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Building Knowledge to Fortify City and Soul

By

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Master of Arts

Art History

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Building Knowledge to Fortify City and Soul

By

Laura Maria Somenzi

B.A., Johns Hopkins, 2013

Advisor: C. Jean Campbell, Ph.D.

An abstract of

A thesis submitted to the Faculty of the

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2016

Abstract

Building Knowledge to Fortify City and Soul

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Laura Maria Somenzi

Between 1475 and 1490, the Sienese polymath, Francesco di Giorgio (1439-1501), composed two treatises on the art of architecture and engineering, now known as the Trattati di architettura ingegneria e arte militare. This paper considers two manuscript copies of Francesco's first treatise, codices Saluzzo 148 (c. 1482-1486) and Ashburnham 361(c. 1480-1482). The pages of the Saluzzo and Ashburnham codices combine machines, tools, building schemes, architectural elements, small topographic portraits of buildings in landscapes, and human bodies, which are alternately analogized to church and city plans or divided into units of measurement, in a building project the character and goals of which demand careful analysis. By addressing the pictorial and textual material in the pages of Francesco's first treatise this paper aims to understand how Francesco, his scribes and illuminators, create a mechanism for accessing and transmitting knowledge for building and protecting city, church, and fortress and by analogy, body, soul, and intellect.

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Introduction

Between 1475 and 1490, the Sienese polymath, Francesco di Giorgio (1439-1501), composed two treatises on the art of architecture and engineering, now known as the *Trattati di architettura ingegneria e arte militare.*[1] Scholars today divide the work into a first and second treatise, which were completed about a decade apart.[2] Although no holograph manuscript survives, most scholars agree that Francesco actively participated in the production of the four main manuscript copies.[3] The manuscript copies of Francesco's first treatise, codices Saluzzo 148 (c. 1482-1486) and Ashburnham 361(c. 1480-1482), are distinguishable from those of the second treatise in the way that they foreground the interrelationship of drawing and writing. Both manuscripts were produced

[1] The first instance in which treatise, or *trattato,* was used as a title appears in the 1540 copy Codex Saluzzo 158, Biblioteca Reale, Turin. See Gustina Scaglia, *Francesco Di Giorgio: Checklist and History of Manuscripts and Drawings in Autographs and Copies from ca. 1470 to 1687 and Renewed Copies (1764-1839)* (London: Associated University Presses, 1992), 192-195. Carlo Promis gave Francesco's manuscripts the full title: *Trattato di architettura e arte militare* in 1841. See Carlo Promis, *Vita di Francesco di Giorgio Martini architetto senese del secolo XV: aggiuntovi il catalogo de'codici* (Torino: Chirio et Mina, 1841).

[2] Although the first and the second treatises deal with similar subject matter, they differ in the manner in which the material is presented. The first is closer to an earlier tradition of technical treatises in which knowledge is more firmly grounded in practice, whereas the second is more philosophically erudite in the tradition of courtly literature. In this paper, I will refer to the specific translations of Francesco's *Trattati*: the Saluzzo and Ashburnham codices. On the distinction between the two treatises, see Pamela Long, *Artisan/practitioners and the Rise of the New Sciences, 1400-1600,* (Corvallis, OR: Oregon University Press, 2011), 41-47. For Long, the differences between the first and second treatises are evidence of a shift in technical knowledge from a practice to a learned tradition. For a discussion of courtly etiquette and the *Trattati,* see Jessica Wolfe, *Humanism, Machinery, and Renaissance Literature* (Cambridge; New York: Cambridge University Press, 2004).

[3] For the attribution of drawings in Codex Saluzzo148 to Francesco, see Mario Salmi, *Disegni di Francesco di Giorgio nella collezione Chigi Saracini* (Siena: Ticci, 1947).

by artist-scribes in monastic scriptoria and their production was likely overseen by Francesco, and both are explicitly in dialogue with earlier books of mechanical and technical nature such as Vitruvius' *De architectura* (c. 1st CE), two treatises by Mariano di Jacopo called "il Taccola," *De ingeneis* (c. 1433) and *De machinis* (c. 1449), Roberto Valturio's *De re militari* (1472), and Francesco's own *Codicetto* (c. 1470) and *Opusculum* (c. 1470-75). A given page in the Saluzzo and Ashburnham codices comprises two neatly delineated columns of cursive script with ink and wash drawings that fill the margins, overlap the text, or go in between paragraphs. Many of the drawings have annotations that are either overlaid on the image or follow the line contours. At times, text and images are aligned so that, for example, the sketch of a geometrical shape is continuous with a line of text that discusses that particular form (figure 1). At other times, the assembly of parts is more spread out. For example, a close-up of an assault machine is shown on one page and then placed within a larger context of use on the following page (figures 2 and 3). The pages of the Saluzzo and Ashburnham codices combine machines, tools, building schemes, architectural elements, small topographic portraits of buildings in landscapes (figure 4), and human bodies, which are alternately analogized to church and city plans or divided into units of measurement (figure 5-7), in a building project the character and goals of which demand careful analysis.

By addressing the pictorial and textual material in the pages of Francesco's first treatise this paper aims to understand how Francesco, his scribes and illuminators, create a mechanism for accessing and transmitting knowledge for building and protecting city, church, and fortress and by analogy, body, soul, and intellect. As I hope to show, Francesco assigns an important role to the drawing hand as a means for developing and

transmitting to others the ability to care for the health of the city and by analogy, the self. The hand is important in this regard because it provides the physical link between drawing and the healthy body. In the pages of the Saluzzo and Ashburnham codices, Francesco, his scribes and illuminators actively develop the claim that to draw is both to understand what it means to be human and to understand the world through the drawing hand.[4] In light of the artisanal epistemologies that have been described by scholars like Pamela Long and William Eamon, my contention is that the Saluzzo and Ashburnham codices teach one how to assemble the necessary components to build and properly fortify a healthy city, and by analogy, how to build a healthy body and fortify the soul.

The initial pages in codices Saluzzo and Ashburnham provide what can be read as a distillation of Francesco's salient preoccupations in his work. In the lower right margin of the first folio is the drawing of a city plan made into the body of a male figure: his abdomen is delineated by a circle indicating the central piazza from which a church extends vertically between the breasts, the elbows hook in and around loops labeled as towers, and the hands reach up towards the head to hold a fortress in place (figure 8). A few pages later Francesco elaborates on the analogy of the body to the building of a city as he explains:

> Adunque è da considerare come el corpo ha tutte le partizioni e membri con perfetta misura e circunferenzia, el medesimo nelle città e altri difizi osservar si debba...e così gli occhi, urecchi, naso e bocca, le vene intestina e l'altre interiora e membra che dentro e introno al corpo organizzati a la necessità e bisogno d'esso, così nelle città osservar si debba.

[4] This study of the *Trattati* is situated in a line of thinking about manuscript production that considers the manner in which the workings of the hand, by the act of drawing, are potentially knowledge-producing. In the catalog for the exhibition on Medieval drawing held at the Metropolitan Museum in 2009, Melanie Holcomb writes that "to draw, it would seem, is to be human." Melanie Holcomb and Lisa Bessette, *Pen and Parchment: Drawing in the Middle Ages*, (New York: Metropolitan Museum of Art), 2009.

> Therefore, one should take into consideration how, just as the body's parts and members have perfect measure and circumference, so should cities and other buildings...and thus the eyes, ears, nose, and mouth, the veins, entrails, and other organs and members that are organized inside and around the body according to its necessities and needs, so it should be done in the city.[5]

As articulated in drawing and text, the analogy of the body to the city is more than a system of ideal proportions. If it were only a question of form, the drawing could articulate ideal proportion more clearly without the tower held over the man's head and the superimposed church between his breasts. Francesco would also not need to concern himself with the body's internal organs and their functions. What is at stake for Francesco in constructing an analogy between body, church, and fortress that requires him to pay heed to both the body's exterior and interior organs?

For the Saluzzo and Ashburnham codices, the 'author' can be understood as a broad category that includes Francesco, his scribes and his illuminators. Within the parameters of scriptorial practices, authorship and readership are closely bound together. Both the practices of production and those of reception involve manual interventions on the pages of the manuscript. As a scribe copies a manuscript, he acts as both its reader and as its maker. The focus of this study will be on the process of copying as a way of gaining and transmitting knowledge, so that the "audience" for the *Trattati* is here defined as those who actively engage with the manuscripts to transcribe and translate meaning. For Francesco, the process of making provides a structure that allows the reader-copyist to directly engage with the interplay between manual work and the development of intellectual and spiritual *discrezione,* a faculty of judgement and an exercise of free will that guides one in distinguishing between discrete entities and

[5] Codex Saluzzo 148, f. 6v, Biblioteca Reale, Turin. My translation.

situations.[6] The faculty of *discrezione* is important insofar as I aim to show that the manuscripts demonstrate a practice that relies on the connection of intellect and drawing hand not only to assemble technical knowledge, but to perform the assemblage of church, body, and fortress. Woven through the drawings and inventions, machines, and buildings that make up Francesco's treatises—and give access to knowledge about human creation—is the suggestion that one might gain access to knowledge of God's creation.[7]

Francesco's goal of building a Christian body in accordance with the architect's good judgement, or *discrezione*, is all the more evident when compared to similar contemporary projects. About two decades before Francesco began compiling his treatise, Leon Battista Alberti wrote *De architectura* (1443-52), which sought to make Vitruvius anew. Francesco's translation of Vitruvius, however, is decidedly different from Alberti's version. Whereas Alberti is interested in an abstract, theoretical understanding of architecture, Francesco's project "translates" Vitruvius through an artisanal epistemology and into a Christian framework. This is why Francesco's analogy of the body to architecture often looks nothing like Vitruvius. In updating the classical, pagan source, I argue that Francesco inscribes the analogy of the body to architecture within a Christian context.[8]

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[6] I here wish to use *discrezione* as it relates to medieval scholastic discourse. *Discrezione* derives from the Latin, *discretio*, meaning division and separation. *Discrezione* is defined by the *Vocabolario Treccani* as: "Facoltà, potere di discernere, come norma del giudicare e del volere; Arbitrio, potere, libero volere; divisione, distinzione." For example, Dante, in the *Convivio* writes: "*lo più bello ramo che de la radice razionale consurga si è la discrezione." Dante claims his authority on the definition of discrezione from Thomas Aquinas: "Ché si come dice Tommaso sopra lo prologo dell'Etica, 'conoscere l'ordine d'una cosa ad altra è proprio atto di ragione,' ed è questa discrezione." Dante Alighieri, Convivio, ed. Ageno Brambilla, (Firenze: Casa Editrice, Le Lettere, 1995), IV, viii.*

[7] On Francesco di Giorgio's adherence to a scholastic tradition in the analogy between artistic creation and divine creation, see Lawrence Lowic, "The Meaning and Significance of the Human Analogy in Francesco Di Giorgio's Trattato," *Journal of the Society of Architectural Historians* 42 (1983): 360–70.

[8] For a relevant history of the analogy of body and building, see Lowic, "The Meaning and Significance of the Human Analogy in Francesco Di Giorgio's Trattato," 364.

Whereas earlier literature focused on Francesco's misunderstanding of Vitruvius, and conversely, on Francesco's personal and unlimited power of invention,[9] more recently, scholars such as Pamela Long, Alina Payne, and Parī Riyāḥī, Gustina Scaglia, have fruitfully redefined Francesco's relationship to his sources as one that shows evidence of a working process of invention.[10] Their contributions lay the foundations for thinking about the related question of drawing and the transmission of knowledge in Francesco's *Trattati*. Scaglia's extensive catalog of copies of Francesco's work is crucial for understanding the activity of copying in the process of reception. Payne's chapter on Francesco di Giorgio, which is mostly concerned with the use of Vitruvius in Francesco's architectural theory, signals the importance of a poetic reading of the treatise.[11] Parī Riyāḥī's claim that, for Francesco, drawing works like a mechanism that activates the imagination of the reader by focusing attention on the process of making is here particularly relevant.[12] Finally, this study follows the thematic lead of Pamela Long's work on practical knowledge and its representation in technical treatises.[13] For Long, the

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[9] For Francesco's frequent "misreading" of Vitruvius, see Corrado Maltese, Introduction to *Trattati di architettura, ingegneria e arte militare*, transcribed by Livia Maltese DeGrassi, (Milan: Il Polifilo, 1967). On the concept of invention in the *Trattati,* see Martin Kemp, "From 'Mimesis' to 'Fantasia': The Quattrocento Vocabulary of Creation, Inspiration and Genius in the Visual Arts," *Viator* 8 (1977): 347–98.

