

Proceedings

Imagination and Images: From the Treatise to the Digital Representation. Sforzinda and the Bridges in the Inda Valley [†]

Caterina Palestini

Dipartimento di Architettura, Università degli Studi “G. d’ Annunzio”, 65123 Pescara, Italy;
caterinapalestini@libero.it; Tel.: +39-3471-933-643

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Abstract: The allegorical-narrative dimension theorized in “Architecture” of Antonio Averlino contains a lot of research ideas to examine, from the point of view of representation, the way of communicating the configuration of an ideal city. In the work, philosophical dissertations and technical aspects intersect in a narrative path marked by images. The objective of the work is to retrace the work by analyzing it through the drawing with three-dimensional study models that allow to explore, in the digital dimension, the places and architectures imagined by the author, his narrative and design paths underlying utopian visions and presumable reality, thus orienting the inventive to other possible images communicated with interactive representations.

Keywords: representation; utopia; ideal city; treatise; bridges

1. Introduction

In “*Libro architettonico*” composed of XXIV volumes, written between 1458 and 1464, Antonio Averlino, called Filarete, outlines the project for a new city. The original narration employs a divulgative literary formula that allows the enlightened creator to communicate historical, political, and social issues of his time by providing advanced urbanistic solutions and archetypal models.

The constructive aspects of utopic city are expounded through images intersecting with philosophical discourses and with the imagination of the author who in his imagination spans in various fields to promote it to his lord, fully interpreting the cultural role attributed to the Renaissance architect.

The work initially dedicated to Francesco Sforza, composed in dialogue form between *Onitona*, anagrammed name of the architect, and the young Duke Galeazzo Sforza, written in vulgar language for favoring the diffusion, proposes technical explanations and images about the ways of edifying.

The different types of buildings considered by the functions to be performed are configured with shapes, proportions and measures that can be attributed to the ambitious project of an ideal city closely related to the architectural conceptions of the time.

The writing of the architectural work, in its allegorical narrative form, had to fulfill the dual aim of enhancing the prestige of the commissioner and the immortality of the author, and that is why in 1466, in the complete work, is inserted the last book, the XXV, in which the dedication to Piero de’Medici is added. The full manuscript, listed in the Magliabechiano Code, allows to grasp the political change and the attempt of Filarete to propose himself to a new patron.

The themes of the conference invites to re-read some of the pieces of the work that provide narrative-visual views of Renaissance culture, considering images and texts being analyzed at the same time in order to be understood and explored in the digital dimension. The purpose is to retrace

and interpret, through new representations, the drawings, the narratives and the conceptual contents expressed in the utopian Sforzinda idea.

The figurative figures of the Magliabechiano Code, fully reported in the Anastatic edition of Polifilo with critical introduction by Liliana Grassi, allow to fully grasp the relationship between text and images, outlined in the propaedeutic setting of the narrative sequence.

In the first tables, the measurements and the graphic representation of the “piè” (the foot) are to be used as a metric reference in the architectural design that symbolically marks the start with Adam thrown out of Paradise. This latter, defending himself with his hands “...*fattosi tetto con le mani*” was the first land architect, the inventor of the hut; then follow the images of the first habitations of the inhabitants of the woods to get to the descent of the Sforzinda site in the Inda valley.

Starting from the choice of the location, protected by winds and crossed by streams of water, Filarete describes the theoretical and practical motivations that led him to position the city at the confluence of two river branches in the Inda valley. The site is depicted in an emblematic overview revealing the map that reveals the geometric perfection of its shape inserted in the hollow hilly landscape reproduced, antithetically, pseudo-prospectively with chiaroscuro effects. Natural and metaphoric elements complement the panoramic scene where the archetype of the hut appears, halfway between architecture and nature, and the trees distributed in harmonious sequences between the sinuous settings.

The creator figuratively establishes the reaction with the water streams in the chosen valley. The importance of the water resources for the different needs of the civil and productive life of the community is revealed in the image, where the rivers dominate the scene, and in the text where their presence is decisive for urban planning and for the power of a canal, governed by aqueducts and locks that are capable of meeting the energy needs of the different machines.

In this regard, the reference to the urban conception of Leonardo, which puts its ideal city on the banks of the Ticino, is based on an ingenious system of navigable channels in which architecture, mechanics and hydraulics contribute to define a public project based on order and rationality.

