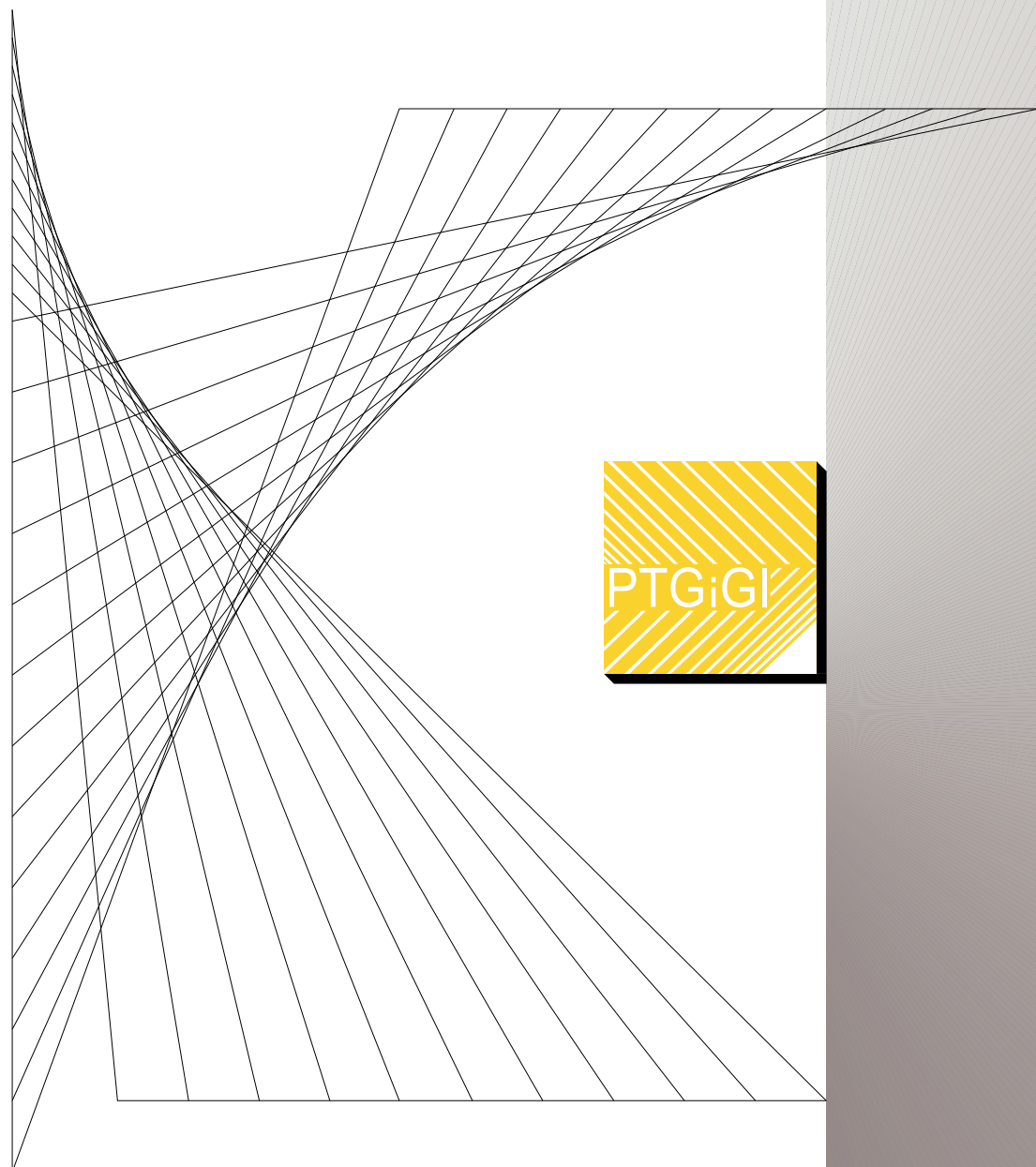


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FOR GEOMETRY AND ENGINEERING GRAPHICS



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OVERVIEW OF THE OLDEST WORKS OF POLISH THEORISTS ON THE SHAPE OF A ROOF

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Abstract. The paper presents an overview of the works starting from the first, a farmhouse encyclopaedia tractate, to the works of Stanislaw Kostka Poniatoski. There are shown different approaches of individual authors to an object's architecture, and therefore to the architecture of roofs. Also, there are included computer models of these shapes, as well as shapes' proportion research..