[10] Long, *Artisan/practitioners and the Rise of the New Sciences*; Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of knowledge from Antiquity to the Renaissance*, (Baltimore: Johns Hopkins University Press, 2001); Long, "Picturing the Machine: Francesco di Giorgio and Leonardo da Vinci in the 1490s," in *Picturing Machines: 1400-1700*, ed. Wolfgang Lefèvre, (Cambridge: MIT Press, 2004), 117-141; Alina Payne, *The Architectural Treatise in the Italian Renaissance: Architectural Invention, Ornament, and Literary Culture*, (Cambridge: Cambridge University Press, 1999); Parī Riyāḥī, *Ars et Ingenium: The Embodiment of Imagination in Francesco Di Giorgio Martini's Drawings*, (New York: Routledge), 2015; Gustina Scaglia, *Francesco di Giorgio: Checklist*.

[11] In Francesco's pictorial understanding of invention, Payne sees a nod to "the relevance and potential usefulness of poetic theory to the discourse of architecture." Payne, *The Architectural Treatise in the Italian Renaissance*, 100. This study pushes further the possibility of a poetic reading of Francesco's inventions.

[12] Parī Riyāḥī, *Ars et Ingenium*, 23.

[13] Long, *Artisan/practitioners and the Rise of the New Sciences*, 41-47.

first of Francesco's treatises bears out a connection between engineering, architecture, and drawing as artisanal practices in which knowledge can be accessed and generated.[14] To the connection between artisanal practice and knowledge, I would like to add that the *Trattati* perform an assembly of knowledge in the form of a Christian allegory.

Scholars such as Karl Whittington, in his work on the mapmaker Opicinus de Canistris, have shown how knowledge is produced and transmitted in artisanal practice and how drawing serves to visualize possible meanings.[15] Empirical and scientific knowledge, according to Whittington, are not to be divorced from allegorical truths. Insofar as Opicinus's manuscript on mapping can perform as a Christian allegory, it is useful for conceptualizing Francesco's manuscripts beyond a narrow definition of technical scientific studies to include an allegorical dimension.[16] As I hope to show through a careful examination of the Saluzzo and Ashburnham codices, Francesco's demonstration of process connects the making and meaning of manual work to sanctifying work.[17]

I shall first consider how Francesco, his scribes, and his copyists present drawing and writing as practices through which one may arrive at a given body of knowledge.

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[14] Long, "Picturing Machines," 116, 142.

[15] Karl Whittington, *Body-Worlds: Opicinus de Canistris and the Medieval Cartographic Imagination*, (Toronto: Pontifical Institute for Medieval studies, 2014). I would like to thank Beate Fricke for drawing my attention to this comparison.

[16] Ibid, 70.

[17] Artistic making as sanctifying work has a long-standing tradition in medieval books of the arts. Most notably, the twelfth century treatise *De diversis artibus*, by the German monk who signed under the name Theophilus (or God-lover), proposes artistic making as a spiritual labor. On Theophilus, see William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994). According to Eamon, 83-4, "Theophilus gave craftsmanship the highest sanction medieval culture could give it: holiness." For the argument regarding making and meaning in the context of Cennino Cennini's *Libro dell'arte*, see C. Jean Campbell, *The Commonwealth of Nature: Art and Poetic Community in the Age of Dante* (University Park, PA: Pennsylvania State University Press, 2008), 80.

This portion of the paper will scrutinize the practices of copying and assemblage evident in the Saluzzo and Ashburnham codices. Next, I shall consider the importance assigned to visual knowledge in Francesco's manuscript and the stress he gives to making manifest, through writing and drawing, an otherwise invisible process that takes place in the mind of the architect. Finally, I will make the case that an inverse process—one that moves from visible knowledge to access invisible truths—is an integral part of Francesco's project.

Copying and Translation

Given the intention of this study to consider practices of copying and translation in the Saluzzo and Ashburnham codices as working models for transmitting both technical knowledge and Knowledge as it pertains to spiritual truths, a good place to begin is by tracing the accumulative process of creation throughout Francesco's work in which copying served both as a source and a means to provide knowledge. Early in his career, Francesco frequented the University of Siena, known as the *Studio* or the *Sapientia*, and in that setting he likely came into contact with the work of Mariano di Jacopo or "il Taccola" (1381-c.1453) which he copied and studied.[18] It also is likely that Francesco provided illustrations for Taccola's manuscripts.[19] Taccola was the appointed Secretary for the *Studio,* and like Francesco, was a polymath with a wide range of contributions; he was regarded during his lifetime as the Sienese Archimedes.[20] Taccola

[18] While at the Sienese Studio, Francesco also completed the illuminations for a manuscript of Albertus Magnus, *De animalibus*, for his teacher, Sermoneta. Taccola had held the position of secretary at the Studio and remained there until 1453. His manuscripts were thereafter conserved in the Studio.

[19] For the attribution of several drawings in Taccola's Codex Monacensis 197 to Francesco, see Luigi Michelini Tocci, "Disegni e appunti autografi di Francesco di Giorgio in un codice del Taccola," *Scritti di storia dell'arte in onore di Mario Salmi, 2*, (Rome: De Luca, 1962), 203–12; Frank D. Prager and Gustina Scaglia, *Mariano Taccola and His Book De Ingeneis* (Cambridge: MIT Press, 1972), 12.

[20] Prager and Scaglia, *Mariano Taccola and His Book De Ingeneis*, 12.

is best known for his manuscripts, *De ingeneis* (c. 1433) and *De machinis* (c. 1449), which include annotated and illustrated technical inventions and fantastical machines.

Francesco's renderings of Taccola's technical drawings are preserved in his autograph notebooks: the *Opusculum de architectura* (c. 1470-5) and the so-called *Codicetto* (c. 1470).[21] Francesco's illustrations are similar in kind to Taccola's drawings of fortresses, mills, pistons, and chimneys. In the course of the various treatises, Francesco also reworks Taccola's techniques for siphoning, building, and finding water. Some of the drawings from the *Codicetto* and *Opusculum* reappear in the Saluzzo and Ashburnham codices. As the drawings pass from Taccola to Francesco's early drafts, and eventually to the treatises, they are modified and placed within different interpretive frameworks. The images are updated in the recombination of their elements and with the addition of new material.

The motif of the tower in the Saluzzo and Ashburnham codices is an example of how new meaning comes from copying and combining various elements, and of how transmission of knowledge is an integral part of novel creations. In Francesco's work, the tower is a recurring motif: how to protect, attack, or keep the tower afloat appears almost obsessively throughout. On folio 35r of the *Opusculum*, Francesco has drawn a hilltop tower for which the height of the building and slope of the hill are carefully measured using plumb lines and a quadrant (figure 9).[22] The *Opusculum* drawing synthesizes two different types of images that are found in Taccola's manuscripts. The first type describes

[21] Unlike the *Trattati*, the *Opusculum* and *Codicetto* consist primarily of drawings. The *Opusculum* does, however, bear a dedicatory inscription written in Latin by a scribe to Federico da Montefeltro. On the complete manuscript works by Francesco, see Scaglia, *Francesco Di Giorgio: Checklist*.

[22] Francesco di Giorgio, *Opusculum de architectura*, f.35r, British Museum.

how and with what tools underground tunnels in mountainous terrain are to be built. To this end, Francesco's drawing demonstrates the procedure and tools as they are drawn on folio 33r of Taccola's *De ingeneis,* which also explains how to build an underground gallery through a hill (figure 10).[23] The second type belongs to the realm of military strategies. On folio 48v of Taccola's *De machinis* is a similar image of a tower on a hillside that is shown crumbling, and is accompanied by written explanations for to how to build a mine beneath the enemy stronghold (figure 11).[24] The image itself does not show the underground ammunition or the tools needed to put it into practice. In the *Opusculum,* Francesco has assembled the tools for making the underground tunnels with the offensive military operation in what amounts to a composite image that brings together the different pieces of knowledge needed to put this strategy into action. In Francesco's *Opusculum* drawing, the tools that measure the hillside to make underground tunnels are married with the final product: nestled inside the hill, and directly under the tower, one finds a barrel of explosives and a fuse ready to set off the ammunition. The fortress above the hill already shows signs of cracking.

Further evidence for how Francesco compiles various images from Taccola into one image can be gleamed from the various drawings on folio 35r of the *Opusculum* in relation to Taccola's manuscripts. In the *Opusculum* folio, Francesco has drawn two *gatti* (large assault machines) and a shield carrying spears in the space above the fortress. Each individual element—the tower, the shield, and the *gatti*—is taken from a different sheet in

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[23] Taccola, *De ingeneis,* Ms. Palatino 766, f.33r, Biblioteca Nazionale Centrale, Florence. See Paolo Galluzzi, *Prima di Leonardo: Cultura delle macchine a Siena* (Milan: Electa, 1991), 277. The system of measurement illustrated by Taccola would have been familiar to Francesco as it was a used for Siena's underground system of canals, the *bottini.* Francesco, in turn, had also been *mastro bottini.*

[24] Taccola, *De machinis,* Codex Monacensis 28800, fol. 48v, Bayerische Staatsbibliothek, Munich. See Galluzzi, *Prima di Leonardo,* 364.

Taccola's manuscripts (figure 12). The drawing of the shield can be found in Taccola's, *De ingeneis,* Codex Monacensis 197, on folio 86v, and the drawing of the assault machines appears on folio 86r as well as on folio 97 of the same manuscript. The drawings are then reconfigured by Francesco onto one folio of the *Opusculum* as part of a new image (figure 13).[25]

Now turning to the Saluzzo codex, on folio 55v there is a similar rendition of the motif of the mine buried under a cracking tower. The drawing in the Saluzzo codex of the mine buried under the cracking tower shows how Francesco glosses the motif in order to both transmit it and to insert it into a new context (figure 14). The cracking tower in the Saluzzo codex is a synthesis of Taccola's drawings in *De ingeneis* and *De machinis,* and Francesco's own drawings in the *Opusculum.* In the Saluzzo codex, however, the cracked tower is part of an unfolding narrative. The commentary adjacent to the image (linked to it by a pointing finger) explains how to make ammunition and recounts a recent event in which a castle in the city of Ragusa caught fire from gunpowder stored underground. Francesco claims that once one has this foresight—that is, first how to make ammunition and second, that storing ammunition under a tower can cause it to fall—it may be used to defeat one's enemies. Taccola's more generic propositions for building an underground tunnel and of placing mine under a tower as an assault tactic are translated by Francesco into a specific narrative of contemporary events.

Placed within a contemporary narrative, namely the explosion at Ragusa, the cracking tower in the Saluzzo codex has a more immediate relevance to its time. The

[25] Francesco di Giorgio, Opusculum de architectura, f.35r, British Museum and Codex Monacensis 197, f. 86v, Bayerische Staatsbibliothek, Munich. The *gatto* was used as a mobile shelter to approach enemy defenses. On the *gatto* see Galuzzi, *Prima di Leonardo*, 460.

meaning of the tower and explosives has been enriched since its formulation in Taccola's manuscript as the context in the *Trattati* has shifted to include a narrative dimension that becomes legible through the assemblage of text and image. Francesco's version of the tower is linked to a particular event and therefore it concretizes the possibility of replicating the explosion in the near future. The knowledge Francesco found in Taccola, once recovered and transposed, continues to be relevant for contemporary readers. What is consistent, however, in Taccola and Francesco's different versions of the cracking tower is the activation of a process of assembling text, image, and outside experiences in order to understand the greater significance of the motif of the cracking tower. In this sense, neither text nor image is complete. All parts on the page—from the description of how to make ammunition to the image of the ammunition buried under the tower—must be put together if one wishes to learn how to make use of this particular assault strategy.