Different expressive formulas characterize the symbolic images of Filarete that specify the interest for hydraulic engineering, and in particular for the covered bridges that his lord prefers. He devotes a large space to this infrastructure, useful for connection and the defense, citing some ancient examples and then passing on the description of those to be done in the Valley of Inda. He designed three on the river Indo and one on the Averlo, about which he provides descriptions, measurements, number of spans and systems for the construction of scaffolding and foundations that derive inspiration from constructive techniques referred to in previous and coexisting treatises.

The bridges are shown in prospective views that enhance the monumentality of the turreted structures put to connect the crossing points and entrance to the city. The pictures show the fairy-tale palaces with pinnacles, which on the one hand recall the fantastic towers of Babel and on the other, reflect the constructive concreteness of the tower made in 1452 for the Sforzesco Castel in Milan.

The study, considering the cultural and ideological context in which the treaty is placed, retraces the texts by analyzing the indications contained in them with the objective of reconfiguring, in digital dimension, the places and architectures imagined by the author, his project intentions that underlie utopian and imaginable visions, thus orienting the imagination to other possible images that can be communicated with new interactive representations.

2. Sforzinda and the Design of the City

The Sforzinda compositional urban design as stated in the introduction, is communicated by the author with a narrative path that expounds the cultural and technical intentions used to outline the design of the ideal city. In order to clarify the methodology of work, there will be synthetic places, explanatory passages that will combine the graphic reconstructions that allow to understand the logic and the steps that support the final design.

“...Sì che io intendo adesso di principiare il disegno della sopradetta città, il quale disegno appellerò «Averliano» e la città appelleremo «Sforzinda», la quale edificheremo in questa forma. Ed eleggerò il

sito, il quale io ho già veduto ed esaminato più volte; e acciò che tu ancora lo intenda, te lo descriverò per modo che tu lo potrai intendere e vedere chiaramente...” (Libro II, p. 53).

The city, as indicated, had to arise in an ideal place, the Valley of Inda, crossed by streams of water and protected by winds.

“...Il sito ch’io ho visto si è che a me pare che questa città sia ben posta. Il luogo salubre, cioè sano, e anche fertile e <ameno> al vivere umano si è questo il quale al presente ti descriverò. Ell’è una valle circondata da monti, e dalla parte meridiana e’ monti sono più alti, in modo che quello vento, il quale si chiama Austro, né Affrico, né Notto, non gli possono offendere; Euro, Sussolano, Vulturno ancora; è assai difesa per rispetto de’ monti orientali. Le parti occidentali sono alquanto più basse, Zefiro e Circio e Favonio assai temperatamente ci spirano. Maisi, che la parte settentrionale Borea con Aquilone ed Eurus pure alquanto a certi tempi con più ardore la vicitano che nessuno degli altri...” (Libro II, p. 54).

The founding date was indicated by an astrologer, and the same stellar plant probably results from motivations of cosmic-geographic order associated with defensive issues.

“...Quando la fonderemo, allora ti dirò sotto che clima, e pianeta, e punto, e ora, e tutto quello che sarà mestiere intendere, tutte le proprietà. Io ti narrerò tutto questo sito, come egli sta di punto, e quello che noi troviamo in questa valle, avisandoti che tutta la cercai...” (Libro II, p. 55).

The plant has a radial pattern: a star, generated by the intersection of two squares rotated by 45 degrees in a circle, to be made physically with a circular moat that delimits the urban nucleus. On the eight points of the figure are placed the towers and in the internal edges the doors, where roads depart likewise that converge in the central portico square. This last one, with a rectangular form, was supposed to be bordered by buildings destined to the most important civic functions: governmental, administrative, religious, and economic activities (Figure 1).