Keywords: theorists of architecture, architectural tractates, roof shape, proportions



Figure 1: Building-up of various roofs on the market in Laszczow, on a photograph from the early twentieth century

The overview will include an analysis of works of Polish theorists of architecture, which were created or issued in the period from 1549 to the first half of the nineteenth century. The given time frame was determined by two events. The first was the publication of the first farmhouse encyclopedia tractate – the translation of a work of Pietro de'Crescenzi, *Ruralium commodorum libri duodecim*, in Poland. The closing date is the collapse of the November Uprising and the eventual loss of independence by Poland, and a huge impact of occupation on our native culture and wide diversity of rules, assumptions, traditions, culture, as well as design requirements in different partitions, which, in practice, did not have such an impact on our native, traditional architecture, but on guidebooks or building regulations issued during this period.

The Polish oldest known book on architectural issues, was a farmhouse encyclopedia tractate — *Piotra Crescentyna Ksiegi o Gospodarstwie i Opatrzeniu Rozmnozenia Rozlicznych Pozytków Kazdemu Stanowi Potrzebne*, published in 1549 in Krakow. This is the Polish translation of Andrzej Trzycieski, or rather its partial adaptation of the works of Pietro de'Crescenzi, *Opus Ruraliaius Commodorum Libri XII* and *Ruralium Commodorum Libri Duodecim*, from the years 1304–1309. The work of Crescenzi was an immensely popular economic tractate, and, by the end of the Middle Ages, it was translated into several European languages. This represented a critical compilation of various well-known works, especially by Columella, as well as the author's own observations, combined with an exposition on "all areas of his profession".

Trzycieski applied a lot of changes and additions in his translation in order to adapt the tractate to the Polish conditions and relations, even though he did not avoid the wording that was not always useful in our land. Tips for construction are placed in separate, small sections, yet they are interspersed with information on breeding, agriculture, or other practical advice on running a farm. And an interesting thing to note is the fact that in his amendments contained in the translation of Crescenzi, he refers to Palladio, whose architectural tractate of *I Quattro Libri Dell'archi-Tettura* was released in Venice only in 1570. This can be explained by the fact that Trzycieski knew the fragments of the works of Palladio in manuscript already before the 1549.

There should be mentioned also a quite original tractate by Anzelm Gostomski, entitled *Gospodarstwo*, which was released in 1588 in Krakow. Although, for example, there is no chapter devoted mainly to the construction of houses, as observed by the publisher in the introduction:

[...] True, there are missing many issues related to running a farm [...] But they wanted also an art of farming: hardening, settling, building houses, which was the Most Holy and almost the last effort of these times: so that not only the present engineers or former Vitruvius, but also the Dorians, Corinthians would be astonished by the crafts [...]

but the text i.a. contains advice on maintenance of buildings or requirements on selecting a site for the construction of a mansion, as well as a description of the model farm and village¹. This tractate was quite popular in Poland and renewed many times.

Another approach to issues related to the architecture of an object, and therefore the architecture of roofs, was demonstrated by Sebastian Petrycy of Pilzno, which can be called the first Polish art theoretician. In his pedagogical tractates: *Polityka ...* (1605), *Ethyka ...* (1618), *Oekonomika Aristotelesowa* (1618), except his philosophical considerations on issues related to art, much space is devoted to architecture. In its "additions" and "cautions" that he attaches to the texts of Aristotle translated by himself, he often returns to issues related to construction and architectural problems in Poland, while the chapter entitled *O Budowie Domow* shows his views on architecture, which is treated as a work of art. It is worth noting that some of his suggestions — particularly those concerning architecture — caused a resonance in the seventeenth century literature, but later none — until the Enlightenment — raised the artistic issues to such an extent.²

Polish first thesis relating only to architecture, written by Adam Freytag from Torun was entitled *Architectura Militaris Nova et Aucta Oder Neue Vermehrte Fortification*, and it was published in German in 1631 in Leiden. This had as many as four editions in German and two in French.

¹ Stanislaw Kot in his book of *Szlachecka Kondycja* demonstrated (p. 20 and p. 69) that the description of a model farm and village was written by Jakub Ponetowski.

² Wladyslaw Tomkiewicz — *Pisarze Polskiego Odrodzenia o Sztuce*, p. 90, 93 and 96.

