Early Modern Emulation as Contemporary Representation

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Introduction

The architect Sebastiano Serlio linked the act-of-drawing to the act-of-knowing by devising a theory of ‘linee occulte,’ or hidden lines, which connected the material world to the neo-platonic one [1,2,3,4]. It consisted of drawing vertex-based hidden lines to form a nexus of polygonal lines, making it geometric. The use of such a geometric system is important for two reasons. First, because it allows representing the architects' ideas—here, representing models or depicting a thing or someone, but, also relates to a concept or mental state for the perception of things [5]. As such, architecture as a representative discipline acts on both the physical and the conceptual level. Second, in the early modern period, nature was considered as the rudimentary building block of the universe, which, in its primordial state was envisioned as a geometrical constellation [6,7,8].

Often, historical thinking is considered to be an act of reminiscence, which nostalgically looks back to the past. However, such a forlorn approach feeds historicist thinking, does not inform the present, and outlives its use. In opposition, one can relate present-day changes to historic shifts and patterns. Such a topical value can be traced in Serlio’s work and underpins the reason of this inquiry. Serlio devised his geometric system as a tool for drawing, but also as a creative instrument, which allowed creating architecture in analogy to the universe. Before one can elaborate on this matter, however, one must highlight the fact that emulating formed part of learning in the early modern period. Moreover, emulation as a particular form of copying intertwines with Serlio’s work and remains understudied. Nonetheless the ‘emulatory’ element binds Serlio’s theory to the present, marking his writing as relevant. Emulating implies—in a historical sense—the matching or surpassing of an achievement through copying, while, as a computational term, it denotes the reproduction of a function by a different computer or software system [9]. Fundamental to the emulation is that it is a particular copy, which utilizes technology to question current ontologies: Otherwise, it would remain a mere copy.

Serlio’s drawings form the basis of emulation as contemporary representation by using 3D scanners, which extract point cloud-based data from an object through spectral imaging. Thus, ‘linee occulte’ informs how the technology and narratives of drawing establish a symbiosis between drawing as a tool-of-doing and an instrument-of-knowing. Engaging with Serlio’s drawings through 3D scanning allows technological immersing with historic drawings and questions the state of
architectural representation. This paper combines historical interpretative methods with 3D scanning and CAD (Computer-Aided Design). By bringing together historical, geometric, and architectural CAD skills, Serlio’s ‘linee occulte’ are examined in a contemporary context, which considers history in relation to the digital renaissance. CAD drawing as a form of inquiry is not new and its rudiments trace back to Rudolf Wittkower’s analogue diagrams as published in his Architectural Principles [10, 11, 12, 13]. In many respects, Wittkower’s writing is still relevant today, although the ‘Wittkowerian’ diagram is sometimes perceived as reductionist. As such, Howard and Longair claim this does not lead to a comprehension of harmonic principles [14], while Vidler and Hight relate Wittkower’s approach to modernist logic rather than Renaissance reasoning [15, 16]. Yet, when one uses drawing as an inquiry in the field of architecture, one cannot get around Wittkower, as he formed the basis of later drawing scholarship. Furthermore, when drawing a historic subject, one must reflect on the notions of representation and copying. As such, it is almost impossible to ignore Walter Benjamin’s writing on this subject [17]. Moreover, when dealing with the ontologies of architectural reproducibility – or the production of copies – many scholars still swear by Benjamin [18,19,20]. However, the present day substantially differs from Benjamin’s time, and the principle of mechanical reproduction can be misleading, [21, 22] particularly in respect to the second digital turn of the recent years. In placing both Wittkower and Benjamin as a starting point in a digital context, the notion of the architectural drawing and its representation calls for refinement.