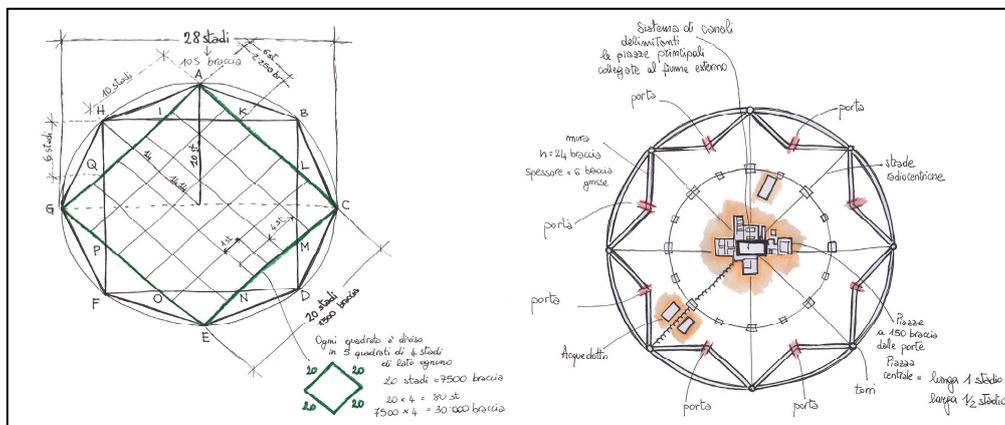


Figure 1. Modular and constructive schemes of the Sforzinda plant.

“...Io t’ho detto come io voglio mediante il potere dell’antedetto edificare questa città, e prima fare il mio disegno, il quale starà in questa forma e proporzione: la prima forma sarà due quadri a dosso l’uno all’altro, non incontrando gli angoli insieme, ma l’uno angolo verrà egualmente distante intra due angoli. Dell’uno e dell’altro quadro la proporzione angolare sarà di distanza tra l’uno angolo all’altro dieci stadii che è uno miglio e quarto, sì che sarà la circonferenza di questi due quadri <ottanta> stadii; il suo diametro sarà ventotto stadii. Sarà la circonferenza angolare ottanta stadii. Questa è la forma del disegno che io t’ho detto. E in ogni angolo io intendo fare tondo, cioè una torre tonda. E acciò che tu intenda la misura piccola del miglio e anche dello stadio, el miglio è tre milia braccia ed è, come t’ho detto, otto stadii sì che lo stadio viene a essere trecento settanta cinque braccia...” (Libro II, p. 60–61).

In the middle part, along the roads there are eight squares connected to each other by a concentric path, designed to accommodate specialized markets: in the east and west, straw and

timber; oil in the north and other furnishings; grain and wine in the south. In each square, as needed, there were various commercial activities, including the sale of meat. Also, other radio-centric axes, united the main square with the towers, on these paths there were widenings with parish churches and convents.

The radical tracks that led to the market squares were lined by a channel system connected to the outer river, joining in a ring around the main square. The function of these waterways was to easily transport freight. This idea has certainly been restored by the merchant system in use in the Republic of Venice and further expanded into the ideal city of Leonardo.

The central square was configured in a rectangle proportional to a ratio of 1:2 with sides of one hundred and fifty for three hundred arms.

It is important to insert the modular lattices used to shape spaces and buildings. The table that exposes the city plans includes, for example, the scales of "parelli" for scale representation, a dense quadrature consisting of "stadi" equivalent to 375 arms each acting as a metric grid.

Around the main square, at the extremities of which stood the palace of the prince and the cathedral with the office of the bishop, there were two smaller spaces on which the other public buildings and among these the town hall, the palace of Podestà, and that of the captain, joined by the prison, customs, mint, the butcher's, public baths, inns and the brothel. The two smaller squares, in addition, hosted, respectively, the market for grocery food and other goods.

"...Perché intenda bene quello che per lo disegno ti voglio mostrare, mia intenzione non è di fare in esso se none d'ogni edificio uno, cioè d'ogni forma e d'ogni ragione d'edificii, come una chiesa, e uno palazzo da signore, e uno da gentile uomo, e uno da officii, e case private. Uno gliene farò ancora d'alcuni edificii i quali intendo poi nella città edificare, in modo che ciascheduno gli potrà bene intendere per misure e proporzioni e qualità, secondo che a ciascheduno s'aparterrà: tu il vedrai tutto squadrato in prima, e poi ogni edificio al luogo suo posto."