Another important thesis is the work by Jozef Narowicz-Naronski, *Ksiegi Matematyczne*, written in the years 1655-1659. It is a 3-volume guidebook, which included: *Arytmetyka, Geometryja lubo Rozmiar, Optyka lubo Perspectiva*.

The third volume (even by the promise, which can be read in its full title), contained chapters on the military and civil architecture. Unfortunately, there is preserved only a manuscript of the part concerning military architecture in the Warsaw University Library under the number of 106. The chapter of *Architektura Civilis* unfortunately is missing. The contents of the missing chapter are presented by the author himself as following:

[...] *The science described in the "Architektura Civilis" is in urban construction, where posts, pillars, arches, supports, windows, door frames, floors, walls, roofs, porches, cloisters has to have its own proportion of all five parts of the palace construction and every part has to have its separate size and shape [...].*

At roughly the same time as *Ksiegi Matematyczne*, there was created the first Polish tractate devoted exclusively to the civil architecture, relating to building in the conditions of the home environment, and entitled *Krotka Nauka Budownicza Dworow, Palacow I Zamkow podlug Nieba y Zwyczaju Polskiego*³. It was published anonymously in 1659 (Professor Adam Milobedzki supposedly dates the creation of this work to about 1657), and the authorship of this tractate is attributed to Lukasz Opalinski, an aulic marshal of the Crown. This tractate was to be a sort of a guide aimed at facilitating the conduct of a construction process by an "economic system", under the supervision of the investor, and with minimised participation of craftsmen – professionals. Therefore this work, unlike other contemporaneous architectural tractates, is concise and compact, and each theoretical or practical issue is given as a "rule", "warning" or "caution" and has a rich in content commentary. The whole work consists of thirteen chapters, grouped into four main parts; each of them is preceded by a preface and completed by conclusions. These parts have separate titles: *De Situ, To Jest o Miejscu I Polozeniu Sposobnym Budynkow, O Materyjej Budynkow, O Formie Budynkow, O Murowaniu*. It is worth noting that in the tractate, the pictures play a dominant part over the text. Also, there is clearly placed a postulate on the adaptation of the construction industry to local conditions and traditions. It is supported by a critical attitude of the author to the recommendations of foreign authorities. He often opposes them, giving his own rules resulting from observations and experience, not only from theoretical considerations. Despite this, his messages and practical advice are supported by theoretical, philosophical and moralistical considerations of the author. In contrast, after Vitruvius and other Italian theorists, he establishes the following criteria for the architecture:

[...] *a good construction is to consist in three features: firstly, the solidity and thorough durability, then the rest and comfort, and, at the end, the shape and beautiful appearance [...].*

In Opalinski, you can find comments on proportions of the roofs that say, among other things, that the roof height should be equal to half the height of the building. These remarks do not stem from theoretical assumptions, but rather from practical reasons justified by the climate. In contrast, in parts on the ratio of the roof height to the walls – the roof must not be higher than the walls – they are only general tips.

³ Professor Adam Milobedzki writes about it in his paper included in *Teksty Zrodlowe do Dziejow Teorii Sztuki*, in Volume VII, on Page XIX.

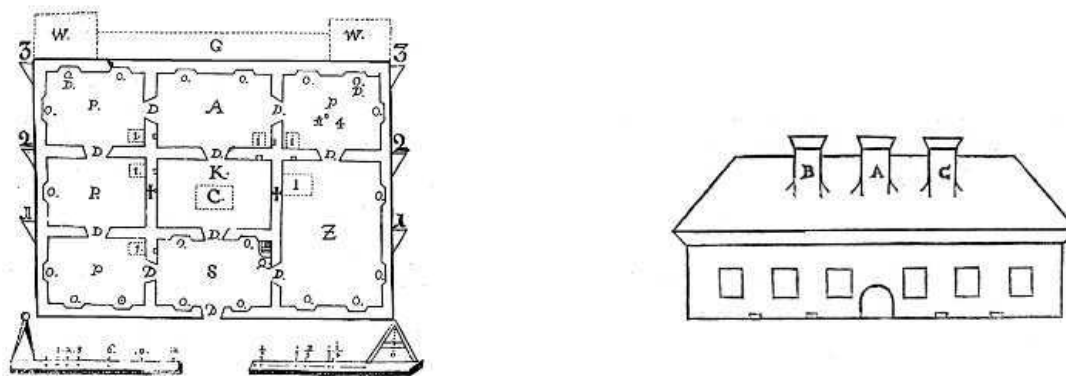


Figure 2: Model house plan and elevation of a manor house in *Ziemińska Generalna Oekonomika* by Jakub Kazimierz Haur