The connection between copying and invention inevitably poses the question of boundaries between the two and raises the issue of novelty. The authors of Francesco's time were aware of the problems related to novelty and addressed them in their writings. For example, Taccola cited Brunelleschi's warning against plagiarism and Francesco echoes the sentiment in his treatise.[26] Francesco writes:

> E di qui nasce la diversità e novità delle cose, donde l'ingegno assottigliando e investigando viene per volere a sé fama e laude attribuire. E certissimo non con piccola fadiga alcuna invenzione, subito a quella apricando, nove cose aggiogne. Ma sono stati molti sconoscenti e ingrati i quali dagli antichi o da altri furando a sé hanno attribuito.

[26] Taccola writes: "Do not share your inventions with many, share them only with the few who understand and love the sciences. To disclose too much of one's inventions and achievements is one and the same thing as to give up the fruit of one's ingenuity...They boldly call themselves the inventors of the things that they first condemned, and attribute the glory of another to themselves." Taccola, *De ingeneis,* Codex Monacensis, f.108v, Bayerische Staatsbibliothek, Munich. See Frank D. Prager, "A Manuscript of Taccola, Quoting Brunelleschi, on Problems of Inventors and Builders," *American Philosophical Society* 112 (1968): 141.

> And from this the diversity and novelty of things is born, where the intellect refines and investigates, desiring fame and praise for itself. And surely with no small effort, invention applied arrives at new things. But there have been many who, being unappreciative and ungrateful, have attributed to themselves what they stole from the ancients or from others.[27]

For William Eamon, whose interest lies in the evolution of secrecy in craft production, these complaints about plagiarism show a conception of technical knowledge as "intellectual property," a concept that was beginning to be defended by property laws in the fifteenth century.[28] Yet there are other ways of thinking about the advertisement of novelty. In addition to reflecting economic concerns and a shifting conception of technical knowledge as capital, the rhetorical function of Francesco's statement is to articulate the boundary between mere copying and invention as a fruit of copying.

On folio 16 of the Saluzzo codex, Francesco elaborates the distinction between his inventions and things that are the products of duplication: "But even I have striven to draw from the water of their springs, and according to the quality of my small intellect, have explained these precepts," (*Ma pure mi so' ingegnato cercare attegnare acqua dalle fonti loro, e sicondo la qualità del mio piccolo ingegno ho isposto questi precetti*.)[29] Francesco refers to the ancients in the process of invention, yet the important difference between himself and those whom he calls ungrateful thieves, is that Francesco has made great efforts to acquire and elaborate his material. Francesco has made it his own by nature of the work and toil involved in its reimagining. The effort that invention necessitates is described by Francesco as a physical exertion. The drawings he has

[27] Codex Saluzzo 148, f.14, Biblioteca Reale, Turin. My translation.
[28] William Eamon, *Science and the Secrets of Nature*, 89.
[29] Codex Saluzzo 148, f. 14, Biblioteca Reale, Turin.

accumulated over the years through the practice of copying are presented as the material he has made his own, and this material further serves as an enticement to continue the process of learning and transmission.[30]

It is true that the cracked tower was copied from one source to another, but copying must here be understood as a creative process akin to a translation that, in addition to linguistic transposition, encompasses cognitive and poetic relocation. Far from mindless activity, copying is a manual labor that provides access to knowledge. In the most literal sense, Francesco has extracted Taccola's drawing of a collapsing tower over a mine and transposed it into his treatise. Yet translation also operates in other ways. For instance, Francesco's drawing differs from Taccola's in that he shows the explosives stored underground, those which cause the tower to crack and fall, whereas Taccola's drawing only alludes to what is inside the mountain without showing it. In other words, Francesco takes what is invisible—such as ammunition buried inside a mountain—and makes it visible. In this case, we can see translation as the possibility that drawing might render something invisible, manifest.[31] Francesco's translation gives visible form to the knowledge about the hidden ammunition which was still invisible in Taccola's version. The drawing of the cracking tower can be taken as a metaphor for Francesco's larger project of translation in that drawing can show how knowledge is acquired and gives access to truths that are otherwise hidden from sight.[32]

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[30] I build here on insights gathered from C. Jean Campbell, "'Scio quid facio': Imitative Practice, Knowledge and Society in the Early Renaissance," lecture presented at Emory University, 2/3/2014. Campbell presented an argument for Taccola and Pisanello in which drawing serves as a constant activity that shapes the human subject.

[31] The practice of drawing, or *disegno* (the Italian word for drawing) is understood in the fifteenth century as a mechanical practice through which one comes to understand the world, rather than the sixteenth-century concept of *disegno* as theoretical design.

[32] For a related argument on copying and translation, see Harold John Cook and Sven Dupré, *Translating*

Embodied Knowledge

The possibility of transmitting invisible knowledge by giving it visible form is further troped throughout the treatises and shows how the mind's eye may be trained to supplement physical sight. Consider the way in which Francesco treats the question of how one can build over or in bodies of water. Francesco writes that in some cases, one does not know how deep the water will be, nor what the soil will be like at the bottom. Yet, even when these elements cannot be seen, techniques may be adduced to approximate a measurement in order to continue building. One of Francesco's proposals for erecting a tower on an underwater cliff includes a naval device that will lower a building platform into the water and onto a cliff.[33] The drawing at the bottom right of folio 10 of the Saluzzo codex shows the floating device above water as it hovers over the cliff. Soon, as indicated by the caption—which reads, "to lower into the sea," (*d'affondare in mare*)–the central platform will disappear underwater (figure 15).[34]

Francesco's early career in Siena as a hydraulics engineer and his connection to Taccola's writings would likely have accustomed him to thinking of underground water and of ways to make it accessible. The ground above could be adequately studied for finding and then moving water through a system of *bottini*, or underground canals. One can learn to see the signs of underground water sources from above ground. In one such discussion on locating water, Francesco writes:

È da sapere dove l'acqua calida, fredda o alcuna miniera o vecchia cava recuperata di

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Knowledge in the Early Modern Low Countries, (Wein: Lit Verlag, 2012). As noted by Cook and Dupré, 6 "*translatio* might mean not only translation in the modern English sense of conveying one linguistic expression into another, but copying, or even the employment of a word in an unusual way."

[33] In Codex Saluzzo 148, f.10, Francesco writes: "We could even build in other ways on cliffs or rocks or mounts covered by water." (*Anco in altro modo in acqua edificare potremo in alcuno scoglio, sasso o monte dall'acqua coverto*.)

[34] Only Codex Saluzzo 148 has this caption, Codex Ashburnham 361 does not.

> metallo sia. Farai così: del mese di maggio, passate ore tre per insino al far del giorno, piglia una torcia accesa e farai andare uno condetta torcia verso quella parte ove presumi che dette acque o miniere sono, e tu andarai lontano dal lume colla testa bassa. E così inanzi e indirietro ricercando, che tu vedrai certa folta e crespa nebbia a guisa di fumo. E dove ciò appare fa fermare el lume e porre uno segno, acciò ricognosciar possi. E li cavando, l'acqua o miniera trovarai.
>
> It is necessary to know where hot or cold water or a mine or an old recovered metal quarry are. You will do it like this: in the month of May, in the final hours of the night, grab a lighted torch and have someone take this lamp towards the place where you think water and mines are to be found. And you go far from the light, keeping your head low. And so searching to and fro until you see a thick and dense fog that looks like smoke. And where this appears make the light stop and there make a mark, so that you can recognize the spot. There digging, you will find water or a mine.[35]

Immediately after this paragraph, Francesco describes how to bring water to an elevated location and lead it through a system of canals. From the depths of the earth, invisible to the eye, water can be found, harnessed, and brought up to the surface. Francesco's instructions for finding water underground read like stage directions, or directions for a scavenger hunt, intended for a person to act out; you walk away from the light and keep your head bent low to the ground until you find the necessary signs. Francesco's descriptions ask the reader to imagine his body involved in the process of doing work.

Elsewhere, Francesco's process of invention calls for bodily engagement and manual labor, in that he frequently tells his reader to pick up or to grab (*pigliare*) the instrument needed to perform a certain task, such as measuring heights of buildings or bases of columns. For example, on folio 28 of the Saluzzo codex, Francesco writes about how one can use the quadrant "to measure height, length, depth, and also how to measure towers, trees, wells, planes, and such things" (*el modo del misurare col quadrante una altezza o longhezza o profondità, siccome misurare torri, arbori, pozzi, piani e simil*

[35] Codex Saluzzo 148, f. 42v, Biblioteca Reale, Turin. My translation.

cose).[36] He then goes on to say that first one must, "pick up a quadrant and look through both holes" (*piglia el quadrante e guarda per ambedue i fori*).[37] The effort of acquiring knowledge for invention is a physical pursuit and is accessed through the tools of artisanal practice. Francesco encourages an active undertaking of the acquisition of knowledge. He lays out the quadrant on the page of his treatise and shows the reader the same quadrant in use. In the Ashburnham codex, a drawing of a small person using the quadrant to measure the height of the building accompanies the section on measuring towers (figure 16). In order to gain knowledge for oneself, one must pick up the tools of the trade and work out the measurements.

Pamela Long suggests that during the fifteenth century, the interest in tools and machines was not confined to their immediate application in engineering problems, but that their appeal was also tied to the idea that machines provided a means for understanding natural phenomena.[38] This argument holds true for Francesco, who shows the instruments and practices of the architect can be translated from the worksite to the philosophical and scientific pursuit of knowledge about the world. Moreover, the shift from building to world is articulated as an embodied practice and not as an ideal abstraction. On folio 28v of the Saluzzo codex, Francesco discusses the ways to measure heights and shows two examples of the quadrant in use to measure the height of a tower

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[36] Codex Saluzzo 148, f. 28v, Biblioteca Reale, Turin.
[37] Ibid.
[38] Pamela Long writes that: "machines became modalities for understanding certain problems in the natural world, such as motion." Long, "Picturing Machines," 18. Following Lowic's thesis that the *Trattati* should be considered with a philosophical and theological tradition, Alice C. Guess frames Francesco's machines in Aristotelian terms so as to go "beyond their practical applications to broader concepts regarding the nature of the world." Guess considers movement as Aristotle's primary charge and sees this philosophical concept in Francesco's exploration of continuous rotary motion in his mills. Alice C. Guess, "The Machines of Francesco Di Giorgio: Demonstrations of the World," (M.A. thesis, McGill University), 1998: 42.

with the shadow cast by the sun (figure 17). Then, in the last paragraph Francesco shifts from simple measurements to more ambitious projects. On folio 28v, we are given a glimpse of how the quadrant can be used to measure things bigger than towers, as Francesco writes that "wise astrologers and philosophers" (*savi astrologi e filosafi*) used the quadrant to measure the circumference of the world.[39] Below the text is a large drawing of a quadrant with clearly labeled degrees (figure 18).[40] The architect's quadrant is part of a practice that contributes to the understanding of the world through the working body. It is an instrument that can serve various ends. In a few quick strokes, Francesco has provided the tools for moving from smaller technical considerations to access a greater understanding of the world.

The body is also important to Francesco's project in that it is the vehicle for transmitting knowledge through practice. The body is crucial for passing knowledge from one person to another both as agent and as object of representation. Taccola's *De ingeneis* offers an earlier example of the recording of the process of drawing a body; the instruments of its making are displayed around the body in order to incite others to replicate its construction. On folio 36v is the drawing of a nude male figure circumscribed by a circle, a square, and other lines (figure 19).[41] In Taccola's image the tools have presumably just acted on the page: a compass, straight angle, and plumb line, are depicted at the top of the folio, and a protractor is shown under the figure's feet. Below the image of the man are a series of architectural joints. The compass is much

[39] Codex Saluzzo 148, f. 28v, Biblioteca Reale, Turin. For example, Eratosthenes of Cyrene (276-194 BC), a Greek mathematician, had measured the circumference of the Earth using the same method described by Francesco.

[40] Codex Saluzzo 148, f. 28v, Biblioteca Reale, Turin. The scale "schala" and "quandrante" are labeled accordingly.

