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Michele RUSSO, Marta ACIERNO (Eds.)



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Editors
Michele Russo, Marta Acierno
Sapienza Università di Roma

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Parallel Lives: Guarini and Dechales and the Theories of Fortification

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Abstract

This paper focuses on the treatises about military architecture by Guarino Guarini (1624-1683) and Claude-François Milliet Dechales (1621-1678). Guarini and Dechales were two religious figures who shared a deep interest in mathematics and the art of fortifications at the same time and, for a specific period of their lives, in the same cultural milieu. Dechales wrote the *Architectura militaris*, included in the *Cursus seu mundus mathematicus* (1674) and *L'art de fortifier* (1677); Guarini wrote the *Trattato di fortificatione* (1676). This research compares the three treatises, including in visual form through synoptic charts, to highlight recurrences, variants, and possible derivations between the themes treated by the two treatisers.

Keywords: treatises, fortification, Guarino Guarini, Claude-François Milliet Dechales.

1. Introduction

This proposal has been realized in the framework of the project Infortreat, funded by the European Union – Next Generation EU. The overall goal of the project is to make accessible the constructive knowledge related to military architecture (as described by early modern treatises) through 3D digital information models that can be consulted and queried by scholars, professionals, and the community. One of the research tasks is to observe possible links and derivations between the over eighty treatises analyzed. The current contribution focuses on the treatises about military architecture by Guarino Guarini (1624-1683) and Claude-François Milliet Dechales (1621-1678). Both were religious; Guarini was of the Theatine order, and Dechales of the Jesuits, and for a period of their lives, they gravitated to the court of Savoy in Turin. The two scholars devoted themselves to mathematics and wrote volumes in Latin on Euclidean theories, the *Euclides adauctus* (Turin, 1671) and the *Elementorum Euclidis* (Lyon, 1660), respectively, and shared an interest in theories related to Modern fortifications. The *Trattato di Fortificatione Che hora si usa in Fiandra, Francia, & Italia; Composto in Ossequio del Sereniss. Prencipe Lodovico Giulio Cavagliere di Savoia da D. Guarino Guarini Chierico Regolare* (in the following *Trattato di Fortificatione*) was published in Turin in 1676, and *L'art de fortifier,*

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de defendre, et d'attaquer les places, suivant les methodes Françoises, Hollandoises, Italiennes & Espagnoles. Le tout enrichy de Figures en taille douce. Par le R. P. Claude François Milliet Dechales, de la Compagnie de Jesus (in the following *L'art de fortifier),* in Paris in 1677. However, Dechales had already written about fortifications. Specifically, he included the *Tractatus XIII - Architectura militaris* into another one of his works, the *Cursus seu mundus mathematicus*, the first edition of which was printed in Lyon and is dated 1674.

This research compares the three treatises, including in visual form through synoptic charts, to highlight recurrences, variants, and possible derivations between the themes treated by the two treatisers.

2. Guarini and Dechales' lives and theoretical works

As mentioned above, Guarini and Dechales shared a deep interest in mathematics during the same historical period and cultural milieu for a specific period. Both lived, worked, and wrote their books in the second half of the 17th century, a period permeated by the so-called *esprit de géométrie*, fueled by discoveries and studies in mathematics, particularly in pure geometry. Indeed, geometry established a leading position within the philosophical method through the theories of Galileo, Bacon, Descartes, and Desargues.

The shared interest in Euclid's work was reflected in Dechales's Latin volume of 1660, translated into French in 1672 and then reprinted and translated numerous times into English and Italian, testifying to the interest in and dissemination of the work, and in Guarini's Latin volume of 1671, which opened the way to the theory of the method of double orthographic projections (Bianchini, 2008) which, as we shall see, characterized the organization of the contents of some of his treatises. Guarini lived and worked in numerous cities, including, in chronological order, Messina, Modena, Parma, Guastalla, Paris, and finally Turin. Besides mathematics, he dealt with philosophy, astronomy, and mainly with architecture as a theorist and designer of numerous works recognized as Baroque masterpieces. In addition to those already mentioned, several treatises resulted from his intense theoretical and didactic activity. Among these we can mention: *Placita philosophica* (1665), *Modo di misurare le fabriche* (1674), *Compendio della sfera celeste* (1675), *Leges temporum et planetarum* (1678).