In 1675, there is published the first edition of a work by Jakub Kazimierz Haur entitled *Ziemińska Generalna Oekonomika*, which brought a long-lasting fame as the most popular agricultural writer to the author. This work, in few special chapters, includes also issues of the rural construction, presented mainly as practical advice. For example, he gives a proportion of the roof similar to Opalinski, and in the theoretical mansion project – for an elevation of a height of 8 cubits (7 cubits of walls, and 1 cubit of ledge), he proposes 7-cubit roof.

It is Haur who published standard manor house plans as the first Polish author. On the basis of drawings included in the work, the shape of the roof of a standard manor house may be recreated.

In 1678, there was published the first Polish academic textbook of architecture. It is the tractate of Bartłomiej Nataliej Wasowski, entitled *Callitectonicorum seu de Pulchro Architecturae Sacrae et Civilis Compendio Collectorum Liber Unicus. In Gratiam et Usus Matheseos Auditorum in Collegio Posnaniensi Societatis Jesu*, which is a summary of an earlier and more extensive version of a manuscript, which unfortunately is missing. This guide consists of 6 chapters, in which there are subsequently discussed general issues such as: the beauty in architecture, types of architectural orders, genesis of architectural orders.

The first, easiest solution would be a hipped roof. In this arrangement, the angles of the roof slope would be greatly varied – 48° and 27° . Taking into account the material that was used for covering manor houses, the minor of the angles was impossible. Therefore, most likely a roof over such mansion had to be multiple – double. Then the slope angles would be respectively 48° and 45° or with additional passage in the middle in order to measure the length of the valley beam (which was probably nearly horizontal). To the body of the building, there were also added bowers covered by the roof that could be located under the general roof body or have separate roofs, like in the medieval corner castle towers, the conversion of which probably resulted in forming the manor house in the sixteenth century.