[41] Taccola, Codex Monacensis 197, f. 36v, Bayerische Staatsbibliothek, Munich.

larger in proportion to the body and it is positioned as if it had just been used to draw the lines around the body. In the text, a capital letter is inscribed with a small face similar to those sometimes used in notarial signatures to record the witnessing presence of the scribe's body and its intervention on the page.[42] Below Taccola's drawing of the man, the text reads:

> Ille qui nichil ingnorat me creavit. Et omnem mensuaram mecum habeo tam super celestium quam terrestrium infernorum. Et qui se ipsum inteligit multa inteligit. Et librum angelicum et naturalem in mente eius habet asconditum. Et infra etc.
>
> He who knows all created me. I have all measure with me, of upper heavenly things as well as earthly and infernal [ones]. He who understands himself understands much. He has the book of angels and of nature hidden in his mind. And below, etc.[43]

Just as the corporeal act of drawing is capable of transmitting knowledge, the body is both the propelling force of transmission and its receptacle.

Francesco, like Taccola before him, calls attention to the process of making the body as a way of transmitting knowledge. In the right margin of folio 16v of the Saluzzo codex are two drawings: one, a skeleton that lacks both hands and feet and the other, a nude male figure with a superimposed grid to show the process of proper proportion and measurement (figure 20). It is particularly odd that Francesco has omitted the hands and feet in the skeleton since the adjacent commentary explains the measurements of the body as they relate to palms and feet (*palmi* and *pié*). The tools for drawing the body in proportion are here relocated at the bottom of the page, where the missing part of the skeleton, the feet, take the form a dismembered and incarnate foot that is drawn as if severed above the ankle and divided into thirteen segments. The various pieces of the

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[42] Campbell, *The Commonwealth of Nature*, 57.
[43] Taccola, Codex Monacensis 197, f. 36v, Bayerische Staatsbibliothek, Munich. For the translation and facsimile, see Prager and Scaglia, *Mariano Taccola and His Book De Ingeneis*.

body that are laid out on the page need to be reassembled and brought together to make sense of the whole. The process of creation thus remains open and subject to reworking. For example, the missing hand could be supplied by the reader-copyist, who actively participates in the remaking of the body. Francesco's inventive process is performed by copying in the acts of accretion, disassembling and assembling. The point is that the construction of meaning remains within the domain of a living practice that requires someone to activate the process of making again and again.

If one of the two manifestations of Francesco's world view is the embodied pursuit and transmission of knowledge, the other is a close correspondence between body and building and divine and human creation. For Francesco, the intellect has a corporeal dimension through which an idea is translated and realized. He thinks both through the body and by means of the body, thus qualifying his use of the analogy of the human body to architecture as more than a theoretical system of proportions inherited from antiquity. Within a Christian world view, the body is a work in progress that needs to be perfected in both beauty and function.[44] It follows that Francesco would find it important that the relationship of the body to a city or building is more than a formal resemblance, and that it includes the function and purpose of each part. On folio 7 of the Saluzzo codex, Francesco explains how the workings of the inside of the body are reflected on the exterior of the body. He writes:

> E così come detto è che tutte le interiora dentro ordenate e compartite sono al governo e supprimento d'esso, così come sono le partizioni drento e fuore del corpo

[44] For example, Christian authors such as Augustine and Nicolas Cusanus, who were widely read in the fifteenth century, discussed the human body—with its beauty and function—as God's most perfect creation. See Lowic, "The Meaning and Significance of the Human Analogy in Francesco Di Giorgio's Trattato," 363.

> necessario è compartire ciascun membro della città al supprimento, venustà e governo d'essa.
>
> And just as it is said that the entrails are assigned to the government and nourishment of [the body], in accordance to the partitions in the body, it is necessary that the members of the city be assigned to the sustenance, beauty, and government of it. [45]

The relationship between social and bodily functions has a long standing tradition in both antiquity and Christian thought.[46] For Francesco, what matters is the ability of the architect to develop the health and beauty of the city and by analogy the body, through the efforts of his craft.

Whereas others such as Henry Millon and Lawrence Lowic have written on Francesco's analogy of the body to building, I would like to add that Francesco's analogy reaches beyond strict notions of measurement to encompass an allegorical dimension with implications for the health of the body and soul.[47] Francesco does not simply borrow the human analogy from Vitruvius; his body is different because it is a Christian body and his analogy of building and body presents a way to rebuild the body and self into the Christian salvation narrative. To this end, the relation of body to building also includes an analogy between the soul and Church.[48]

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[45] Codex Saluzzo 148, f. 7, Biblioteca Reale, Turin. My translation.

[46] Lowic points out that Francesco's "application of the human analogy to the end of achieving social order, utility, and beauty in city plans," was well situated with a "long and continuous tradition of received opinion." Lowic further writes that in Cusanus's *de docta Ignorantia,* Cusanus argues that "only in the incarnation of Christ could there have occurred the maximum spiritual and phyisical perfection necessary to the idea of man as a microcosm raised to the maximum level of perfection." Lowic, "The Meaning and Significance of the Human Analogy in Francesco Di Giorgio's Trattato," 364. Furthermore, Nicholas Cusanus, in *De concordantia Catholica,* sets up an analogy of the functions of the human body with those of the political body.

[47] Lowic, "The Meaning and Significance of the Human Analogy in Francesco Di Giorgio's Trattato," 360–70.

Henry Millon, "The Architectural Theory of Francesco di Giorgio," in *Renaissance Art,* ed. Creighton Gilbert, (New York: Harper & Row, 1970), 133-147.

[48] For a more mathematical and structural reading of the analogy of the human body and church, see Lowic, "Francesco di Giorgio on the Design of Churches: The Use and Significance of Mathematics in the 'trattato,'" *Architectura* 12 (1982): 151-163; Millon, "The Architectural Theory of Francesco Di

As already seen, the connection of the soul to the Church is present in the drawing on folio 3 of the Saluzzo codex, where a man is shown holding a tower over his head and the plan of a basilica is inscribed over his heart. This correlation comes up again on the bottom of folio 11v of the same manuscript in the drawing of a basilica plan (figure 21). The walls of the basilica are painted red; a black ink outline marks the perimeter and radiating chapels of the transept, nave, and apex. Inside this plan is a figure of a standing male nude, rendered in faint chiaroscuro of ink and wash. His outstretched arms echo the cruciform shape of the church and his body is partitioned into the measured units of the building and from each finger and every sense organ of the face, straight lines have been drawn that lead to radiating chapels.[49] The connecting lines are witness to a deeper relation between the body and the plan of the church. The rays unite the sensory elements of the human body to the fabric of the church.[50]

A relevant passage on the connection between the hand, intellect, and soul, appears in Albertus Magnus's commentary on Aristotle's *de animalibus,* a manuscript copy of which Francesco illuminated in 1463 while at the Sienese *Studio*.[51] It reads as follows:

> Unde cum aliquis intendit exprimere, quod intime intelligit, vis potest manus retinere, quia ita multum oboedit manu intellectui, quod naturaliter intendit opere manifestare, quod interius concipitur in animo.
>
> Thus, when someone attempts to express something that he understands intimately, he can hardly restrain his hands, since the hand so completely obeys the intellect that

Giorgio," 257-261.

[49] Only the left hand of the man has the rays connecting to the chapel, since the folio is cut off at the right hand's fingers.

[50] On the movements of the soul-body in Aristotle, see Abraham Paulus Bos, *The Soul and its Instrumental Body: A Reinterpretation of Aristotle's Philosophy of Living Nature,* (Leiden: Brill, 2003). In an Aristotelian understanding of sense perception, the body and its sense organs, such as the eyes, mouth, and fingers, cannot be separated from the movements of the soul.

[51] Albertus Magnus, *De animalibus,* Siena, Basilicca dell'Osservanza, Museo Castelli, MS 3, 1463.

> it naturally tends to manifest in an outward act what is conceived internally in the soul.[52]

Albertus Magnus articulates, on philosophical grounds, the importance of the hand as vehicle for communication as it connects the inner faculties with embodied expression, a notion that finds its translation in Francesco's artisanal epistemology in which the hand connects the body to soul and intellect in the practice of drawing.[53]

As suggested by the Saluzzo and Ashburnham codices, one comes to acquire knowledge through a practice of copying that connects the hand of the artisan to his intellect. In this regard, the act of drawing is crucial for making ideas visible and communicable. On this matter, Francesco writes:

> E perché volendo descrivare tutto quello che en tale facultà s'appartiene sarebbe quasi impossibile, e faccenda infinita a raccontare molte diverse e strane fantasie le quali secondo luoghi e siti adattar bisogna, ed anco perché assai son quelle che la lingua o penna spriemer no le può, le quali lo intelleto cogitando vede…Ed essendo in esse due contrarietà le quali difficilmente dimostrar si possano, l'una è per iscritto molte diversità di forme, l'altra è per propria figura e disegno.
>
> And wanting to describe everything that belongs to such faculty would be almost impossible, as one would go on to infinity by telling of the many strange and different ideas that need to be adapted according to site and location, and as there are many that the tongue and pen cannot express, which are seen by the intellect as it cogitates…And because there are two sides that are difficult to show, one shows the many different forms by writing, and the other is shown by its own figure in drawing.[54]

Without the ability to draw, the architect's mental vision remains inaccessible not only to others, but also to the architect himself. Drawing also functions as a means of

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[52] Albertus Magnus, *Questions Concerning Aristotle's On Animals*, translated by Irven M. Resnick and K.F. Kitchell Jr., (Washington: CUA Press, 2008), XIV, 434.

[53] For a discussion of this passage in the context of artistic work, Wolf-Dietrich Löhr, "Handwerk und denkwerk," in *Fantasie und Handwerk: Cennino Cennini und die Tradition der toskanischen Malerei von Giotto bis Lorenzo*, ed. Wolf-Dietrich Löhr and Stefan Weppelmann (Munich: Hirmer Verlag GmbH, 2008), 172, n.21.

[54] Codex Saluzzo 148, f. 6v, Biblioteca Reale, Turin. My translation.

knowledge acquisition, so that the drawings Francesco copies become part of a personal corpus. Drawing is not only how Francesco gains knowledge, but an essential component of Francesco's method for transmitting knowledge.

Francesco states, however, that even drawing fails to render the full picture and he repeatedly stresses the impossibility of laying everything out on the page of his manuscript. This may seem surprising given Francesco's robust interest in drawing as a way of making visible the working intellect. Nonetheless, Francesco stresses that "many things are to be made and that cannot be shown by pen and drawing" (*che molte cose sono da fare le quali la penna e disegno mostrar non può*).[55] Again later in the treatise, Francesco underlines the impossibility of seeing any one object in its totality from a drawing, since if you show the outside, then the inside is left obscured: "And it is particularly so for those which cover one from the other and make themselves hidden," (*E massime di quelle che l'una all'altra coprendo se medesme occulte fanno*).[56]

If the visual and textual apparatus remains incomplete, then what might one expect to gain in studying and copying Francesco's manuscript? What kind of knowledge do the Saluzzo and Ashburnham codices transmit and how does one learn how to access it? My contention is that Francesco produced a treatise that functions by activating a critical engagement with the material that allows one to use the visible as a springboard to reach invisible, higher truths. In order to reach higher truths, the Saluzzo and Ashburnham codices teach one how to develop one's spiritual

[55] Codex Saluzzo 148, f. 5v, Biblioteca Reale, Turin.
[56] Codex Saluzzo 148, f. 6v, Biblioteca Reale, Turin.

eyes by way of the physical ones. By learning *discrezione* through the practice of art-making, a process that is made visible throughout the Saluzzo and Ashburnham codices, one can learn to apply that same *discrezione* to invisible matters such as spiritual health.

