assumed elements. Realistic paintings of the three-dimensional reality with the classical perspective view are a rarity nowadays. The ability to draw in perspective is not immediately needed. The tedious, manual work has been replaced by digital techniques. This method of presentation prevails over the other presentation possibilities. Computer-made visualizations and photographs took over the role of the documentation, while the role of the “portrait” has been taken by the photography and film. Virtual observation, modelling and presentation take place. Computer-made images of architecture can be transformed number of times by altering the position of the camera, lightning, texture, colour etc. One can thus experiment and obtain, in a short period of time, numerous views and striking perspectives of an object. The authors are trying to surprise the spectator with unusual views, sharp convergence of the perspective, intensive contrasts of the colour and light. Computer visions are simulating photographs of existing objects, “in computer visualization diminishes the border between the interior and the exterior, between a drawing and the reality” [3, p. 10].

Only a few years ago, hand-made, drawn and painstakingly time-consuming perspectives of architectural objects were created in the final stage of the execution of a design. Nowadays, modern technologies enable the design and the perspective observation of a building at each stage of its construction. Computer software provides a variety of possibilities for presenting the structures in perspective. Buildings and what they look like depend on the possibility of performing a rendering. The SketchUp software can be used for modelling 3D objects, creating perspective views (III. 7a) as well as the renderings with the V-Ray software, the frontend of the SketchUp (III. 7b–d). In the SketchUp software the user establishes the position of the observer and the direction, at a standard visibility angle. The V-Ray (handling) relates to traditional Photography – the visibility angle is focal-length-dependant at a default small-format. It is possible to obtain the depth and the high definition adjusted to the digital equivalent of a diaphragm, which can affect the exposition. Like in camera lenses, a picture with a different degree of distortion can be obtained (III. 7d).

A mechanically created linear perspective is objective, ideally accurate, in perfect harmony with the rules of the geometry. However, due to routinization, it lacks the expression of a perspective drawn by hand.

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<sup>5</sup> The author classified the following designers as architect-theorists: Giovanni Battista Piranesi (1720–1778), [from the period of French Renaissance] Étienne-Louis Boullée (1728–1799), Claude Nicolas Ledoux (1736–1806), [from 19th century] Joseph Michael Gandy (1771–1843), Karl Friedrich Schinkel (1781–1841), [from 20th century] Antonio Sant’Elia (1883–1916), [an expressionist] Wenzel Hablik (1881–1934), [constructivists] El Lissitzky (1890–1941) i Yakov Chernikhov (1889–1951).



a)



b)



c)



d)



III. 7. Perspective views/images made with the use of the following software: a) SketchUp, b, c) V-Ray; object renderings at different visibility angles, d) V-Ray with distortion 0.5 – the ‘fish-eye’ effect (by: Szymon Filipowski)

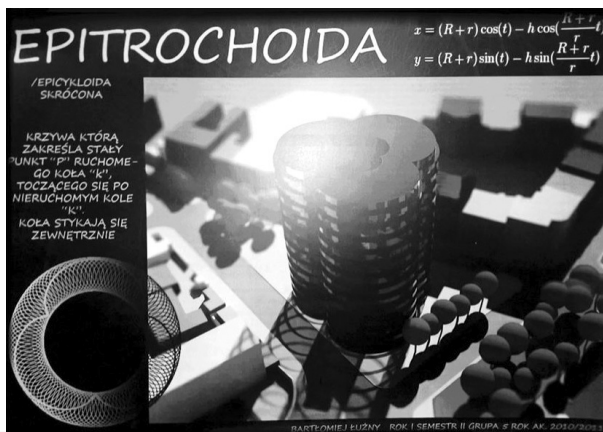
The geometrical theory of the perspective, reduced to its basics, remained in the curricula of architecture, engineering (civil engineering) and arts studies<sup>6</sup>. The theory is conveyed using modern information technologies though. This affects both the lectures and the laboratory classes (an example here is a set of exercises developed by the Faculty of Architecture of Krakow University of Technology). Within the framework of the geometry classes interactive courses and presentations were prepared using the Moodle platform. The platform allows the students to return to the lecture materials at any time and at any pace. The knowledge from these lectures is then brought into practice during laboratory classes on the subject Computer Techniques in Design (III. 8a). The materials constitute a basis for preparation of a proper modelling rendering and next of a photorealistic rendering in both

<sup>6</sup> Perspective, and air perspective in particular, is a subject of numerous studies and written works. For the purpose of the academic subject of Descriptive Geometry the chapters on perspective can be found in textbooks and many works on the topic are available [16, 18]. Yet still one of the most remarkable pieces of work on this type of projection remains the work of K. Bartel [4] in which the author subjects paintings to the analysis in terms of perspective.

a)



b)



III. 8. 3D objects in AutoCAD software: a) Model of the area of the Cracow University of Technology at Warszawska Street in Krakow, prepared by the students of the Imago Science Club (graphical study by: Piotr Vogt), b) Epitrochoide (Bartłomiej Łuźny) – student’s work prepared within the framework of Mathematics classes

architectural and developmental design. Such visualizations and models are created using the following computer programs: Graphisoft ArchiCAD, Autodesk AutoCAD, Autodesk 3dStudioMax, Accurender, Artlantis, Autodesk Architectural Deskop, Adobe Photoscop, SeechUp, Lumion, Revit, RhinoCeros, Grasshopper etc.

A kind of marketing, in which computer graphics and perspective are used, belongs to the basics of education of specialist workforce also in such subjects as mathematics (III. 8b). It is recommended to strictly follow the rules of the perspective in the end of semester projects (in mathematics). These rules are not observed as strictly in the handmade drawing, as long as the suggestion or the implication is of higher importance<sup>7</sup>. Handmade sketches on a location, as well as based on recollections and imagination, have a cognitive purpose; they stimulate the spatial imagination, perceptiveness, memory, and when made based on imagination, they constitute an initial record of an idea, a notice of a future design.