Dechales mainly devoted himself to teaching: he was a professor of hydrography, navigation, military engineering, philosophy, mathematics, and theology, in Marseille, Lyon, and finally Turin. Among his other writings, we can mention the *Art de naviguer* (1677).

Guarini's stay in Turin is documented from 1666, when the Theatines called him to renovate the church of San Lorenzo, and he soon held many assignments from the court of Savoy until he died in 1683. No information has been found regarding the date of Dechales' move from Marseille to Turin, but, as will be seen in the following paragraph, he probably met Guarini in Turin in 1674 (Roero, 2009). Other meetings between the two, in Turin and Milan, have been reported (McQuillan, 2014).

As religious figures, both dealt with the subject of fortifications without having direct experience as men-at-arms, as they pointed out in their respective texts, in which they referred to contemporary fortification techniques in the international context, sometimes including their own personal solutions.

3. Guarini and Dechales' scientific links: critics' contributions

Two scholars, in particular, have linked the theoretical contributions of Guarini and Dechales. Roero (2009) observed that the *Cursus seu Mundus Mathematicus* by Dechales was cited by Guarini in the *Architettura civile* (Guarini, 1737). Moreover, she affirmed that Guarini and Dechales probably met in Torino in 1674, when Dechales gave a scholarly lecture in the aula magna of the Jesuit College. (Roero, 2009).

McQuillan (2014), in an article dedicated to Guarini's *Trattato di fortificatione*, recalled that the Theatine's stay in Paris coincided with that of the greatest military architect of the day, Sebastian le Prestre de Vauban.

He went on to emphasize the didactic purpose of Guarini's work, which, in his opinion, is demonstrated by the choice to preface it with two preludes, dedicated to the basic principles of geometry and arithmetic before arriving at military architecture.

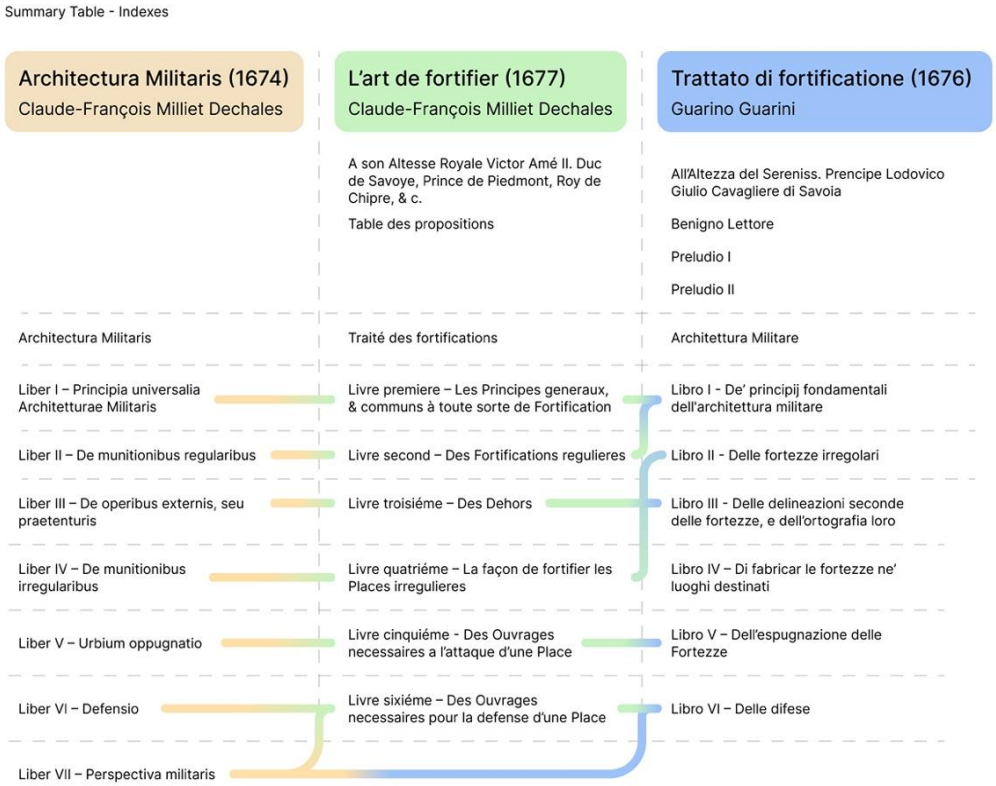


Fig. 1- Synoptic chart representing the treatises' indexes and their contents' relation (editing by Martina Rinascimento)