Discrezione and Analogy

Francesco's use of the three-part analogy of city, church and fortress to body, soul, and intellect offers the reader a lesson on how to use the visual and material practice of art making to move towards understanding spiritual matters. Through artistic work, one can attempt to partake, by analogy, in the making of a healthy body and soul. The body is the visible referent that, by process of analogy, lets one comprehend that which cannot be seen. Through Francesco's creative process, drawing translates the workings of the intellect through the workings of the hand. In so doing, the mental visions pass through the body of the artist and are made visible to others and to himself. This takes shape in the metaphorical sense of inner sight as the guide to proper health. From the very first page of his treatise, Francesco makes a differentiation between physical and mental sight, and argues for the importance of the latter:

> E siccome noi vediamo che l'uomo ha due occhi co'quali vede e cognosce le cose apparenti, così come ha gli occhi visivi debba avere li occhi mentali, i quali sieno guida e via dell'intelletto di giudicare e cognosciare le foture cose.
>
> And since we see that man has two eyes with which he sees and knows things that are apparent, just as he has seeing eyes, he must also have mental eyes, which will guide and direct the intellect to judging and knowing future things.[57]

By casting a broader net to form a picture of the larger tradition in which Francesco operates, we find that Dante Alighieri (1265-1321), in the *Convivio* (c.1304-1307), makes

[57] Codex Saluzzo 148, f.3, Biblioteca Reale, Turin. My translation.

a related claim for the difference between physical and mental sight:

> Sì come la parte sensitive dell'anima ha suoi occhi, colli quali aprende la differenza delle cose in quanto elle sono di fuori colorate, così la parte razionale ha suo occhio, collo quale aprende la differenza delle cose in quanto sono ad alcuno fine ordinate: e questo è la discrezione.
>
> Just as the sensitive part of the soul has its eye with which it sees the difference of things in regards to their exterior color, so the rational part has its eyes with which it sees the differences among things in regard to the end for which they are intended: and this is *discrezione*.[58]

Dante's passage is relevant in the context of Francesco's treatise, in that he defines *discrezione* as the rational spirit's ability to see, differentiate, and order things according to their substance and proper end.[59] The juxtaposition of Francesco and Dante's passages is useful for understanding the implicit argument about spiritual discernment in Francesco that is of explicit concern for Dante.

Dante goes on to write that he whose eyes of *discrezione* are blind, is unable to judge for himself right from wrong:

> E sì come colui che è cieco delli occhi sensibili va sempre secondo che li altri…così colui che è cieco dell'occhio della discrezione va sempre secondo che li altri giudicando lo male el lo bene…così quelli che è cieco del lume della discrezione sempre van el suo giudicio secondo grido.
>
> And just as he whose sensible eyes are blind always follows others…so he who is blind in the eye of *discrezione* always follows others in his judgement of good and bad…so he who is blind to the light of discrezione always follows common opinion.[60]

Discrezione is pictured as a guiding light that allows one to develop a sense of right and wrong for oneself. Dante believes that to avoid the fate of a blind man, and to maintain a

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[58] Dante, *Convivio*, I XI 9-13. My translation.
[59] In his turn, Dante is drawing on Thomas Aquinas, *In decem libros Ethicorum exposition*, III 13 521.
[60] Ibid, 13-17. My translation.

healthy sight, one must habitually practice *discrezione*, just as one must work to cultivate any given virtue:

> E però che l'abito di vertude, sì morale come intellettuale, subitamente avere non si può, ma conviene che per usanza s'acquisti.
>
> And because the habit of virtue, both moral and of the intellect, cannot be attained immediately, it therefore must be acquired through use.[61]

Discrezione, as both a guide and a practice, is crucial for understanding Francesco's project. For Francesco, *discrezione* is what guides the architect in practical matters that require good judgement. As technical knowledge can only be gained through practice, *discrezione* on spiritual matters is likewise to be gained through an active practice.

The virtue of *discrezione* is given substance in the Saluzzo and Ashburnham codices, through the story of Dinocrates, which Francesco adapts from Vitruvius. In Vitruvius, the architect Dinocrates, desirous of entering into the service of Alexander the Great, approached the king with the proposal that a city on Mount Athos be made into the shape of a man. According to Francesco, what Dinocrates lacked was a more extensive vision that took into account the well-being of the city's inhabitants. The anthropomorphic mountain was only deemed impractical when, prompted by Alexander, Dinocrates had to admit that all provisions would have to reach Athos by sea as the land was not suited for agriculture. With the story of Dinocrates, Francesco suggests that *discrezione* is an important virtue that the architect must care to develop in order to build where conditions are favorable. Francesco's preoccupation in the story of Dinocrates, with the health of the body and of the city can be taken as a metaphor for his concern for the health of the soul, for which spiritual sight must be trained to prevent corruption.

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[61] Dante, *Convivio,* 30-31. My translation.

In contrast to Dioncrates's shortcoming, Francesco stresses the importance of the architect's intellect in choosing the quality of the location on which to build, as he writes that "it is important to consider the quality of the sites...and this consists in the *discrezione*, and subtlety of the architect's intellect" (*...è da considerare i siti e qualità de'luoghi...e questo consiste nella discrezione, sottilità e ingegno dell'architetto*).[62] Indeed, for Francesco, the importance of mental sight, as it is able to know and judge future things, (*giudicare e cognosciare le foture cose*)[63] is directly related to good health. He writes that:

> Imperò, se vede e cognosce incorrire il corpo in qualche piccola o grave infermità, a essa presto ripara si debba, e non per sé, coll'aiuto e consiglio del fisico così el governatore...continua vigilanza considerare e vedere se la città incorrisse in alcuno mancamento.
>
> Just as we should not rely on ourselves when the body falls into some minor or serious illness, but rather call on the help and counsel of a doctor...so too the governor of a city should see to it that his city should not fall ill.[64]

In the metaphor of the physician, Francesco articulates the relationship between the health of the city, body, and soul. The role of the architect, in an adaption of the age-old metaphor, is likened to that of the physician in his ability to foresee and prevent future illness.

Foresight and *discrezione,* according to Francesco, are crucial for the architect if he is to learn how to fortify his city against the possibility of corruption by siege. The first lines of the Saluzzo codex read:

> Parmi che le fortezze colle loro circuizioni in tal modo adatate sieno che dalle macchine delle bombarde o scalamenti o altri stormenti bellici difendare si possino. In prima è da considerare el sito in qualità del loco, imperò che altro richiede un loco

[62] Codex Saluzzo 148, f. 6v, Biblioteca Reale, Turin. My translation.
[63] Ibid, f.3. My translation.
[64] Ibid.

> montuoso, altro un piano, e così sicondo i luoghi più o manco debili, da quella parte dunde più offesi sieno a quella principalmente è da riparare.
>
> It appears to me that fortresses with their surrounding walls should be made to be defended against bombards [a type of early cannon] ladders [to scale the walls], and other instruments of war. First, the quality of the location needs to be considered, because the requirements of a mountainous site are different from those of one in the plains, and likewise, according to the greater or lesser weakness of the sites, that part whence they are more subject to attack should be protected above the others.[65]

For Francesco, it is important that the architect be able to develop his own judgement in accordance with the specificity of the site in order to create the best possible solution. Fortifications, according to Francesco, are not a matter to be taken lightly, because the consequences can be devastating if one does not pay heed to their proper design:

> Adunque la rocca de' essere principale membro del corpo della città, siccome el capo è principal membro di tutto el corpo. E come perso quello perso el corpo, così persa la fortezza persa la città da essa signoreggiata.
>
> Therefore, the fortress must be the principal member of the entire body of the city, since the head is the principal member of the body. And just as if [the head] is lost, so the body is lost, so too if the fortress is lost the city ruled by it is lost as well.[66]

In these lines, the progressions from city to fortress and body to head are made explicit. Although in its most immediate significance the subject at hand is the physical defense of a city, if we follow Francesco's analogy as indicated in both his drawing and writing, we are also brought to consider the potential loss of one's tower and self. At this point it is important to recall that in the lower left margin of the same folio adjacent to the passages quoted above, is the drawing of a man holding a tower above his head. Placed on the top of the figure's head like a crown, and cautiously held between his hands, the tower is clearly meant

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[65] Codex Saluzzo 148, f. 3, Biblioteca Reale, Turin. My translation.
[66] Ibid.

to be protected against loss. The tower stands in the place of the man's mind, his reason, and reinforces the analogy between the tower and the self.

Roughly at the time when the first treatise was being composed, Francesco was in the service of the duke of Urbino as city architect and engineer. During a series of wars in which Siena and Urbino were allied against Florence, Francesco acted as an ambassador and was responsible for obtaining missiles and other artillery for Siena. Francesco also oversaw many projects of fortification, which continued well after the wars had subsided.[67] For Francesco it is imperative that these new fortifications be able to withstand the weapons of modern warfare, such as explosives. Since he is able to fulfill this difficult but crucial need, his inventions are of the utmost importance.[68]

On the literal level, Francesco's translation of architectural and engineering works to make them relevant for the present historical moment, ensures that fortresses might withstand modern explosives. If translated to the metaphorical level, in which the fortress is seen in analogy to the soul, the moral preoccupations in the Saluzzo and Ashburnham codices are made all the more urgent for the present: the possibility of the soul's corruption is applied metaphorically to the realm of warfare and thus linked to the possibility of an impending siege. The connection between literal and spiritual siege

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[67] For biography related to Francesco's political and military career, see Allen S. Weller, "Francesco Di Giorgio, 1439-1501," (Chicago: University of Chicago Press, 1943). According to Allen Stuart Weller, Francesco likely accompanied Federico da Montefeltro on his war campaigns as several letters of this period from the Duke to the Signoria of Siena make mention of Francesco. In these letters, Francesco appears to have acted as an ambassador between the Duke and the Sienese government as he was entrusted to deliver messages. Weller hypothesizes that Francesco was in charge of getting explosive materials for Siena. This is particularly relevant since Francesco sees explosives as the new technology that distinguishes modern warfare and that requires new methods of fortification. For Francesco's political involvement, see also Fabrizio Nevola, *Siena: Constructing the Renaissance City* (New Haven: Yale University Press, 2007), 190-193.

[68] Francesco writes: "*Io per me, quanto considerare ho potuto in nelle difese delle bombarde, assai dificil mi pare da esse potersi difendare.*" (As for me, when I have applied myself to defending against bombards, I have found it to be very difficult.) Codex Saluzzo 148, f. 6, Biblioteca Reale, Turin.

makes the need to prepare the best possible defense system all the more pressing.

Conclusions

We can now circle back to the drawing of the cracking tower over buried ammunition, to appreciate that the stakes are much greater than they may at first have seemed. The tower on the hillside when compared to the first drawing of the man who holds a tower on his head, at the site of his reason, makes the need to see invisible danger—such as the ammunition hidden inside the hillside—all the more pressing. In the treatise, Francesco writes that in choosing a building location for a city, the quality of the soil must be adequately balanced in its mineral make-up, since it must be capable of nourishing plants, animals, and lastly humans. The architect must have the proper foresight to identify and choose a salubrious site for future inhabitants; lack of such physical sight stands in metaphorically for the inability of one to see to the spiritual nourishment of one's soul. As Francesco urges:

> I corpi delli uomini vogliano essere colle finestre aperte, acciò che none occulti ma manifesti abbino i sensi a giudicare le cose.
>
> Human bodies should have open windows, so that their senses will not be obscured, but manifest so to judge things.[69]

Although we do not know for certain for whom the manuscripts of Francesco's treatises were made, some general considerations can be offered.[70] Given that both

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[69] Codex Saluzzo 148, f. 17, Biblioteca Reale, Turin. My translation.

[70] No formal dedication is made in the Turin or Ashburnham manuscript. Vasari, in his *Lives*, writes that Francesco's books were given to Cosimo de Medici. The copy of the second treatise, the Codex Magl. II I 141, Libreria Magliabecchiana, Florence, has a posthumous dedication to the duke of Montefeltro and Francesco was employed in his service at the time the first manuscript was produced. The *Opusculum de architectura* has a preface dedicated to Federico of Montefeltro. An abridged version of the architectural treatise was made for Alfonso of Aragon King of Naples.

codices Saluzzo 148 and Ashburnham 361 are large presentation manuscripts written on vellum and richly illuminated, they seem well-suited to a princely context. Even if they were not made for Federico of Montefeltro, by whom Francesco was employed at the time, they would have been intended for a wealthy *signore*.[71] The *signore* would likely have identified with the fortress and the need to physically defend his city as well as his person.[72] For the scribes who copied Francesco's manuscript, a long standing tradition that saw artistic work in relation to salvific work, would also have supported an allegorical reading. The work of fortifying the city to save it from potential loss, would have also been akin to spiritual work for the salvation of one's soul. The monastic scribal production of the Saluzzo and Ashburnham codices manuscripts provide another framework of readership in which an allegorical dimension of the manuscripts would have been readily understood.