"...Le mura prima ottangulate saranno grosse braccia sei, e alte voglio che siano quattro volte quanto sono grosse. Le porti saranno negli angoli non retti; poi le strade si partiranno dalle porte e andranno tutte al centro. E quivi farò la piazza, la quale sarà per lunghezza uno stadio, e pel largo sarà mezzo stadio. E in testa d'essa sarà la chiesa cattedrale colle sue appartenenze. Dall'altra testa sarà la corte, cioè il palazzo signorile, e ancora gli altri palazzi appartenenti, come quello del podestà e quello del capitano, con tutte quelle cose che a loro s'appartiene. Sarà in mezzo della detta piazza una torre, fatta a mio modo, alta tanto che per essa si discernerà el paese. Poi faremo dall'un canto all'altro della piazza due altre piazze: cioè una per li mercatanti, l'altra per fare il mercato delle cose meccaniche, cioè delle cose che bisognano per vivere. E in su questa risponderà il palazzo del capitano, e in su l'altra risponderà quello del podestà..." (Libro II, p. 63).

In the hypocritical dialogues between the architect and the client, in which Filarete demonstrates his intellectual knowledge, the spaces and the design of Sforzinda are gradually formed, resulting from the conjunction between aspiration to classical antiquity and cohesive ideology, developed with the help of the humanist, Francesco Filelfo.

A detailed urbanistic and architectural design with a popular cultural substrate that considers philosophical ideals without neglecting the practical aspects of everyday life, regarding public hygiene, internal safety, and defense. It is no coincidence that, on the subject of defense and the connections of the city, he opens the discourse on the bridges that are commissioned by his lord in the ancient way "al modo antico" (Libro XIII).

The interview reveals the interest of the client for the bridges, especially those who fulfill the dual function of defense and connection, to which the commercial aspect is associated.

In this regard, it is taken as example the covered bridges of Pavia, of medieval origin; the bridges of Florence, as that of the Grazie of 1237, that got its name from a chapel dedicated to the Madonna, erected on a pillar of the bridge and then destroyed and rebuilt in modern forms; the Vecchio bridge of Roman origin, more than once destroyed and reconstructed; the Saint Trinita' bridge and the bridge at Carraia. The bridges of Mantova are also quoted as the "bridge of Porta Molina", a covered structure of the XI century stretching between "the upper lake and the middle lake" consisting of a

succession of mills. Mantova, originally surrounded by four lakes formed by the Mincio River, constituted a concrete and perfect reference to the amenity of the places, in relation to the water resources benefited by the city, bordered by the waters and in turn connected with the island of Teleto, chosen by the Gonzaga to implant the Palace. There are also the bridges of Rome, in particular the Saint Peter bridge, or Elio's also depicted with the parapet pillars. The bridges, reviewed and examined in various respects, formal and constructive, constitute the reference and insights for designing those to be made for the connections and defenses of Sforzinda, so he proposes several models of which three on the Indo and one on the Averlo, not all described in the text.

The bridges on the Indo are represented in the tables, depicted prospectively with tower-like palaces at the extremities, of which, for example, also portrays constructive details such as a poplar shuttering with iron tips for foundations of piles. He illustrates the "Castello" system for the sinking and laying of the structures. In this case, he associates with the exhaustive perspective view, a plan in which it is possible to understand the modularity and the form of the powerful foundations.

3. The Bridges on the Indo River

Referring to the description of the bridges on the Indo, in particular one of them where there is useful information for the reconstruction of the digital model, the text shows that it had a total structure of 150 arms in which 7 arches were housed, of 18 arms wide with a height of 26 arms that ended laterally with two tower-like palaces "...a sostegno dello stesso ma anche belli da vedere...". He then provides the dimensions of the internal spaces with a schematic description of the rooms contained in the buildings that, from the crossing of the suspended part of the bridge, led to a large ground floor room; the latter had stairs to connect the upper floors with similar distribution, all ended with four corner towers joined by the terrace cover.