Roger Malina outlined that mechanical production, consisting of prints, photographs, and films, no longer applies in the digital era [23]. Malina themed the new evolution a post-mechanical one, where digital media allows generative reproduction, which codifies algorithmic aesthetics stating; “not only is the software the art, but the behavior of that software constitutes the work of art in the age of post-mechanical reproduction” [24]. Malina wrote his text at the time the world wide web and parametrics emerged, and ever since takes a prominent position in art history. However, Malina was not in a position to differentiate digital ontologies, such as cybernetics and artificial intelligence (AI). Cybernetics deals with digital systems, which simulate or produce machines and devices based on living organisms, or biological reproducibility. It includes fields such as robotics, where cybernetic systems remain discerned and controlled by the human mind [25]. In contrast stands AI, where computers simulate intelligent behavior [26]. The sets of algorithmic functions allow AI to mimic and seemingly surpass human intelligence with calculations, which the human mind cannot grasp, nor exhaustively explain, due to the complexity of generative computation. This level of digital reproducibility has only recently been explored and machine creativity remains part of the reproduction asides the generative [27].

New technologies such as 3D scanning allows questionning and developing cybernetic and AI approaches. 3D scanning is a surveying tool which collects raw data point clouds, either through structured-light scanners, which detect light distortion, or through remote sensing devices, such as LiDAR (Light Detection and Ranging), which measures light refraction. This implies 3D scanning itself is not exclusive to cybernetics or AI. The maneuvering of the scanning device during the data-capturing process becomes a bionic extension of the human body. The scanner extends the human arm grasping to distances which the human body cannot reach. At the same time, the scanner’s multi-spectral gaze scrapes data from surfaces unperceivable and unexplored to the human eye. The resulting point cloud output, as encoded data-sets,
allows algorithmic altering. The data can be reverse engineered, a process which relies much on cybernetics. When exposed to AI deep-learning algorithms, the data feeds into machine-learning, pattern recognition, and generative creation. My forensic method discerns processes of architectural drawing by anatomizing the skin of architectural orders in order to understand their skeleton, that is, architecture’s inner composition of linee occulte. Even though resembling reverse engineering, I designate my approach ‘reverse design’, since I probe past drawing processes in order to interpret drawn morphologies. This type of digital reproducibility remains within the scope of human comprehension and relates more to cybernetics.

As a response to the imposing change of the second digital turn, some authors have tried addressing its representational repercussion in the recent past. Remarkably, two of these writers are also prominent Serlio scholars, namely, the art historian John Onians and the architectural historian and writer Mario Carpo [28,29]. Both Onians and Carpo address scientific and technological shifts in architecture and art history. For instance, Carpo describes Serlio’s xylographs for conceiving his architectural prints as ‘designed for reproducibility,’ hinting at Benjamin [30]. Beyond Serlio, Carpo also links the Renaissance technological evolution and the effect on the architectural representation to digital shifts [31,32]. In contrast stands Onians’ writing, who is most famed for his neuro-art-historical approach, which provides insight into neuro-aesthetic approaches to art and art history [33, 34, 35, 36, 37, 38, 39]. Even though both write on Serlio and on paradigmatic evolutions in art and architecture, their writing diverges. Whereas Carpo writes on the impact of the technological, Onians writes about the mental and the (sub)consciousness in architectural design [40, 41, 42, 43]. One can perhaps even state that Carpo is inclined to the pragmatic side, omitting the Ideas of representation, while Onians does the exact opposite, writing primarily about mental perception.

Combining both the Idea and the pragmatic aspect permits reflecting on the production and the ‘being’ of representations. This is where 3D scanning comes in. As a product of the techno-scientific revolution, 3D scanning computes real-life objects in a virtual realm. The obtained data transmits points and vectors into a universal system. The scan infuses measurable and quantifiable units, which are Idealized due to their rudimentary vector state. The study of the universality of a Renaissance subject implies holding relevance to the present, otherwise it negates universality. Moreover, the all-encompassing embodies a shift from linear to variable thinking, known as quantum-thinking, and produces meaning on a holistic physical level [44, 45, 46]. Quantum-thinking elevates 3D scanning from its surveying origin, allowing the point cloud to be researched from a narrative point of view. As such, a parallel with the so-called digital renaissance can be drawn, making historically scanned images contemporary representations through the technological implications imposed by architectural producibility. Emulating historic drawings does not only serve as an analytical and didactic tool, since these form new creative and intellectual images. Therefore, the focus on Serlio’s linee occulte allows discerning how theory helps elevate the digital tool into an instrument of architectural invention. By applying 3D scanning, new types of historical perception are unveiled through a digital renaissance lens and act as a form of creative practice.