Finally, the fact that Francesco's manuscripts were immediately re-worked and adapted in many different settings after they were composed adds to our understanding of the treatises as open bodies of materials that not only provide lessons on the art of architecture, but also make visible and accessible the process of knowledge acquisition. Invention, as it is enacted by Francesco, is like a poetic act of finding. It is by finding

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[71] The Duke of Urbino, in a letter to the Sienese government dated to1478, refers to Francesco as: "*vostro citadino,* e *io dilettissimo architetto,*" cited in Weller, *Francesco Di Giorgio, 1439-1501*, Appendix XXXV.

[72] For a discussion relating the tower and the prince, see Joanna Woods-Marsden, "Images of Castles in the Renaissance: Symbols of 'Signoria', Symbols of Tyranny," *The Art Journal* 48 (1989): 130–37. Although Woods-Marsden limits her discussion on the image of the fortress in the Quattrocento to that of a political motif—a symbol of princely power and oppression—she also offers compelling examples for how a *signore* could identify his person with the castle. Marsden writes that in various instances, fortresses were named after their lords: the castello Sigismondo for Sigismondo Malatesta of Rimini and the Rocca Costanza for Costanza Sforza of Pesaro. Woods-Marsden, 132, cites a letter from the astrologer, Giacomo degli Ovetari to Ludovico Gonzaga in which Giacomo draws a metaphor between castle and lord: "The castel in Mantua is the person of your lordship" (*el castello de Mantoa...la persona de La Signoria sua*).

existing knowledge and by bringing it together that new knowledge can be discerned and novel problems resolved. A distinctive feature of Francesco's inventions is the updating of older types. Francesco's fortifications, for example, rework earlier models to measure up to the task of protecting a city from modern military weapons. The treatises provide access to the process of creation both of buildings and of healthy bodies in which various sources are gathered and sutured together and in which copying serves as a way of gathering, putting together, and transmitting knowledge. That the process of making was well received, is shown by the extensive copying of not just the finished material but of the inventive process set forth by Francesco.

In the Saluzzo and Ashburnham codices, the invisible workings of the artist's mind are made visible through drawing and text, in what amounts to a translation of the work of the intellect and by analogy, of God's saving work. The process of analogy in Francesco's treatises connect proper fortifications of a city and the health of the soul and so invite a reader to a more poetic reading, one that goes beyond the detailed technical precepts, past the surface. A biblical story speaks closely to Francesco's project of relating the body to a building. In Matthew 7:24-27, Jesus tells his followers that those who abide by his teachings will be like the wise man who built his house on stone; and those who do not will be like the fool who built his house on sand. Francesco's treatises teach one how to build the tower of one's soul to safeguard it from moral storms and at the same time how to avoid the rainfall of enemy missiles.

Appendix I

The *Trattati* enjoyed immediate popularity and were circulated throughout the fifteenth and sixteenth centuries. According to Gustina Scaglia, Francesco's "written and graphic works," were "copied more than those of any artist," up until the mid-sixteenth century.[73] Among the notable copies of Francesco's work are those made by Lorenzo Donati, Pietro Cataneo, Giuliano da Sangallo, Benvenuto della Volpaia, Leonardo da Vinci, and Antonio Sangallo il Giovane.[74] The list of copies is sizable and includes numerous instances of abridged versions of the treatises or instances in which sections from Francesco's treatises were incorporated into larger works.

Assembled by the Venetian architect Angelo da Cortivo between 1489 and 1536, the Zichy Codex exemplifies how Francesco's project was received and transmitted.[75] The Zichy codex is a draft of a manuscript, which among other things, contains an architectural treatise. The section on architecture brings together and juxtaposes a preliminary version of Francesco's first treatise and Vitruvius' *De architectura*.[76] However, Angelo does more than simply copy the earlier works: he rearranges pages, adds his own drawings, and elaborates on select concepts. The effort of understanding ancient works through a contemporary lens is made all the more apparent in the Zichy codex as Angelo systematically alternates Vitruvius' work with Francesco's material.[77] In

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[73] Scaglia, *Francesco Di Giorgio: Checklist*, 17.
[74] Ibid, 16.
[75] Carolyn Kolb, "The Francesco di Giorgio Material in the Zichy Codex," *Journal of the Society of Architectural* Historians 47 (1988): 132-59. According to Kolb, the Zichy codex is based on a preliminary draft by Francesco of the first *Trattato*. On the Zichy Codex, see also Long, "Picturing the Machine," 121.
[76] Ibid, 144. Kolb suggests that the Zichy codex is in fact a copy of a draft of Francesco's first treatise that predates the Codex Saluzzo 148.
[77] Ibid.

its visible suturing together of sources, the Zichy codex mirrors Francesco's process of treatise making and translation of knowledge. Invention, for Angelo and Francesco, is an operation that involves making visible the sum of one's own process of gathering and learning information. Angelo is not only reproducing the appearance of Francesco's treatise, but he is actively following Francesco's combinatory strategies for invention. Cognitive processes, such as knowledge acquisition, are thus rendered physically visible through the workings of the hand.

Francesco's treatises fell into disregard sometime in the seventeenth century and were gradually rediscovered in the mid-eighteenth century.[78] The first manuscript to come to light in 1759 was the Codex Siena, which was followed by the Codex Magl. II I 141 in 1803.[79] In 1831 Codex 148, Turin was found and then in 1847 the Codex Ashburnham 361 was discovered. These two manuscripts of *Trattato I* were first attributed to Leonardo da Vinci.[80] When Vasari wrote on the architect in the 1568 edition of the *Vite*, he only noted that the ingenious architect, Francesco di Giorgio, had filled several books with drawings of machines.[81] Vasari's statements were of little help for the early scholars who undertook the task of assigning attributions to the unsigned

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[78] Ibid, 20. Scaglia cites Vincezo Scamozzi's 1616 reference to Francesco as one of late date. See also Christoffer H. Ericsson, *Roman Architecture Expressed in Sketches by Francesco Di Giorgio Martini: Studies in Imperial Roman and Early Christian Architecture* (Helsinki: Societas Scientiarum Fennica, 1980), 2. Scaglia and Ericsson hypothesize that the fall of the Sienese government contributed to the fall in Francesco's fame.

[79] Ibid, 20-22. The four main manuscripts were discovered in 1759, 1803, 1831, and 1847 respectively. Scalgia writes that the Codex Siena was first called the Codex Trombelli until Giuseppe Ciaccheri purchased the manuscript from Gian Grisostomo Trombelli da Zorlesco. Attributions varied until Vincenzo Corazza attributed the work to Francesco in his personal copy of the codex. It is to Giuseppe del Rosso and Vincenzo Follini that we owe the recovery of the Codex Magl. II I 141, Libreria Magliabecchiana, Florence.

[80] Scaglia, *Francesco di Giorgio: Checklist*, 22.

[81] Vasari writes: "Disegnò anco alcuni libri tutti pieni di così fatti instrumenti, il miglior de' quali ha il signor duca Cosimo de' Medici fra le sue cose più care." Giorgio Vasari, *Le vite de' più eccellenti pittori*, 1565, edizione Giuntina, 384.

manuscripts of the *Trattati.* Carlo Promis attributed the Turin manuscript to Francesco in 1841 and finally in 1967 Corrado Maltese and Livia Degrassi Maltese published facsimiles and transcriptions of both treatises.[82] The last seventy years have seen significant critical studies of the Trattati, including topics such as Francesco's years at the court of Urbino and Federico of Montefeltro's patronage, as well as considerations on Francesco's use of analogy.[83] Much attention has also been devoted to situating Francesco's inventions within technical, military, and architectural histories.[84]

[82] See Maltese, Introduction to *Trattati di architettura, ingegneria e arte militare*; Promis, *Vita di Francesco di Giorgio Martini architetto senese del secolo XV*.

[83] For relevant studies, see Lawrence Lowic, "The Meaning and Significance of the Human Analogy in Francesco Di Giorgio's Trattato," 360–70; Richard Johnson Betts, "The Architectural Theories of Francesco Di Giorgio" (PhD diss., Princeton University, 1971); Henry Millon, "The Architectural Theory of Francesco Di Giorgio," 257–61.

[84] Several notable studies that deal with the technical, engineering, and architectural nature of the *Trattati* include: Galluzzi, *Prima di Leonardo*; Pamela Long, *Science and Technology in Medieval Society* (New York: New York Academy of Sciences, 1985); Long, *Artisan/practitioners and the Rise of the New Sciences, 1400-1600*; Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance*; Francesco Paolo Fiore and Manfredo Tafuri, *Francesco di Giorgio architetto* (Milano: Electa, 1993); Marco Dezzi Bardeschi, *Francesco di Giorgio e l'ingegneria militare del suo tempo*, (Firenze: Artigraf, 1968).

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Figures:

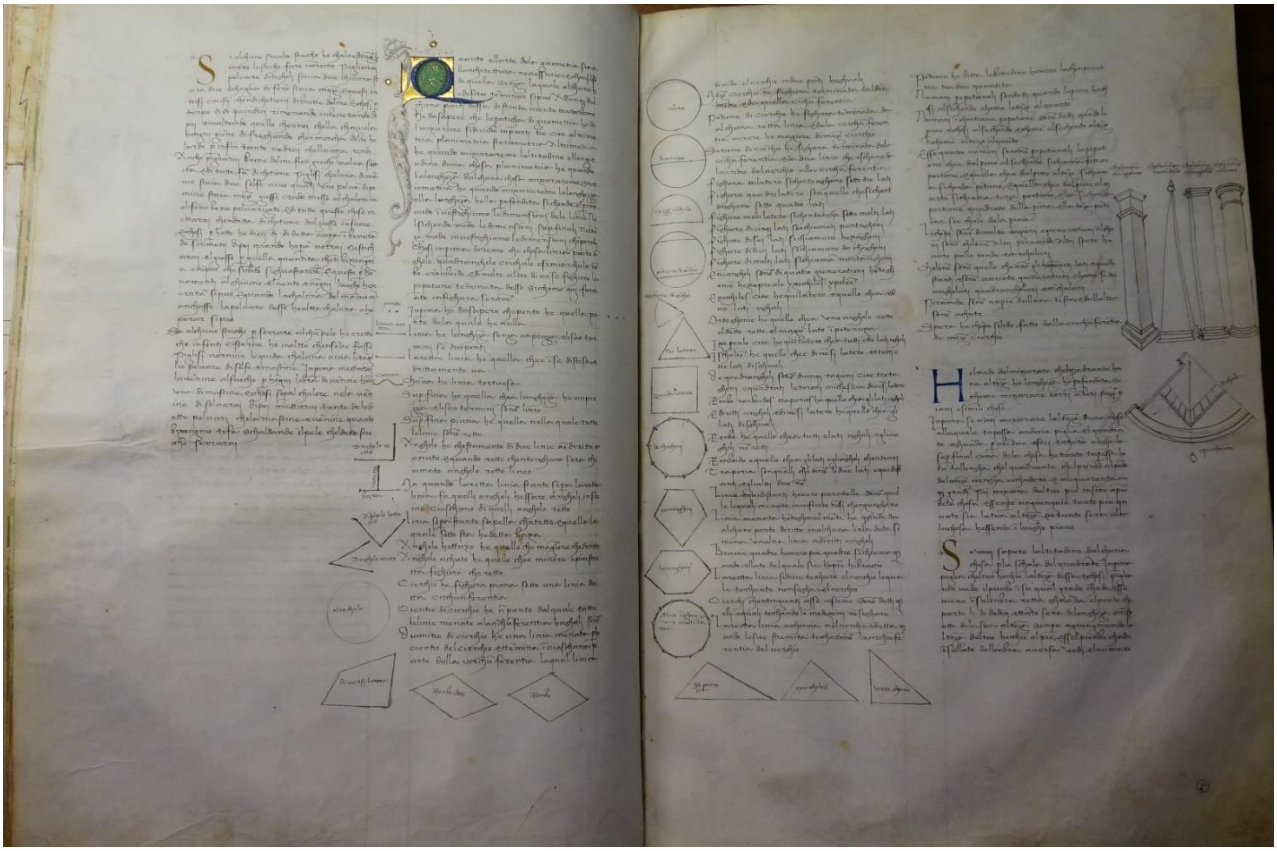

Figure 1. Francesco di Giorgio, Codex Saluzzo 148, f.27v and f.28, Biblioteca Reale, Turin. (Photograph by Author).