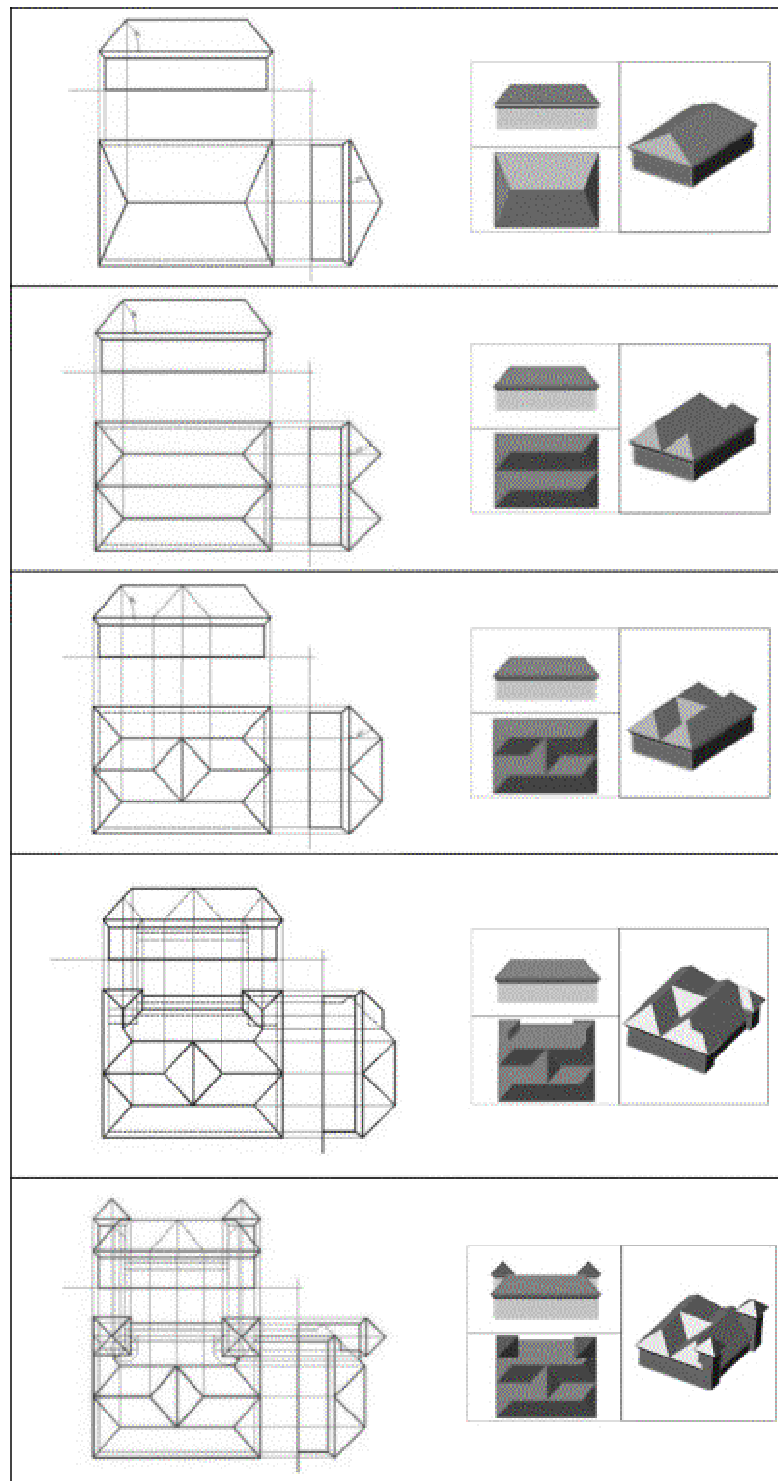


Figure 3: Models of roof shapes

The whole work was completed by 7 summary tables, which contain several dozen of illustrations. In his work, Bartłomiej N. Wasowski ignores construction and material issues. The novelty is giving the Polish architectural terminology, which was summarised with the names in Latin and Italian. This Latin tractate was translated into Polish in 1728, but this version remained only a manuscript.

The next major thesis was published in Oliwa in the years 1680-1682, and it was *Philosophia Curiosa, seu Universa Aristotelis Philosophia* by Wojciech Adalbert Tytkowski.

Its third part entitled *De Visione Directa et per Artem Coloratios*, was devoted to painting and aesthetics problems – *Pars Septima Physicae Curiosae de Sensu et Sensili*. In this part, there is also a small disquisition on architecture, entitled *De His quae Pictura Supponit ex Architectonica*. It contains mainly comments on the elevation of a building, as well as all orders of architecture and their proportions.

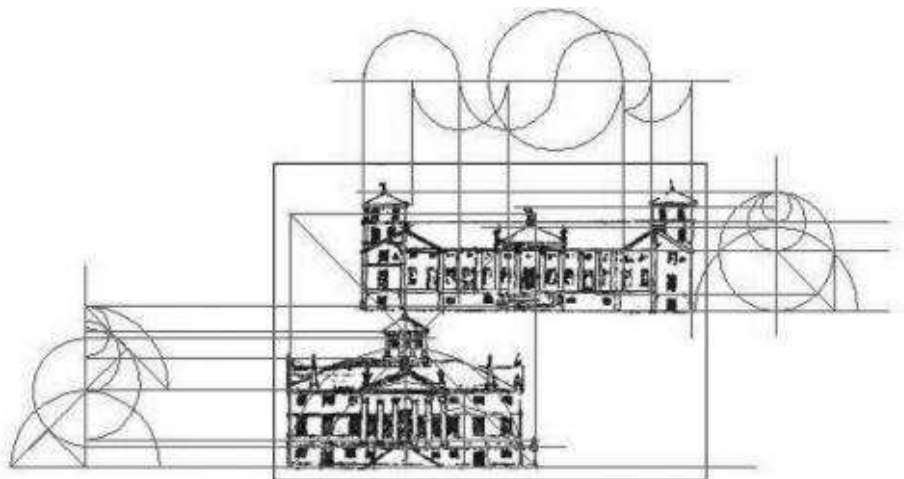


Figure 4: Silver proportion occurring in the tractate by Bartłomiej N. Nalecz-Wasowski, entitled *Callitectonicorum Seu De Pulchro Architecturae Sacrae Et Civilis Compendio Collectorum Liber Unicus* in the projects of palaces clearly separates body and the shape of the roof from the body of the building