Early Modern Emulation
Sebastiano Serlio (1475-1554), the famed Bolognese architect who worked in Rome, Venice and France, makes an ideal case study [47, 48]. In his time, Serlio was regarded as an important architect known as ‘pintre et architecteur du roy’—the King’s painter and architect—at the court of Francis I of France [49]. The most important of Serlio’s built contributions include works on the Château de Fontainebleau, most famously, the Salle du Bal [50, 51]. However, through time, most of Serlio’s buildings underwent heavy alteration, making it difficult to see how Serlio practiced architecture. The exception to this is the Château d’Ancy-le-Franc, built for Antoine III de Clermont-Tallard, family to Diane de Poitiers, the famous mistress of Henry II [52]. But first and foremost, and beyond building, Serlio’s name lives due to the treatises he published from 1537 onwards [53]. These treatises were particularly important for the propagation of Renaissance architectural representations and theory throughout Europe [54, 55]. Serlio’s revolutionary usage of xylography in his treatises made him the first classical architect to consistently use scale in architectural prints to form his own theory by combining text and illustration [56, 57, 58].

The fact that Serlio used scale and measurements in his treatises remains particularly relevant because his writing addressed the issue of accurately representing architectural ideas on paper, an element that still impacts dealing with clients and contractors today. Translating an easily communicated idea into a concept does not mean it is buildable. However, to realize a buildable concept, the idea needs relying on a coherent system of conventions by demarking scale and standardizing units. Such measured demarcations in architecture use modularity, usually based on multiples and divisions of 30. As such, coordinate-based modularity transfers architectural ideas into easily discernible, buildable, plans. In the early modern period, this modularity was no different, since the common way of design applied the “module,” as seen in Serlio’s Regole Generali on the orders [59]. But how does measuring relate to emulating? Emulation, as a particular genus of copy, seeks to match or surpass that which is being reproduced [60]. Moreover, copying, as a common early modern practice, sought to imitate and surpass the buildings and principles of antiquity [61, 62]. Exemplary are the copies and measured drawings in which architects and masons looked back at former achievements. First, emulating meant gaining drawing experience in using proportion by both the ancients and the moderns. The gained insight could then be used for one’s own architectural conception. As such, emulation formed a proactive part of the architectural ontologies by applying historical knowledge. Ontological, because the architects’ engagement with history permitted appropriating knowledge and power over the antiquities, which then facilitates contemporary needs by amending preexisting ideas. The principle of decorum, or propriety, already mentioned by Vitruvius allowed building classical temples [63] despite the fact that the temples of the pagan gods had no place in early modern society, which only venerated one God. However, monotheist belief did not prevent architects and humanists from using decorum. Rather, the early moderns reinterpreted decorum to suit the needs of the then current belief [64]. Serlio modernized decorum by aligning it with secular buildings and the status of patrons [65]. As such, emulating always embeds the historical and the contemporary. This is because the emulation has to copy something that came before, while it also adds something to the narrative of that which is copied. Emulation relies on appropriating, matching, reflecting, and surpassing history, thus making it a contemporary act.

Serlio’s Terzo Libro on antiquities, first published in 1540 [66], shows traces of emulation. When Serlio drew the colosseum, he measured its ratios and proportions
In its most rudimentary interpretation, Serlio’s measured drawing remains a type of copy, but is not necessarily ‘emulatory,’ since a copy’s aim is not necessarily to understand the original. However, Serlio described the roman palms, the lighting condition, the seating, the construction of staircases, and the placing of stones to provide drainage of water and urine to not ‘inconvenience anyone’ [67]. This implies that Serlio not only measured but also tried to understand the tectonics—that is the structural principle in use and design—of the colosseum. Discerning the edifice becomes even more evident in how Serlio composed the plan of the colosseum (see figure 2). Collating the four measured plans into one allows easy reading of the planimetric relationships [68, 69]. Serlio’s plan allows us to perceive the colosseum in a way the physical site does not, unlike his elevation drawings. Serlio’s particular composition of four plans allows comparing and superimposing the structure in one plan, which gives a glimpse of the colosseum’s tectonics.