The room: "...divisa in due parti, a metà della quale sarebbero state posizionate due camere di 12 braccia una e 16 l'altra..." "e sopra le quali si sarebbe posta un'altra sala di 14 braccia, con stanze divise in egual maniera.." (Figures 2–4)

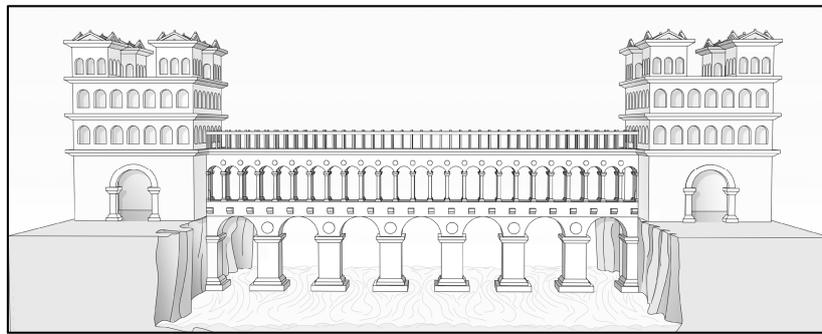


Figure 2. The bridge on the River Indo, 3D reconstruction corresponding to the view in the treatise.

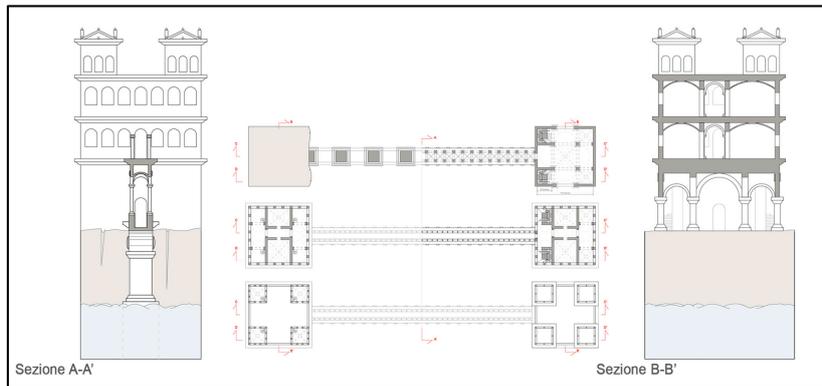


Figure 3. The bridge on the River Indo, reconstruction in scale and cross sections.

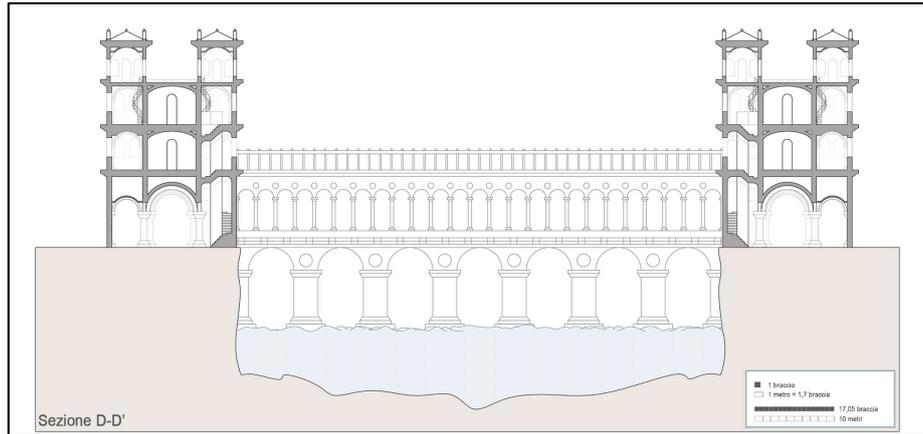


Figure 4. The bridge on the River Indo, longitudinal section.

Also sets the features of the most essential and strongest bridge on the Averlo (Figure 5) that should have had a length equal to “150 braccia, con 5 archi di 16 braccia di vano l’uno, con pile grosse 12.5 braccia, alto 40 braccia e profondo 14 ” with lateral buildings supported “di base ferro in modo tale che si saldino nel fondo del fiume, usando il pioppo. Queste non avranno fondo, si infileranno nel terreno grazie all’ausilio di due navi dotate di un marchingegno che metterà la cassa nel fiume...”.