[Image redacted]

Figure 2. Francesco di Giorgio, Codex Ashburnham 361, f.51v (detail of assault machines), Biblioteca Medicea, Florence.

[Image redacted]

Figure 3. Francesco di Giorgio, Codex Ashburnham 361, f.52 (detail of assault machines used against a tower), Biblioteca Medicea, Florence.

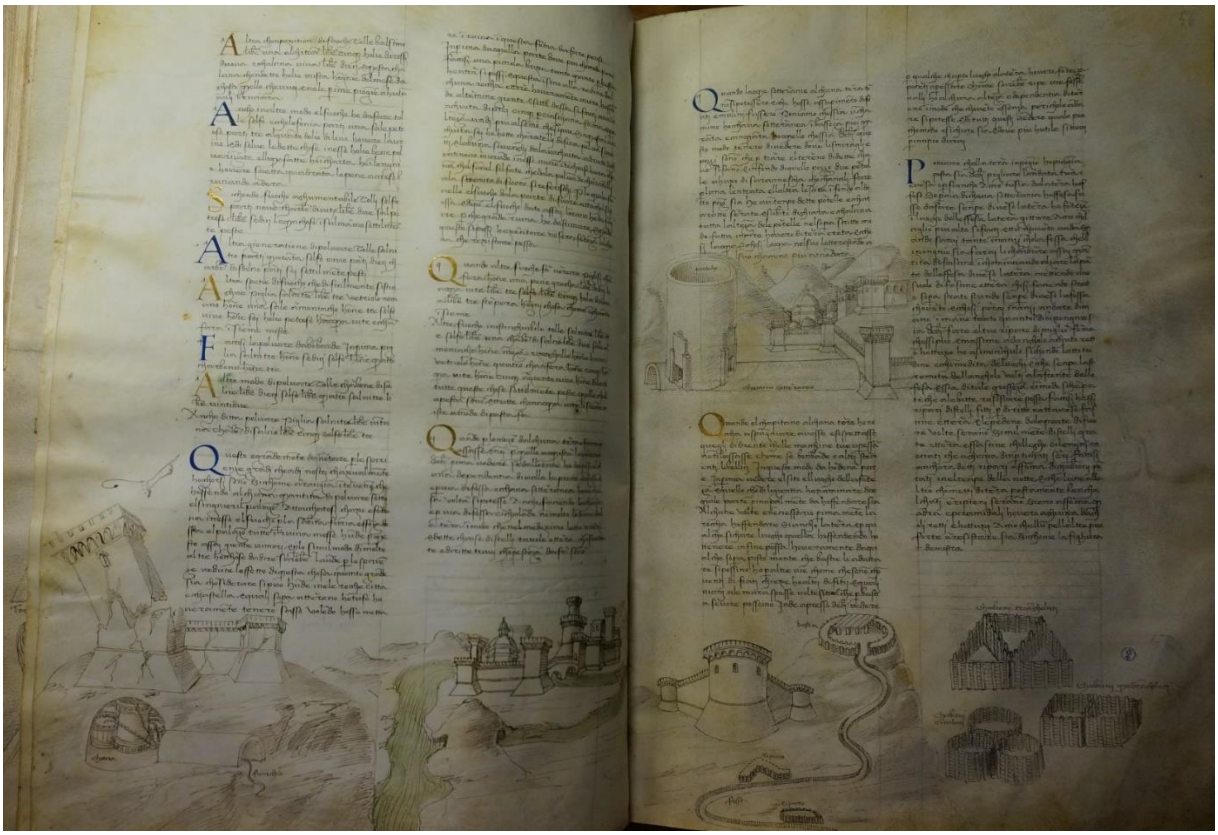

Figure 4. Francesco di Giorgio, Codex Saluzzo 148 f.55v and f.56, Biblioteca Reale, Turin. (Photograph by Author).

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Figure 5. Francesco di Giorgio, Codex Ashburnham 361, f. 11 (detail), Biblioteca Medicea, Florence.

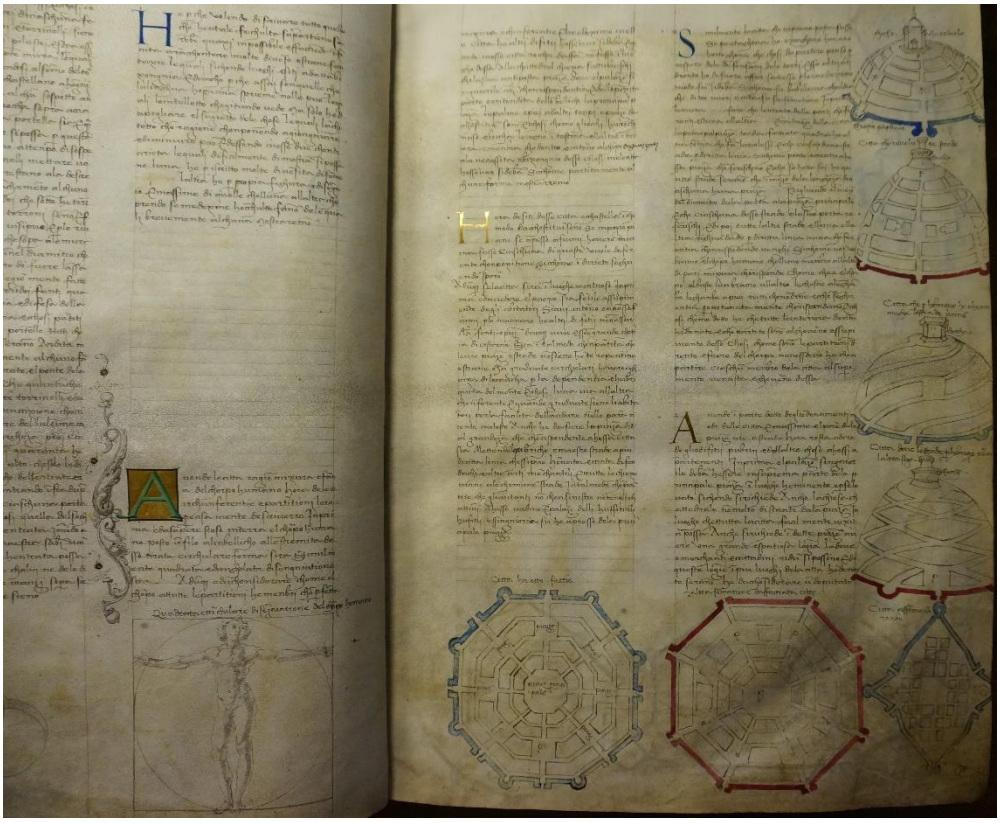

Figure 6. Francesco di Giorgio, Codex Saluzzo 148 f.6v and f.7, Biblioteca Reale, Turin. (Photograph by Author).

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Figure 7. Francesco di Giorgio, Codex Ashburnham 361, f.15v (detail), Biblioteca Medicea, Florence.

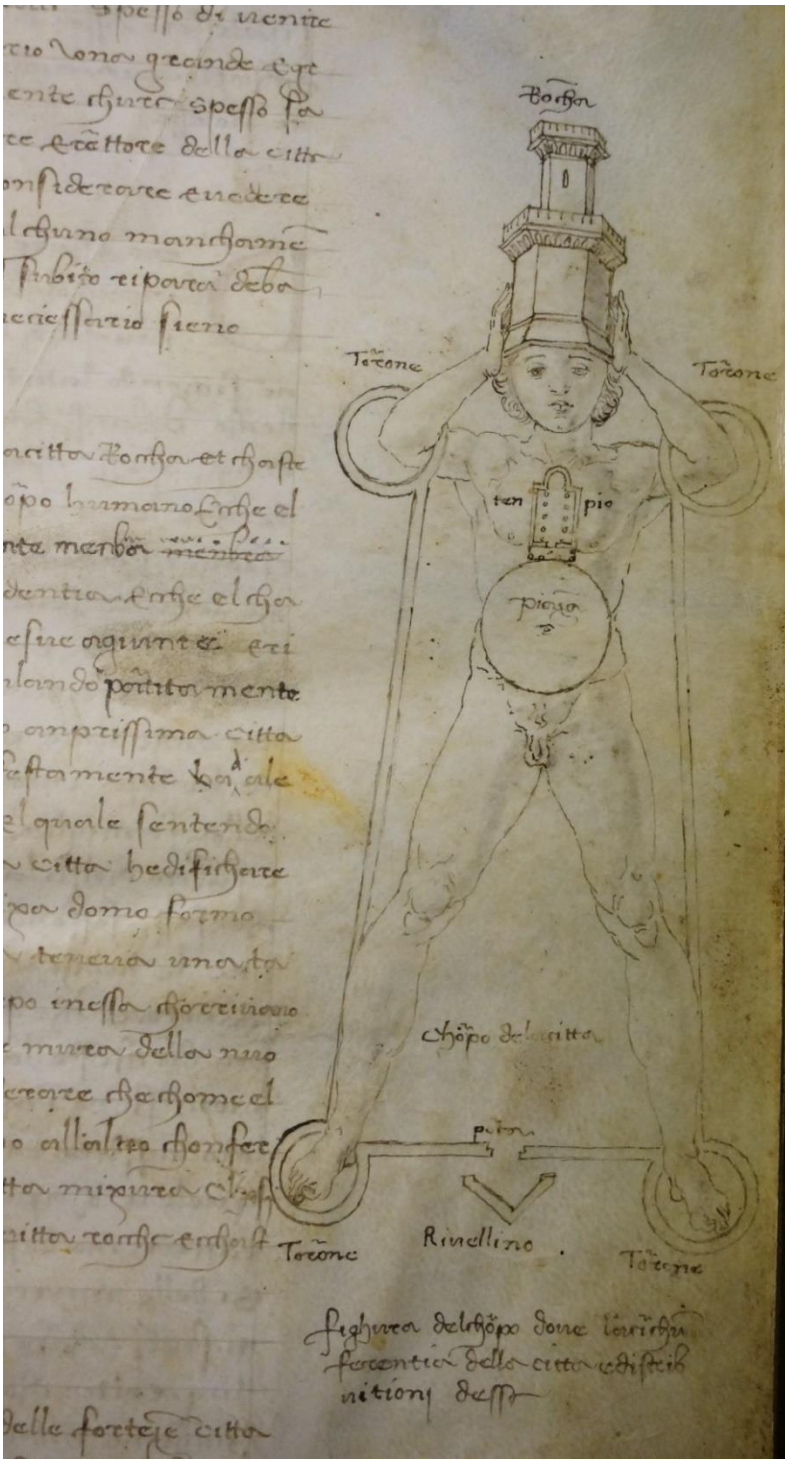

Figure 8. Francesco di Giorgio, Codex Saluzzo 148, f.3 (detail), Biblioteca Reale, Turin. (Photograph by Author).

[Image redacted]

Figure 9. Francesco di Giorgio, *Opusculum de architectura*, f. 35r (detail), British Museum.

[Image redacted]

Figure 10. Mariano di Jacopo il Taccola, *De ingeneis*, Ms. Palatino 766, f.33r, Biblioteca Nazionale Centrale, Florence.

[Image redacted]

Figure 11. Mariano di Jacopo il Taccola, *De ingeneis*, Codex Monacensis 28800, fol. 48v, Bayerische Staatsbibliothek, Munich.