Furthermore, he observed that "this is very typical of Guarini's methodical approach to any subject, as he was a trained philosopher in Second Scholastic as well as in mathematics". He then examined and compared the indices of Guarini's text with Dechales' Architectura militaris, noting similarities in the structure of the six and seven books, respectively, and differences in the placement of content in books II, III, and IV.

Finally, he stated that Guarini met with Dechales on several occasions and that the Theatine had taken up the *Tractatus XIII*, presenting military architecture in the *Trattato di Fortificatione*, and concluded that "there is little doubt that both authors were working in parallel to some extent". The analysis carried out in this paper, including three synoptic charts, highlighting similarities in definitions and differences in the methodological approach to the subject of fortifications. This study follows the comparative analyses carried out as part of the aforementioned Infortreat project, particularly about the topic of irregular fortifications between the 16th and 17th centuries (Bevilacqua et al., 2025) and previous investigations into the geometric constructions of the profiling in Guarini's treatise (Spallone 2015, 2017, 2024).

4. Visual synoptic charts for contents comparison

The decision to create synoptic charts as a tool for comparison and data visualization made it possible to represent the results of the analysis of the three previously mentioned treatises in a clear and easily understandable visual form. As an outcome of this analysis, three synoptic charts were developed to compare specific aspects, namely: the indexes and the sequence of contents in the treatises; the definitions of the terms *Architettura Militare*, military architecture, and *Fortificazione Regolare*, regular fortification; and finally, the drawings produced by the authors to illustrate the defining elements of regular fortified structures.



Fig. 2- Synoptic chart comparing the definitions of terms such as military architecture and regular fortifications in the three selected treatises (editing by Martina Rinascimento)

In detail, the first synoptic chart retraces the indexes of the treatises and, through connectors, shows how and in what sequence the same topics are addressed in the three documents.

The second synoptic chart focuses on the different definitions provided by the authors for the aforementioned terms. The original manuscript definitions were displayed by inserting the manuscripts'scans and photographs, in order to demonstrate their authenticity.

The third synoptic chart compares the schematic drawings of fortified structures and the possible combinations of architectural elements used to generate more or less complex configurations. Drawing on the original illustrations contained in the treatises, these were aligned along their ground-plan axes to facilitate reading and comparison.

In conclusion, the chosen and carefully designed visualization tool also offers the additional advantage of being adaptable and scalable to the many other treatises selected and analyzed within the framework of the Infortreat project, of which this contribution is part. It thus constitutes a highly useful and modular methodology for the representation, analysis, and technical dissemination of the literature on fortifications.

5. Guarini and Dechales' treatises on fortification

A comparison between Guarini's and Dechales' treatises reveals the primogeniture of the *Architectura militaris* di Dechales in relation to *L'art de fortifier* by the same author and the *Trattato di fortificatione* by Guarini. This observation inspired the order in which the

contents of the three texts will be examined (Fig. 1).

The *Architectura militaris*, as said, is the *Tractatus XIII* in the three-volume encyclopaedia *Cursus seu mundus mathematicus* (1 ed. Lyon, 1674). The entire work is in Latin, as was required for disciplines belonging to the field of 'artes liberales', has in-folio format [36,1x22,5] cm., and woodcut diagrams and schematic illustrations inserted in the text. The *Tractatus XIII* consists of 159 pages and is divided into seven books. In sequence, it deals with the general principles of military architecture (Book I), regular fortifications (Book II), external works (Book III), irregular fortifications (Book IV), attack (Book V), defense (Book VI), and military perspective (Book VII).