In addition to the description of the various structures and their laying work, he concentrates carefully on the techniques to make the foundations made of lumber that, depending on the type of soil, could have been compacted by stone flakes and poles: “farà delle casse di legname con punti di volta messe giù, svuoterà tutta l’acqua all’interno e una volta giunti al fondo, farà scavare fino a quando troverà un buon terreno. In caso contrario inserirà dei pali nel fondo e tra i pali metterà scaglie di pietra per rendere il tutto più stabile. Sopra le sca glie di pietra metterà tavole in rovere e poi altre pietre e tra le pietre inserirà della ghiaia. Tutti i ferramenti verranno fatti di bronzo, per essere più duraturi ” “Da una pila all’altra inserirà un muro lungo 10 braccia e largo quanto la distanza tra le pile. In questo metterà travi di rovere incatenate da una pila all’altra” (p. 364 v. 20).

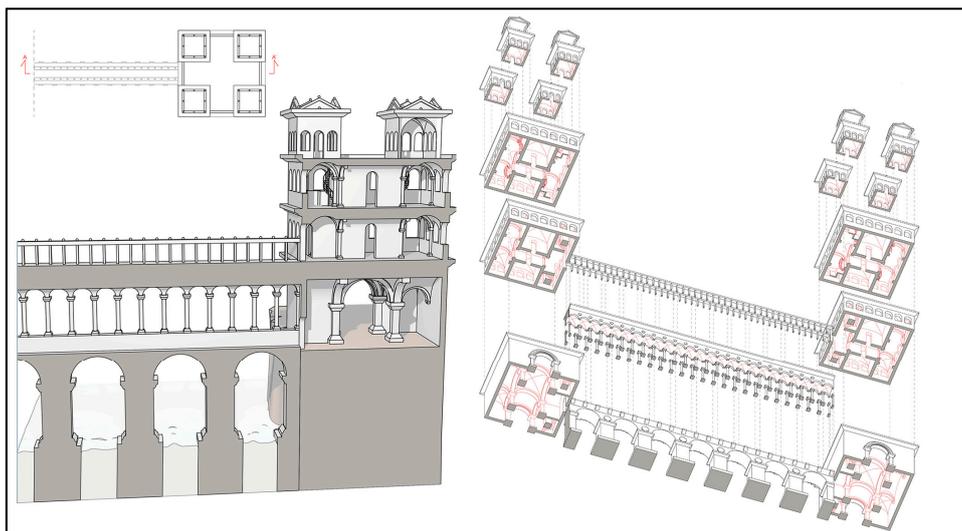


Figure 5. The bridge on the River Indo, three-dimensional sections and exploded view.

It is also proposed in the work the construction of a maritime city for which the Filarete had predicted a bridge made up of two arches. “Qui dove il fiume si restringe in 100 braccia, inserirà due archi di 40 braccia l’uno, in cui la pila centrale sarà grossa 20 braccia, con un’altezza totale di 40 braccia...” Al di sopra di questo primo ponte ne prevede un altro utile in caso di piene: “lungo 200 braccia, con archi larghi 20 braccia, alto 100 braccia, in cui ogni abitazione è alta 20 braccia con volte di 1 braccio e mezzo...”.

From what was analyzed, the desire of the architect emerges to provide indications and constructive solutions for the different needs with differentiated approaches: from historical quotation, to compositional models, to technical explanations for the executive realization. This approach that falls from the overall urban criteria in the urban context, in some cases up to the architectural detail, is a constant feature of the technical references to the text, in which there are continuous mentions to the perspective construction applied to geometric figures “...tracciamento di figure per successione di punti...” “...per via di scorcio...” “...tracciamento del quadrato per successione di punti e metodo per ridurlo proporzionalmente”. It is symptomatic in this regard the example of the visual pyramid and the diagram referring to “costruzione legittima”.

The richness of the topics contained in the treaty, in which the lines lay complex notions that refer to various possible fields of study, and was analyzed and summarized in relation to the theme of the bridges, subject to the subsequent graphic reconfiguration.

4. From the Treatise to Digital Reconstruction: Results and Conclusions

The phase of the reconstruction that, from the treatise leads to the reconstruction with digital models, provides a working method that, starting from the information contained in original texts and representations, allows to explore the spaces described in three dimensions, obtaining further explanatory images.

As an indication, the case study is carried out on one of the bridges of the Indo bridge, located near one of the ports of Sforzinda, replicable for other buildings proposed in the treatise. This instance gave, as a first result, the possibility to understand the treatise through graphic analysis. Starting from the indications on the anthropometric proportions adopted, the compositional plot is based on regular geometric forms, in this case the square modulated in its harmonic successions.