Fig. 1 Elevation and details of the colosseum. Serlio, (1569). De Architectura, Venice: Saraceni Giovanni Carlo De Franciscis, fol. 133, ETH-Bibliothek Zürich, Rar 9270 q, http://dx.doi.org/10.3931/e-rara-12168.
Fig. 2 Plan and details of the colosseum. S. Serlio, (1569). De Architectura, Venice: Saraceni Giovanni Carlo De Franciscis, fol. 128, 129. ETH-Bibliothek Zürich, Rar 9270 q. http://dx.doi.org/10.3931/e-rara-12168.
However, so far, the result remains a measured drawing. What makes Serlio's measured drawing an emulation is the reasoned justification Serlio adheres to his drawings of antique edifices and their compositions. To clarify, Serlio argues the orders used in the colosseum consist of the Doric, Ionic, Corinthian, and Composite, respectively [70]. Beyond providing the mere measurements, Serlio elaborates why every order classifies into that particular category. Serlio considers the lowermost order Doric, despite having no triglyphs, metopes, or guttae [71]. Serlio does not elaborate much on the Ionic and Corinthian, as these exemplify their order, but he explains the problems of what he perceives as a Composite. Serlio mentions that some of his contemporaries would categorize the uppermost 'Composite' order as 'Latin' or 'Italic,' and goes on that his categorization does not base itself on the capital, but on the corbelled frieze [72]. Serlio's deduction relies on his perception of the historic subject, which allowed him to formulate his argument in favor of the 'composite' by deriving knowledge from observation. Perception led Serlio to use the emulated observation as a model for his own Composite order (see Figure 3). Thus, Serlio looked at the past to come to new conclusions by measuring, analyzing and reflecting and can be found throughout his writings. The classical or historical resonated well with the then contemporary mannerist view, both morphologically and aesthetically, but entirely differ in its interpretation and use.

Fig. 3 Serlio's composite order. S. Serlio, (1569). De Architectura, Venice: Saraceni Giovanni Carlo De Franciscis, fol. 332. ETH-Bibliothek Zürich, Rar 9270 q, http://dx.doi.org/10.3931/e-rara-12168.
**Linee Occulte and Instrumentality**

Beyond emulating the antiquities, Serlio formulated his *linee occulte* – or hidden lines [73, 74, 75]. *Linee occulte*, as a series of guidelines, helps measure the historic subject, and the (re)construction of a drawing, to state it in today’s terms. Thus, such lines are relevant to the act of emulation, as they aid in the visualization of architectural principles. Furthermore, due to their existence as vectors, *linee occulte* make the representation, since these lines constitute the act of drawing. One must understand drawing not only as the drawn representation but also as the Idea drawn from the mind [76, 77]. Serlio’s theory of *linee occulte* strongly relates to the better known *lineamenti* of Leon Battista Alberti. These *lineamenti* are, according to Joseph Rykwert, ‘the lines and their placement which targets the essence of the act of drawing manifested through points, lines and surfaces’ [78]. But beyond drawing, Alberti distinguishes *lineamenti* from architectural matter stating ‘a building ... consists of *lineamenta* and *materia*’ [79]. Thus, both matter and *lineamenti* present themselves in a building, but *lineamenti* relate to the mind of the architect, while the design and material in turn, do so, to the tangible building.