L'Art de fortifier (1^ ed. Paris, 1677), in French, is composed of 405 pages in duodecimo [9,5x15,5] cm, and is enriched by 68 full-page plates, made using chalcography and inserted into the text. The imprimatur is dated September 1, 1676. The text is preceded by a dedication to Victor Amadeus II, Duke of Savoy, and is divided into six books whose titles mirror those of *Architectura militaris*. The sixth book covers military strategy.

The *Trattato di fortificatione* (Turin, 1676) is written in Italian, consists of 128 pages in octavo [10.2x18.1] cm, and features 12 woodcut plates at the end. The imprimatur is dated April 13, 1677. The volume is dedicated to Lodovico Giulio, Prince of Carignano, a distant relative of the Duke of Savoy and Prince of Piedmont, Carlo Emanuele II, and a pupil of Guarini. A dedication to readers follows this. Two preludes, dedicated to plane geometry and arithmetic principles, precede the discussion of military architecture. Military architecture is divided into six books devoted to fundamental principles, which include the description of regular fortifications (Bk. I), irregular fortifications (Bk. II), the complete definition of the plan profiles of fortifications, including external works and related elevations (Bk. III), the construction of fortifications in particular places (Bk. IV), attack (Bk. V), and defense (Bk. VI). The last book also contains instructions on military perspective drawing and the coloring of drawings.

A comparison between the indices reveals the natural derivation of Dechales' subsequent treatise from *Architectura militaris*, due in part to the fact that only three years separate the two works and to the aforementioned correspondence between the themes of some of the books in Guarini's work (McQuillan, 2014). An in-depth analysis of the texts reveals that, compared to the *Tractatus* of 1674, in 1677 Dechales reorganized and systematized the contents by moving some paragraphs and enriching the iconographic apparatus, both from the point of view of printing technique and by using chalcography instead of woodcut, allowing the transition from line drawings to more detailed iconographic representations, especially in military perspectives, enriched with hatching shadows. In addition, the 1677 volume included plans of fortified sites taken as examples of the cases discussed.

Guarini's treatise, beyond the obvious correspondence of general definitions (Fig. 2) and the organization into books, shows differences in content choices, in solutions to the problems of bastion construction (Bevilacqua et al., 2025), and even, as can be seen from the extended title, in the choice to exclude Spanish examples from the discussion.

The different order of content in Guarini is linked to his particular approach, also present in the *Architettura civile* (posthumous, 1737), according to which construction topics are addressed through the sequence between iconography (the plan) and orthography (the elevation and section). For this reason, only in Book III, after completing the descriptions of the geometric constructions of regular and irregular fortifications and their external works, does he devote himself to the description of the vertical sections that define the three-dimensionality and matericity of fortified works (Spallone & Vitali, 2023). Unlike Dechales, Guarini uses the propaedeutics of preludes, as he did in *Modo di misurare le fabriche* (1674), with an obvious didactic purpose, while minimizing the use of tables, which were common in 17th-century treatises and widely used in Dechales' works, to spare military engineers the calculation of lengths and angles of polygonal fortification elements with different numbers of sides. Furthermore, Guarini includes a series of personal tracing methods, although he states that he would not discuss his own inventions in the introduction.



Fig. 3- Synoptic chart focusing on schematic drawings of fortified structures and the possible combinations of architectural elements (editing by Martina Rinascimento)

Dechales makes explicit references to the methods of Pagan, whom he holds in high regard, dedicating entire paragraphs to them, as well as those of Goldman, Dögen, Marolois, and Errard. At the same time, Guarini refers to the methods of Goldmann, Pagan, Dögen, and Fritach.

Among the shared features of the three texts, it is worth noting the discussion of irregular fortifications, which reveals the treatise writers' new interest in modifying pre-existing fortifications, made necessary by the invention of gunpowder, and the application of the second flank, which consists of a portion of curtain wall between the razant and the fichant line of defense, dedicated to soldiers armed with muskets.

Finally, the two authors fully adhere to the new dictates that inspired the fortification of the early modern age, intended as a geometric system, where altering one element affected the entirety (Fara 1989). As will be seen in paragraph 6, Guarini applies this principle from the very definition of the elements of the regular fortress. A different approach to geometric tracing emerges from the authors: Dechales uses sequences of geometric constructions to define the different bastion systems. In contrast, Guarini uses them to relate the other elements of the fortress to respond to new methods of war.