A sketched drawing can also serve the purpose of reaching intellectual focus, supporting creative thinking, raising questions and searching for solutions. The analytical function of sketching involves two elements:

- a set of symbols that distinguish an architectural design in a unique way,
- a narrative expressed by images that interpret these symbols, i.e. composition, articulation, arrangement and line density [8].

<sup>7</sup> „The rules of projecting, comprehending the subject in the category of geometry as a discipline of science, in handmade drawing constitute only a general guideline on the construction of an image. The perspective does not have to be strictly followed. Numerous circumstances exist where it is virtually required to omit some of its rules in the handmade perspective drawing. It is done due to different properties of the space to plane relationship, if they prove more important for the drawing as a measure of expression which shall move the imagination and form not only information but also a spatial suggestion” [10, p. 267].

Sketching, as such, still remains needed, as an exercise in drawing and design, as a method for a record of a concept and as a communication mean<sup>8</sup>. An impression is present that nowadays perspective is more widely used by architects and civil engineers than artists painters though. “Once the methods for the construction of a perspective have been developed, the workshop of an architect, to a certain degree, became closer the workshop of the painters. In paintings, architecture was presented and perspective became an art of its kind” [6]. The works of architect Michał Suffczyński demonstrate his artistry in presenting the reality and mastering perspective<sup>9</sup>. His watercolours are displayed at numerous exhibitions and available for viewing on his own website [27].

At present, perspective is the most popular convention for presenting spatial objects. The development of graphic computer software made perspective available to laymen who do not necessarily have to know the principles of its creation. Are drawn and painted perspective views going to survive in the age of the digital technology? Looking at the workshop of famous contemporary architects, who do utilize modern computer software, we can still see that they are drawing, sketching and painting by hand. They value this method of work and publish their first, general sketches of designs<sup>10</sup>. Handmade perspective drawings presenting sketches of conceptions are still present at the end of semester works made by students and also in dissertations and competition works. Naturally, a dominating majority of designs is made using a computer (Ill. 9). However, during the selection of the proper perspective and of the view point, the knowledge of the perspective is still applied. „Despite the development of computer techniques, hand-made drawing still remains a fast, effective and convenient design tool” [9, p. 5-14].

And what can be taken away from the traditional painting representations of architecture? What values remained up to date for the nowadays creators of images who are using the computer graphics?

Painting representations of architecture constitute an interesting material from the standpoint of the workshop of the old masters. In the masterpieces, we observe a coexistence of the nature and architecture, setting of the latter in the surroundings and terrain, consideration of the landscape values, the greenery and water. Authors were seeking interesting and harmonizing views, favourable from the compositional standpoint, as well as standpoint of the light, which would enrich the vividness (at the right time during a day). They would often synthesize the theme by eliminating excessive details and giving up pedantry, by means of which they would emphasize the lead motive and would draw the spectator’s attention towards the key elements. Artists were selecting objects and were purposefully moving away from a detailed record of reality, omitting thus unaesthetic and defacing elements. The harmony of shapes and colours is also worth attention. An interesting feature is a reduction of the number of colours, sometimes limitation of the palette to an almost monochromatic set.

<sup>8</sup> On 29–30 May 2015 in Kraków the III International Conference on *Challenges of the 21<sup>st</sup> century: To Draw, to Paint or to Use a Computer* took place. The conference was one of the series on Teaching Drawing, Painting and Sculpture in Architectural Education. The review of conference articles, published in both the Technical Transaction, 2015, and two monographs, shows that perspective is still one of the most popular methods of recording the ideas and the thoughts of a designer. The works contain many hand-made sketches which are unceasingly considered as the ‘simplest and fastest method for recording images and thoughts [14].

<sup>9</sup> This work [21] is addressed to those who are interested in methods of space visualisation. It is accompanied by a CD in which the author recorded the process of creating a drawing ‘step-by-step.

<sup>10</sup> Architectural drawings of famous architects, can be viewed at the websites: [23–25, 28, 29].

a)



b)



III. 9. Design of a house: a) garden side view, b) interior (license to use the graphical materials obtained from the ARCHON company on 15.09.2011)

It turns out that such approach facilitates the play of the chiaroscuro, vividness and mood. Masterful wield of the perspective is visible in the smooth and delicate transitions between the close and the distant plans, variable intensity of colours, diminishing outlines in the distance. A perspective captured with a painter's brush constituted a spontaneous expression, which was based on a feel of a moment and highly individualized.

#### 4. Conclusions

Referring to the sources of the art of perspective allows to observe subsequent achievements of creators in the field of interpretation of the third dimension. Perspective was fascinating artists since the Renaissance, in particular the painters of landscapes and panoramas. Gaining knowledge on the history is an opportunity to touch the art of painting and to discover the relationships between the painting and architecture, as well as to get to know the workshop of the old masters and its modern interpretation. The linear perspective, which is still in use, is a wonderful discovery of the human mind. "The same way a photographic image documents, to certain extent, the artistic effect of the object realisation, a correctly constructed perspective image can be an objective test of the spatial and artistic concept of a design before its realisation. From this, among others and most of all, springs the purposefulness and the necessity for designers to become familiar with geometrical laws that rule the perspective image, so that the designer could perform the role of such an objective test of forthcoming realisation. The familiarity with these laws can assist a full use of information contained in a photographic image as an objective stocktaking record which in fact is a central projection of a situation in space onto the plane of the photo" [15, p. 16].

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