In contrast, Serlio’s principle of *linee occulte*, as a continuous network of plans, and façades of buildings, as well as the space around it, includes the physical building [80, 81]. Beyond the physical building, Serlio describes these lines as: “all the lines which cannot be seen are *occulte*” [82]. With the term ‘hidden’, Serlio states “the continuous lines are those which form the circumferences, and the *linee occulte* of points show the inner parts’ meaning the geometrical construction of a building rather than that which one sees first” [83]. Clearly, Serlio’s *linee occulte* relate to Alberti’s *lineamenti*, but, also diverge from them, since Serlio also used *linee occulte* in built architecture. Further, Serlio differentiates *linee occulte* from *linee evidente* which correlates hidden geometry and perceivable design. In figure 4, the dotted lines represent the ‘*occulte*’ of what otherwise would exist as hidden geometry. In contrast stands figure 5, where the represented image erased the hidden lines, as they outlived their use, which results in a construction of ‘*linee evidente*’ or visible lines. Essential is that, after erasing these lines, the knowing architect still understands how to extract them. Serlio even states that, particularly the geometry of the hidden parts, gives most insight in architecture, explaining, “once a man is acquainted with ... hidden parts, ... [he] will make many things with a practice which, however, will have originated with theory” [84]. In this definition, *linee occulte* exists in the material world while still being hidden. Thus, *linee occulte* correspond to hidden systems which relate the platonic world of the mind with the physical world of matter. *Linee occulte*, beyond tools for drawing, also narrate architectural conception due to its embeddedness in theory. Serlio devised the principle of hidden lines as a way of constituting a drawing, or rather, constituting a preconceived architectural Idea into a drawing, thus the *linee* become instrumental to drawing. This means Serlio’s scholarship ontologically placed itself well in the context of the Renaissance as he used printing technology to make a new type of architectural representation [85]. Surely, the long-upheld tradition of single-leaflet prints predates Serlio’s publications, but Serlio invented this particular combination of scale, text, and representation in print [86]. As such, one must perceive Serlio as a contemporary architect in his time, who incorporated technological change into a theoretical narrative of hidden lines.
Fig. 4 Visualising Linee Occulte. S. Serlio, (1569). De Architectura, Venice: Saraceni Giovanni Carlo De Franciscis, fol. 43. ETH-Bibliothek Zürich, Rar 9270 q. http://dx.doi.org/10.3931/e-rara-12168.
Fig. 5 Visualising Linee Occulte. S. Serlio, (1569). De Architectura, Venice: Saraceni Giovanni Carlo De Franciscis, fol. 45. ETH-Bibliothek Zürich, Rar 9270 q. http://dx.doi.org/10.3931/e-rara-12168.

Contemporary Representation
Serlio’s work remains important for architectural representation and for discerning technological shifts because he embeds geometry within technology and ideology for creating images. Such geometric constitution remains important since architecture, as a derivative art, draws inspiration from nature. Wherein nature, stemming from its Pythagorean foundation, is the geometric constellation of the universe [87]. This principle of universality remained imminent to humanist thinking, due to the belief in the immanent nature of God [88]. When Serlio made use of points, lines, and planes, he made a constellation of vertexes and loci, all inherently geometric [89]. Through linee occulte, Serlio’s representations and treatises conform to universal principles, as their geometries imitate the nature of God’s creation. Serlio’s linee occulte, as geometric principles, translate into concepts and tangible drawings, whether used in a historical or in a contemporary context. Nevertheless, these geometries still hold relevance today since Serlio’s vector manipulation allows architectural creation similar to vector modification in the age of computation. Further, bringing together emulation and representation from a technological point has an interesting repercussion. Namely, current change in society is often themed as a digital renaissance [90, 91, 92]. Robin Wood names it a second renaissance:

“A renaissance is a moment of reframing. We step out of the frame as it is currently defined and see the whole picture in a new context. We can then play by new rules. We are currently living through a shift as profound as the original Renaissance. The equivalents of perspective painting are the holograph and virtual reality, which allow us to experience not only three dimensions, but to move through them in real time... In this new understanding, unlike that of earlier philosophers and scientists who attempted to comprehend a collective organism, every part of a system in some way reflects the whole thing. In the second Renaissance we are conscious of the fact that we are connected, and we take responsibility for the collective every time we make a personal choice” [93].