[Image redacted]

Figure 12. Mariano di Jacopo il Taccola, *De ingeneis*, Codex Monacensis 197, f. 86v and f. 86r (details), Bayerische Staatsbibliothek.

[Image redacted]

Figure 13. Francesco di Giorgio, *Opusculum de architectura*, f. 35r, British Museum.

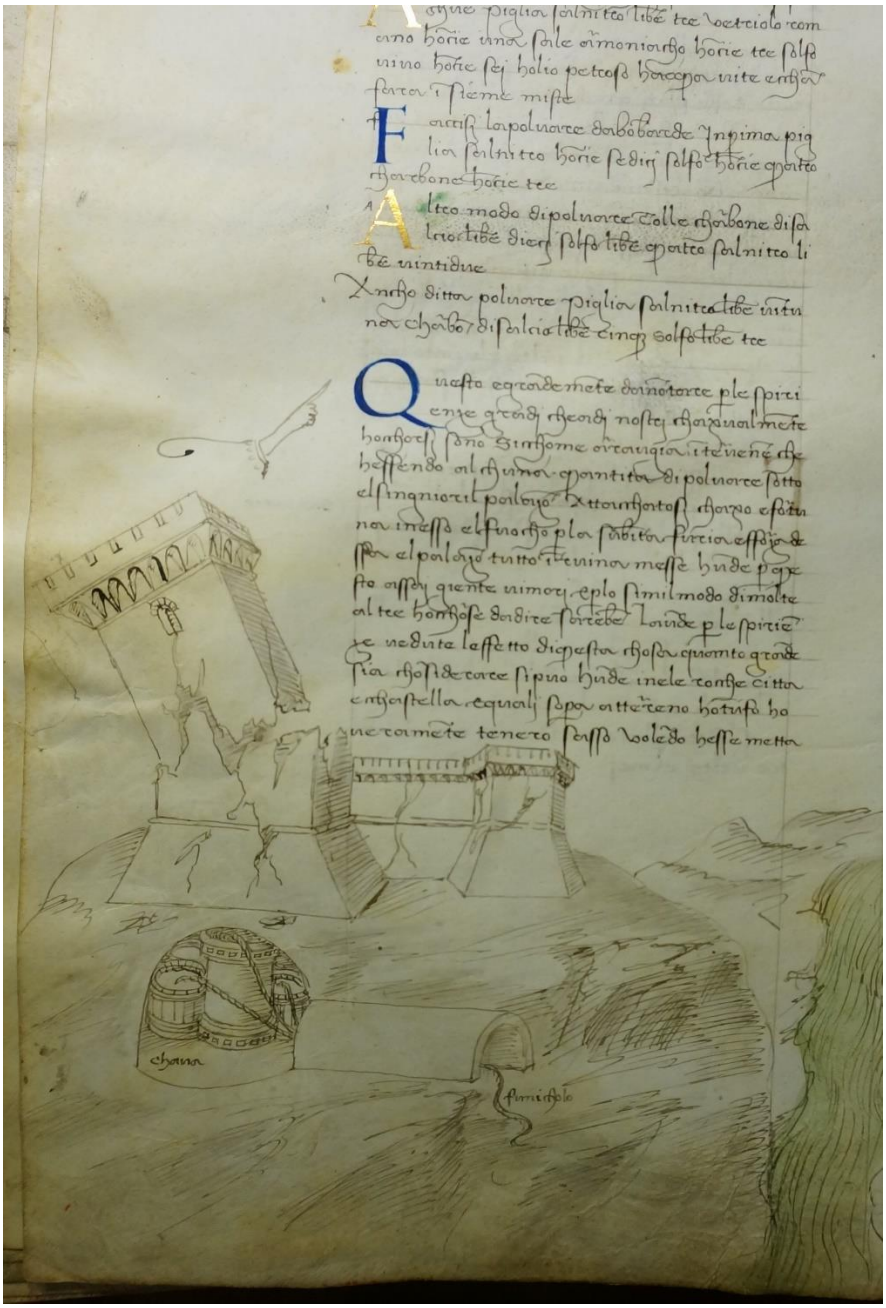

Figure 14. Francesco di Giorgio, Codex Saluzzo 148 f.55v (detail), Biblioteca Reale, Turin. (Photograph by Author).

Figure 15. Francesco di Giorgio, Codex Saluzzo 148, f. 10 (detail), Biblioteca Reale, Turin. (Photograph by Author).

[Image redacted]

Figure 16. Francesco di Giorgio, Codex Ashburnham 361, f. 28v (detail), Biblioteca Medicea, Florence.

Figure 17. Francesco di Giorgio, Codex Saluzzo 148, f. 28v (detail), Biblioteca Reale, Turin. (Photograph by Author).

Figure 18. Francesco di Giorgio, Codex Saluzzo 148, f. 28v (detail), Biblioteca Reale, Turin. (Photograph by Author).

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Figure 19. Mariano di Jacopo il Taccola, *De ingeneis,* Codex Monacensis 197 f. 36v, Bayerische Staatsbibliothek, Munich.

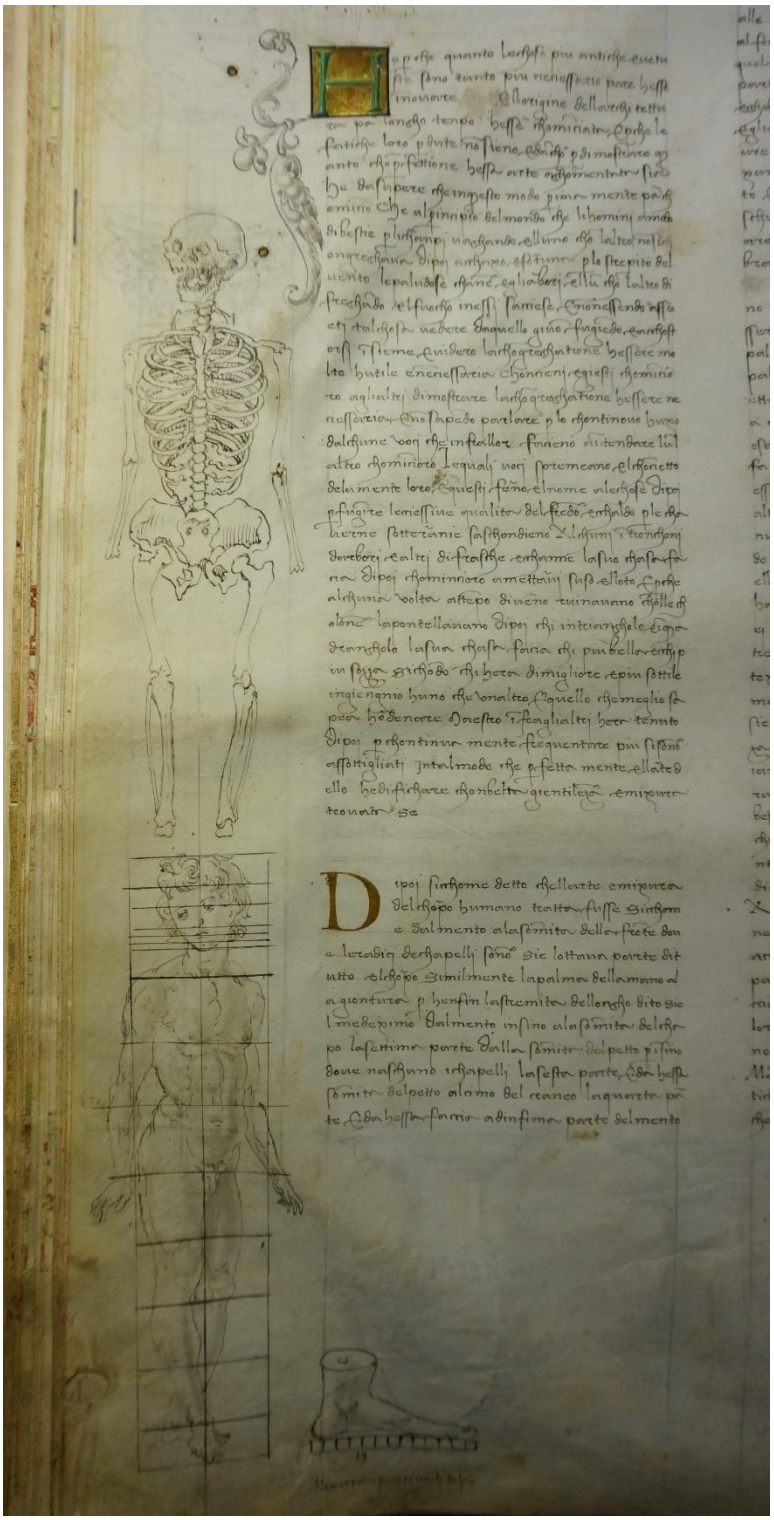

Figure 20. Francesco di Giorgio, Codex Saluzzo 148, f.16v (detail), Biblioteca Reale, Turin. (Photograph by Author).

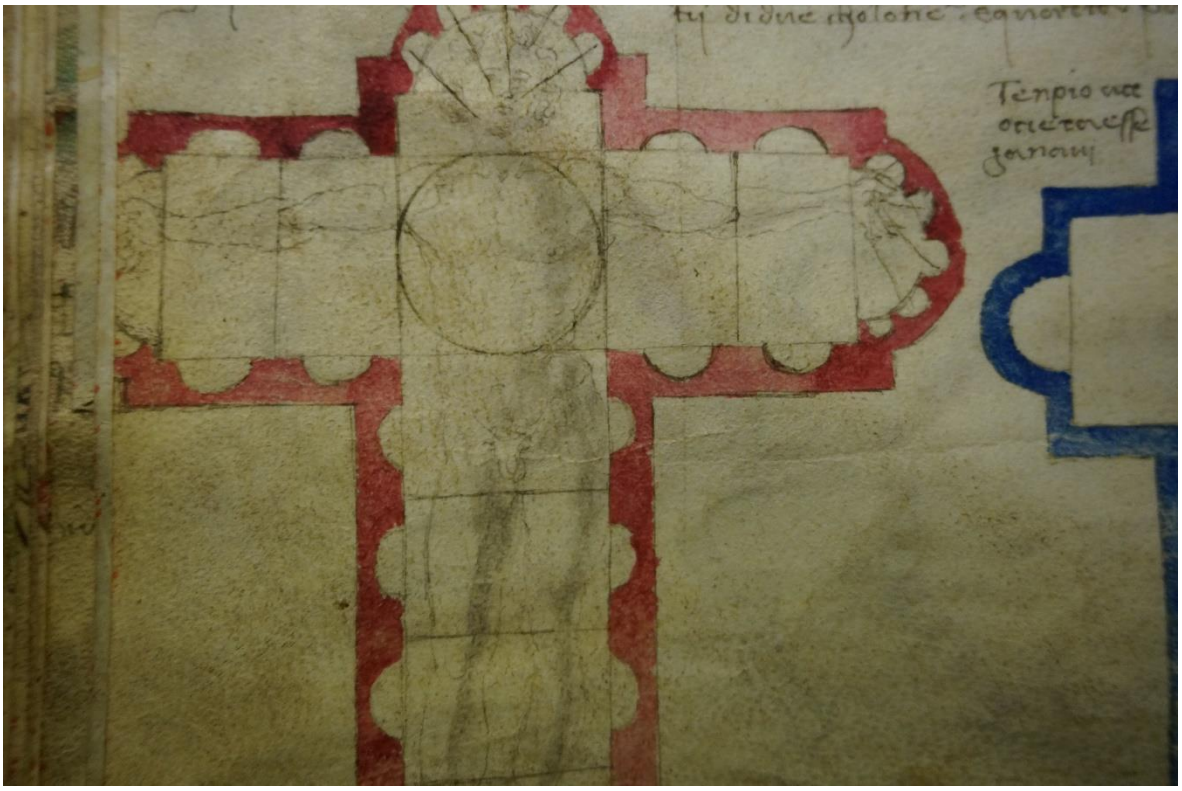

Figure 21. Francesco di Giorgio, Codex Saluzzo 148, f.11v (detail), Biblioteca Reale, Turin. (Photograph by Author).