6. The regular fortresses

The discussion of regular fortifications in all three books begins with a general definition of a work having equal sides and angles. It continues with a description of the elements by lines and angles. As will be seen, the elements described vary from work to work, as do the drawings accompanying the descriptions and the relationships between text and image. (Fig. 3).

In the *Architectura militaris,* the pentagon, hexagon, and square are mentioned as examples

of regular fortresses, and the elements described can apply to all of them. The schematic drawing shows a hexagonal fortification that references different layouts and elements of the work. In fact, the geometric construction of the bastion with a second flank is built on the MN side of the inner polygon. At the same time, the HIT demi-bastion is set on the HN demi-gorge, which appears to be equal to 1/5 of the side of the hexagon, while the angle at the vertex is 90°, as is typical in French bastions. Similarly, the razant line starts from 3/5 of the side, leaving 1/3 of the curtain to the second flank GH. In contrast, due to different proportions between the elements, the adjacent horizontal side has no second flank, since the razant and the fichant lines hit the same points E and F. The XQV semi-bastion has a shoulder and a squared oreillon, while the TRSV bastion has a round oreillon. External works include the XYZ ravelin, the 5 6 7 8 horned work flanked by half-moons, the 9 10 11 crowned work, and the 12 13 14 15 tenaille.

In the *L'Art de fortifier,* the definition of regular fortification is expanded to include figures with three to twelve sides, and the description begins with curtains and bastions, defined as the ordinary elements of modern fortification. This introduction is accompanied by two figures on plate 1, representing details of the fortified square and the bastion with round oreillons visualized from a military perspective. Figure 1 appears to be a partial 3D implementation of the geometric construction of the bastions present in the *Architectura militaris* scheme, and focuses on the presence or absence of the second flank by highlighting the razant line of defense that strikes the curtain CD near C, giving rise to the second flank. At the same time, it is absent concerning the bastion CGFEH. Table 2 shows the plan of the entire regular fortress and is comparable to the above scheme from *Architectura militaris*. Still, it takes on an exclusively typological meaning concerning the different elements, as the geometric constructions of the elements represented, although described in the text, are missing.

In the *Trattato di fortificatione*, the description of the regular fortress and its elements closely connects with figure 1 in table 1 of the book, which, as Guarini points out, takes the regular pentagon as its basic shape. The line drawing represents only the pentagonal fortress, i.e., the first delineation, through icnography. The geometric reconstruction carried out in previous research (Spallone, 2015) highlighted the morphological and metric relationship between all the elements of the fortress, which appear to be generated by consecutive and concatenated geometric constructions typical of Guarini's design method (Millon, 1970; Portoghesi, 1970) and typical of modern fortifications, understood as a system (Fara, 1989). Some dimensional and proportional data provided by Guarini in the text, such as the maximum line of defense, which must be between 750 and 850 geometric feet (equal to the musket shot), the fichant line, which must not be greater than the shot of a musket, the curtain, which must be between 500 and 300 feet, resulting in a bastion face of approximately 240 feet, the flank, which must measure between 1/3 and ½ of the face, and the semi-gorge between 1/3 and ½ of the face, made it possible to verify the plausibility of the reconstruction hypotheses (Spallone, 2017). Therefore, in Guarini's system, each element is dependent on the previous one through a geometric logic that, in the deconstruction of Guarini's scheme, follows the same sequence in the text.

7. Conclusions

A comparative analysis of the three treatises, based on the hypotheses of derivation and links highlighted by critics, has revealed complex relationships between the three works.Dechales's French-language treatise on the art of fortification, written just three years after the publication of *Cursus seu mundus mathematicus*, is not a mere translation, nor is it simply a reorganization of the contents.

The iconographic apparatus, of higher quality thanks to the technique of chalcography, allows the work to be configured as a new edition in terms of content and images. Guarini's work, despite explicit references, especially in the organization of the text and definitions, proves to be largely original in terms of methodology, revealing profound connections with the other theoretical works of the Theatine.

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