Further, Golding & Kuturna link the digital renaissance to the fourth industrial revolution hinting at AI and ‘learning machines’ [94]. Likewise, Tomás García Ferrari interrelate the fourth industrial revolution with ‘digital and biological spheres’ as well as 3D printers and genetic algorithms.’ [95]. The links between cybernetics, AI, the fourth industrial revolution and the digital renaissance hence come to light. Most history books describe the Renaissance and the early-modern as past existences, something that has been and never will be again. However, with the arrival of the digital shift, it appears the early modern Renaissance potentially connects to the present. Such a renaissance has nothing to do with issues of style or imposing a humanist revival, but rather implicates the Renaissance’s technological and intellectual developments. Thus, a ‘second renaissance’ transmits geometric principles through new technologies and new mindsets.

Even though Serlio emulated history, he always represented these antique edifices according to the latest fashion by using xylographs [96]. Like the early moderns, current society stands at a paradigmatic shift of the digital era which already affects architectural aesthetics [97, 98, 99]. But beyond the analogy of technological shifts, thinking about universal principles holds more relevance. As mentioned previously, Serlio’s linee occulte rely on geometry. The geometric vector is still key in architecture, as seen in CAD and the authority the cartesian coordinate system still holds for conceiving architectural drawings. A second, and perhaps more interesting, aspect of
the digital renaissance allows us to think about representing contemporary architecture through digital networks of loci and vertexes represented through lines and points. Serlio’s work, based on geometry and his *linee occulte*, forms an ideal case to explore contemporary shifts in the digital renaissance. By 3D scanning some of Serlio’s prints, the repercussion of digital technology on the ontology of representing architecture becomes clear.

3D scanning, whether through remote-sensing or structured-light scanning, emits its multi-spectral light source, including the visible light, but also spectra of infrared, ultraviolet, or any other, depending on the used machine, and peels information from the scanned object when the light touches its surface. The spectral aspect of 3D scanners allows engaging, protruding, and gazing onto the object extracting data never perceivable to the human eye—which it then transmits into a data point. The resulting data-set, a point cloud, becomes a virtual constellation of singular data points into a vertex-based coordinate system, creating a 3D digital scan. In Serlio’s case, the seemingly 2D paper print is 3D scanned. The result, unlike conventional computer scanners, creates a coordinate-based data set beyond the 2D pixel, which allows vectoral analysis, something a pixel-file does not. Visualizing point clouds in software, such as CloudCompare or Meshlab, allows altering data for inspection, perceives formerly unperceivable information, or any other required action.

Extracting the now-virtual ink of the virtual paper becomes possible because the scanner registers topological deviations of the paper with an accuracy up to 50 μm (0.05 mm). The micro-level accuracy of the scanner observes the paper folds and curvature, its grain, its flaws, and the ink. By applying scalar fields, the ink can be extracted and allows selecting the magnitude, or elevation height, of data. Then the ink or lines of the 3D scan can be transposed into CAD programs as loci. When importing loci in CAD, their fixed vector positions allow reconstructing the drawing. Since the scanned point distance varies between 200-2000 μm (0.2-2 mm), scanning each of the original line thicknesses results in two or three data points. This allows refining the image in a way the original could not due to the mechanical limitations of xylograph technology. The resulting drawing digitally copies Serlio’s orders and allows dismembering the proportional systems as described by Serlio [100]. Conventionally, the architect started drawing geometric constellations (the *linee occulte*), which resulted in the image of an architectural order. In contrast, I depart with the architectural order, which allows me, through reverse drawing, to visualize Serlio’s processes of drawing. Discerning Serlio’s drawing process allows investigating *linee occulte* in Renaissance designs.

Figure 6 is a 3D scan from Serlio’s fourth book from 1537. The original printed image is two-dimensional, with the image only being printed on one side of the page. Yet, through 3D scanning, the digitally reproduced image shows the original two-dimensional image in a new three-dimensional way. Digital reproducibility marks a new ontological state of the representation because the nature of the point cloud represents the digital copy as an intangible material metaphor of the tangible paper original. The digital reproduction also creates an inverse image of the original as it aims to represent the point cloud in a three-dimensional format. Hence, a digital reproduction culminates into a new state of being, as the recreated 3D scan creates the inverse image that never existed in the material world. The scan only exists in the imaginary and intangible virtual world. It can be observed, yet not touched, and is
only apprehensible in motion. In this way, the digital reproduction adds to the aura of the object, rather than taking away, if one would believe it does so as a mechanical reproduction.