In 1690 in Krakow, Stanislaw Soliski released the first part of the work entitled *Architekt Polski, to Jest Nauka Ulzenia Wszelkich Ciezarow, Uzywania Potrzebnych Machin Ziemnych i Wodnych, Stawiania Ozdobnych Kosciolow Malym Kosztem, o Proporcji Rzeczy Wysoko Stojacych, o Wschodach i Pawimentach, Czego się Chronic i Trzymac w Budynkach od Fundamentow az do Dachy, o Fortyfikacyi i Innych Trudnosciach Budowniczych*. At the end of the first part, including a mechanics and hydraulic engineering lecture, which was combined with descriptions of various machines and devices, there was attached a table of contents of the missing second part. According to the table, this part covered issues concerning civil architecture. It was primarily devoted to religious architecture, but also included information on the basic five orders, provided guidance on adjusting the size of various components to the height at which they are to be placed (that is, all the proportion issues in architecture – of details and whole of the body, including optical illusions or perspective at the reception by an observer). It also included a number of technical issues. And the third part was devoted to military architecture.

The next work, which is worth mentioning, is a published in 1743 *Informacja Matematyczna Rozumie Ciekawego Polaka, Swiat Caly, Niebo i Ziemie, i Co na Niej Jest w Trudnych Kwestiach i Praktyce Jemuz Ulatwiajace* by Wojciech Bystrzonowski. It is a kind of a "rational encyclopedia", compiled from several tractates dedicated to different areas of mathematical, natural, technical and military sciences. Among them, there is a thesis entitled *Informacja Architektoniczna*, which includes theoretical and practical construction knowledge. It consists of 6 parts, which are devoted to the issues of: solidity – material, general principles of arrangement, comfort – the area, arrangement, beauty – architectural orders, decorations, church architecture, residential architecture and architecture of individual elements of the building.

In his work, Bystrzonowski was inspired by the works of classic Italian theorists, but also used newer works of German authors, as well as works of his Polish predecessors – Wasowski and Solski, but he mainly used a mathematics textbook by Christian Wolff, whose fourth volume is entitled: *Elementa Architecturae Civilis*.

In Lviv in 1745, as an encyclopedia, there was issued a three-volume, popular work of Benedykt Chmielowski *Nowe Ateny albo Akademia Wszelkiej Scjencji Pelna*. It is a very strange job, which contains a lot of even specious and fantastic information, and the story tangles with the mythology in addition to the concrete contents. However, it contains many interesting articles in the field of architecture, which are included in volumes I and III. In the I volume, the author involves architecture to the mathematical sciences: ***This part of mathematics is nothing else than a Scientia aimed at exposing the Political or Military Structure***, while in the III volume we find information on it in the supplement about economics. The content of these articles are comments on building materials, arrangement, components and structure of buildings of various types. Included illustrations are historical examples, but unfortunately often from the Bible.

In 1749 in Lviv, Kajetan Zdzanski issued a book, which was a translation of Latin lectures of Faustyn Grodzicki supplemented by illustrations, and it was entitled: *Elementa Architektury Domowej Krotko Zebranej na Lekcyjach Szkolnych po Lacinie Wydanej, atu na Ojczysty Jezyk Przelozonej*. This work, despite the Baroque language and style, and often dogmatically stated principles of design, has a clear content layout and it is some kind of announcement of the coming Enlightenment age. The author, by counting architecture among the mathematical sciences, gives a quite terse definition of it:

"Architecture is the ability to insert strong, comfortable, beautiful structures".

This tractate is divided into three parts, in which there are considered the following issues: sustainability or solidity, beauty and convenience. Each part is divided into chapters, and these to 300 numbered definitions, problems, questions and answers. They exhaust general housing issues, considered on the basis of principles of shaping the Baroque architecture. Moreover, though to a modest extent, this work relates to the church and monastery construction. In his work, Zdzanski recommended construction of roofs with a slope of the angle of 45°.

In chronological order, the next thesis is a tractate published anonymously in 1764 by Fr. Jozefa Rogalinski, entitled: *O Sztuce Budowniczej na Swoje Porzadki Podzielonej Zabawa Ciekawa Miana w Szkołach Poznanskich Soc. Jesu Roku 1764*. It is a small book, completed by two tables, containing mainly a discussion of the classic orders and their application in architecture. This tractate appeared again in 1775, developed by Franciszek Degen, who introduced small but quite significant changes and supplements to it.