The new images that accompany the text provide the various steps taken to reach the three-dimensional model and a movie that allows to enter in the Filarete’s spaces, particularly in the bridge explored in the Valley of the Inda valley (Figures 5 and 6). The position of the other bridges, located according to the directions given by the author, was also hypothesized, with respect to the city map.

In conclusion, the main result is to perceptively give the forms and concepts contained in the treatise (Figures 7 and 8) by describing them by graphic representation, which, by its immediacy, can offer new reading keys to understand and communicate the principles underlying the complex concepts of the treatise, useful for scientific, educational and training purposes.



Figure 6. The bridge on the River Indo, video sequences.

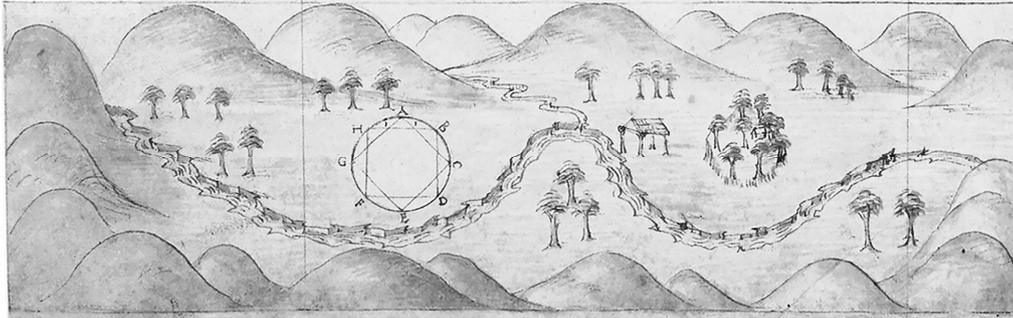


Figure 7. Site of Sforzinda from: Trattato di Architettura (Book 1, f.11 v.) ed. Il Polifilo 1972.

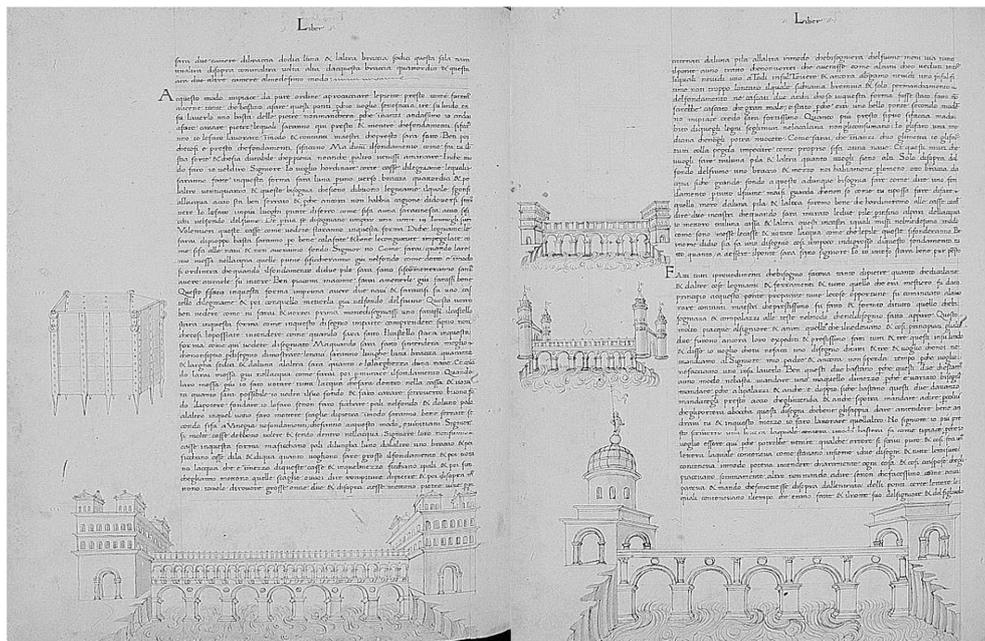


Figure 8. Tables of Trattato di Architettura (Book X, f.94 v.-f.95 v.) ed. Il Polifilo 1972.

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Conflicts of Interest: The authors declare no conflict of interest.

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