By using 3D scanning, the resulting point clouds anchor themselves as vertexes into a cartesian coordinate system. Every scanned object whether a print, a body, or a building, transposes into a point coordinate which shapes a geometrical mesh, creating vertexes and loci, which have always been the foundation of architectural drawing. Thus, the points virtually connect, which allows making digital reproductions. The raw point cloud data here also acts as the DNA of the scanned object, which permits studying and emulating hidden geometries, or rather, through the scan, the possibility of visualizing the hidden geometry becomes possible—the linee occulte are made tangible.

Fig. 6 Virtual 3D model of a 3D scan of Serlio’s canon of the five orders (Author’s image).

Fig. 7 CAD emulation of 3D scanned point cloud data of Serlio’s canon of the five orders (Author’s image).
However, the claim that Serlio’s hidden geometries stem from his geometric method for making an order [101] remains unproven and un-visualized. Figure 7 shows the CAD emulation of Serlio’s geometric principle by unveiling *linee occulte*. The drawing visualizes a digital reproduction of what Serlio envisioned as an analogue making of the Tuscan order. Through dematerializing point cloud data, the copied order’s proportions allow us to match and surpass Serlio’s geometries. Proportioning the copy through drawing allows discerning the composition of the represented architecture. However, as a consequence of the process, an original image results, and thus becomes a creation in its own respect. The copy of the five orders allows refining lines and details by CAD redrawing and becomes a unique representation. The resulting image is both analogously crafted and digitally reproduced. This results in a universal image—universal, since it is reduced to its essential morphology and
devoid of any material concreteness. As such, a Serlian emulation arises and acts as contemporary representation.

**Representation in the Age of the Digital Reproduction**

Emulating historic drawings serves as an analytical tool, while allowing us to form new creative and intellectual images. The ontological differences between the digitally reproduced and conventional modes of copying highlight the creative aspect of digital making. Benjamin stated: “by replicating that which has been reproduced many times over, the technology of reproduction substitutes a mass existence for a unique existence” [102], yet that no longer applies as information technology provides unique copies [103]. Through emulating Serlio, the digital reproduction creates new states of images and such reproductions have never existed before. 3D scanning retrieves point clouds which act as the ‘DNA’ for making an emulation. This ‘DNA’ then acts as the basis for re-drawing Serlio’s prints in order to visualize the initial geometries of *linee occulte*. Figure 8 shows the superimposed emulated *linee occulte* onto its point cloud origin showing more refinement than the original. Thus, the copy indeed emulates and surpasses—or at least matches—the original copy.

Fig. 8 CAD emulation of point cloud data from Serlio’s Tuscan order (Author’s image).
Serlio’s use of irrational numbers [104, 105] represented the infinite and incomprehensible divine nature of God, following Luca Pacioli’s postulates [106]. Such an incomprehensible concept becomes relevant once more. Maybe not from a religious point of view, but due to the condition of the digital renaissance [107]. A condition as a surveyed set which allows digital altering, whether cybernetic or through AI. However, rather than generating incomprehensible matter through computation, 3D scanning allows visualizing something formerly unperceivable, and thus incomprehensible to the human body, which only materializes by utilizing digital technology. Historical research often disconnects from the present, or, is difficult to understand in relation to the present. Yet, 3D scanning allows us to refine historical understanding while also contributing to the contemporary, whether contributing in ontological, epistemological or representative terms, or in relation to contemporary theory. 3D scanning dematerializes the human condition and reduces material data into virtual point clouds which delineate vectors bound by a coordinate system. 3D scanning bases itself on the historical as the object of its scan is a thing in existence. Due to the spectral possibilities and the creative capacity of the digital, its
existence makes it inherently contemporary. The historic emulation and the contemporary representation thus mutually co-exist.

References


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52. Ibid., p. 85.


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71. Ibid., p. 158


79. Ibid., p. 7.


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83. Ibid., p. 64.

84. Ibid., p. 48.