Zdzanski and Rogalinski were the precursors of the new trend in the Polish culture – the Enlightenment. An indication of this was a new way of looking at architecture. Theorists stopped to consider and notice only the aesthetic aspect, but drew their attention to its purpose as an art, as well as its constructiveness. Issues of the purpose of architecture, which were so strongly expressed in tractates of the period of the Renaissance, once again become the main postulates of the architectural creation. Architecture itself becomes a common knowledge, on par with literature or history, as exemplified by the script of lectures, which, at the same time, constituted a basic minimum knowledge required for the examination in architecture at the College de Nobles des PP de la Compagnuee de Jesus in Warsaw. This script was published in French in 1767 in Warsaw by the students of the College: Florian Stawinski and Andrzej Wollowicz and was entitled: *Exercice sur l'Architecture ...*.

During the Enlightenment, there appear numerous tractates on rural construction. Although they are not always original works, they are generally adapted to Polish conditions and do not go far beyond the issues of a rural construction guidebook.

The first of these was the tractate addressed to heirs, written by Fr.. Piotr Switkowski, entitled: *Budowanie Wiejskie Dziedzicom Dobry y Possessorom toz Wszystkim Jakazkolwek Zwierzchnosc po Wsiach i Miasteczkach Majacym do Uwagi y Praktyki Podane*, published in Lviv in 1782. It was modelled by the work of Franciszek Rausch, published in Budapest in 1779, and entitled *Elementa Architectura ad Structuras Aeconomicas Applicata, in Usam Academiaram etc, Conscripta per Franciscum Rausch etc.A.A. LL.etc. Philosophiae Doctore, etc.: in Regia Scientiarum Universitate Budensi, Mathesees Sublimieris Applicate Professore pub. Ord.*, translated into Polish by Cyprian Zapolski and released in 1788 as *Budownictwo Wiejskie....*

The work of Switkowski is very comprehensive and richly illustrated. It consists primarily of practical information about "comfort and durability" and construction materials, as well as various economic issues, equipment and furnishing. Many times, the author cites the latest, national and international achievements of his time. This work was well received, as evidenced by the fact that other authors often refer to it, and it was even summarised. One of such summaries, although with some changes, is an article by Maciej Debski, published in the *Kalendarz dla Krolestwa Polskiego na Rok 1786*. In the part entitled *Na Czym Zawisla Piekosc Budynku* he included an article entitled *Uwagi nad Budownictwem, Kazdemu Gospodarzowi do Wiedzenia Potrzebne*, which is the aforementioned summary.

Cheap and practical issues of rural construction were described in a released in 1791 construction textbook by Piotr Aigner – *Budownictwo Wiejskie z Cegly Gliny-Suszzonej z Planami Chalup Wiejskich Stosownie do Gospodarstwa Narodowego ...*

Unfortunately, there is missing the manuscript of a tractate by Tomasz Jaworski, created in 1793, deriving from the Vilnius Dominican archive archives in Vilnius, which was entitled: *Compendium Architectonicae Civilis [...] Praesentatum Anno D[omi]ni 1793 Diebus Novembris*. Among other things, it contained a large number of freehand drawings of architectural details, entire buildings, various roofs and illustrations of architectural orders that reportedly had come from a French tractate. Also a manuscript of a tractate from the years 1796-1799 by Ludwik Glowacki, *Architektura Civilis*, is missin.

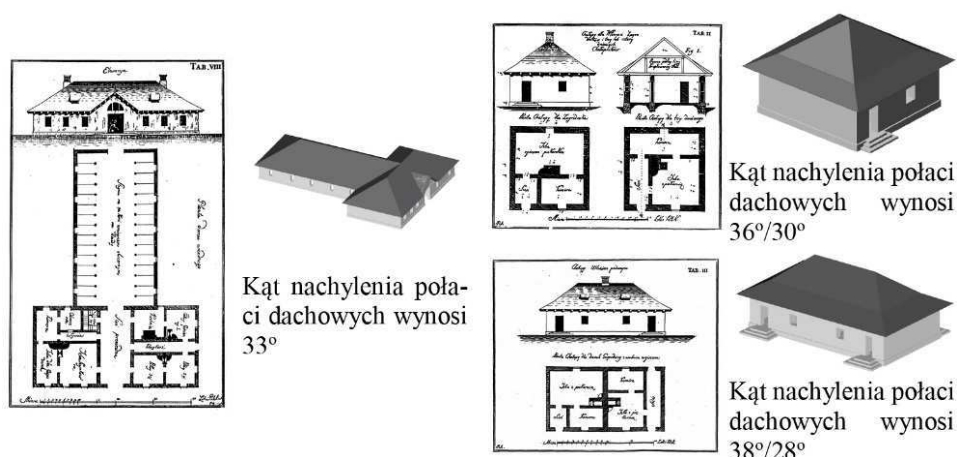


Figure 5: Examples of tables, presented in the construction textbook by Piotr Aigner – *Budownictwo Wiejskie z Cegly Gliny-Suszzonej z Planami Chalup Wiejskich Stosownie do Gospodarstwa Narodowego ...* and a computer reconstruction of a proposed shape of the roof with an indication for the proposed roof slope angles

In the years 1796-1797, there appeared the first, not associated with a Jesuit education, a Polish textbook of architecture, *Architektura Cywilna dla Młodzi Narodowej przez [...] w Dwoch Częściach Zawarta* by Fr. Waclaw Sierakowski. This work was to be short compendium of theoretical and practical knowledge about architecture. The first part mainly contains general information about the principles, genesis and important objectives of architecture, the second one – about the orders and remarks on the history of architecture and its national variations, while the third one covers technical issues, but mainly building materials. This part was published separately as a supplement for *Architektura w Częściach II Wydana dla Powszechnego Użytku Względem Materialow na Budowie Przydane Potrzebne Wiadomosci przez [...]*.

In 1807, in Vienna, it is published a book in German by Ignatzy Chambretz, entitled: *Betrachtungen Uber Charakter der Gebäude*. This book is an exponent of trends in the theory of architecture at the beginning of the nineteenth century and shows the relationships of architecture and psychology.

Architektura Obejmujaca Wszelki Gatunek Murowania i Budowania by Fr. Sebastian Sierakowski was released in 1812. It is the principal work on the theory of architecture of the Enlightenment and a closing of the previous era. This work was created on the initiative of Stanislaw Kostka Potocki, and Sebastian Sieroslawski was working on it for 12 years. It was supposed to be a textbook, which might be used by both educated people, such as the architecture students, but also by simple builders. In this work, the author presented the whole knowledge of contemporaneous architecture – moving from the theoretical to practical knowledge. He discusses the following issues: the beauty, including architectural orders, proportions, principles of composition, convenience, or the location of the object and principles of design, durability, including construction materials, as well as construction techniques. The work is based on an extensive literature, primarily on the works of the eighteenth-century, mostly French theoreticians, but also on Renaissance and Mannerist Italian tractates. The work of Sebastian Sieroslawski is modelled mainly on a tractate by Francesco Milizia, *Prinzipi di Architettura Civile*, published in 1771; however, there can be found a lot of his own, original thoughts and expressions adapted to native conditions. He also refers to the earlier Polish authors: Nalecz-Wasowski, Solski, Rogalinski, Switkowski and started works of Stanislaw Kostka Potocki. However, he stresses that all the basic principles of architecture was established already by Vitruvius. The work of S. Sierakowski refers to the Vitruvian tradition with the scope of the subject, and with its content – to the eighteenth-century literature.

Stanislaw Kostka Potocki, which also dealt with the theory of art, archaeology and architecture, released a work entitled *O Sztuce u Dawnych, czyli Winkelman Polski* in 1815. This work, which was the first Polish art history, contains the history of fine arts, and architecture among them. The view of the author on architecture does not differ from ideas of Waclaw and Sebastian Sierakowski. However, it draws attention to the impact of both climate, national customs and religion on forming of a specific national art, born from the internal need of the society. He is also the author of two other, unfortunately, not finished works: *O Sztuce u Dziejniejszych* and *O Architekturze Wiejskiej*.

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PRZEGLĄD NAJSTARSZYCH PRAC POLSKICH TEORETYKÓW PORUSZAJĄCYCH ZAGADNIENIA ZWIĄZANE Z KSZTAŁTEM BRYŁY DACHU

Praca przedstawia przegląd prac zaczynając od pierwszego traktatu o charakterze encyklopedii gospodarstwa wiejskiego, aż do prac Stanisława Kostki Poniatowskiego. Pokazane są różne sposoby podejścia poszczególnych autorów do zagadnień związanych z architekturą obiektu i tym samym z architekturą dachu. Zamieszczone są również modele komputerowe omawianych brył dachów oraz analiza proporcji brył.