

Hertziana Studies
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Visualizing Complexities

Practices and Heuristics of Digital Models in Art History

Edited by Nicola Camerlenghi, Tanja Michalsky & Elisabetta Scirocco



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Reconstruction by Nicola Camerlenghi; 3D model by Evan Gallitelli;
image by Andrew Maurer.



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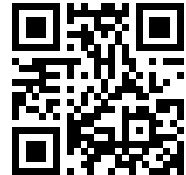
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Abstract

Lex Bosman

The Fourth–Century San Giovanni in Laterano in the Twenty–First Century: Digital Approaches and Reconstruction

keywords – 3D reconstruction model, Early Christian architecture, San Giovanni in Laterano, GPR research



A few important elements in the reconstruction of the early Christian church of San Giovanni in Laterano justified new research: how certain was the reconstruction with lower spaces to either side of the main altar area where later in the Middle Ages the transept would be built? Combined with the existence of two giallo antico marble columns in the actual building this problem justified a new reconstruction. The already operating Lateran Project of Ian Haynes and Paolo Liverani offered the possibility to combine our research and our research methods. With laser–scan and GPR research the tools were available to build a 3D reconstruction, making use of new digital tools and approaches as well as more classical methods. Since the data obtained by Richard Krautheimer and his team proved to be less accurate, the new data provided by the Lateran Project was the best basis on which to build a 3D reconstruction. Our research also showed that a large foundation wall underneath the present south transept had never been considered in reconstructions; the GPR research showed that on the north side a similar foundation wall most likely exists. Building a 3D reconstruction model was the best way to find out if the giallo antico columns and two other shafts could have been used as continuation of the colonnade between the inner and the outer aisles. Contrary to reconstruction drawings, our 3D model also encourages discussion about things like the color of the materials, atmospheric elements, etc.

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The Fourth-Century San Giovanni in Laterano in the Twenty-First Century: Digital Approaches and Reconstruction

Lex Bosman

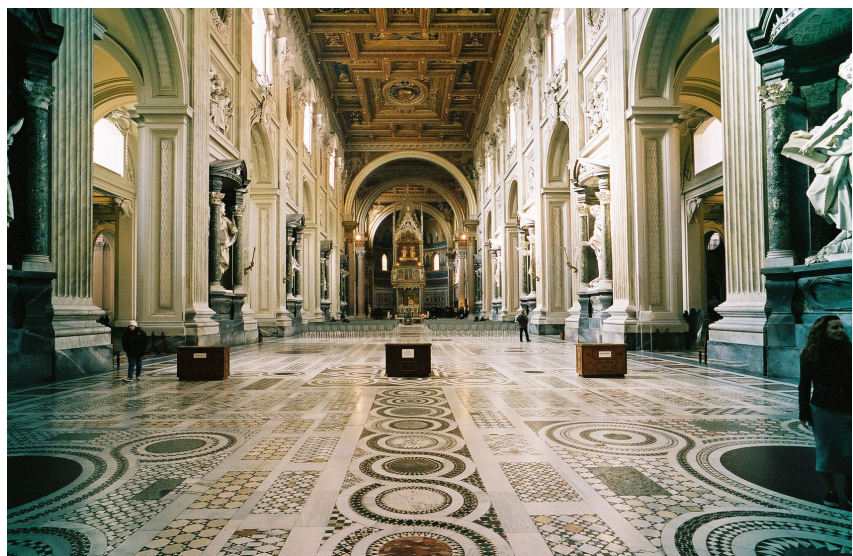
San Giovanni in Laterano was constructed as the first large Basilica in the city of Rome and as the first cathedral for the city's Christian community. First built in the early 4th century, this church building still exists, albeit with many changes made during its long existence (fig. 1). So why would one bother to build a 3D model of this Basilica, which can still be visited after all? The façade was built in the 18th century by architect Alessandro Galilei, whereas the interior as it appears today is largely the result of the renovation of the building by Francesco Borromini. To put it simply: we can state that the spatial structure to a large extent is still that of the fourth century, but the architecture of the Basilica was changed several times. A major change has been the building in the Middle Ages of the transept on the west side.

A legitimate question, of course, is what we wanted to find and which questions were not yet answered by previous research, in other words, what was the purpose of the research project? We

focused on the early phases of the construction history of the Basilica and one of the interesting and most important items was the connection of the Christian Basilica with earlier structures.

The research began with the so-called Lateran Project, which was initiated and led by Ian Haynes (Newcastle University) and Paolo Liverani (University of Florence).¹ The archaeological area underneath San Giovanni in Laterano is important for the study of transformations of the area and its buildings in Severan times, not least to understand the chronology of the buildings. A domus seems to have been the first built structure, which was then succeeded by the castra of the Equites Singulares and from 312 onward the Christian Basilica was built, which we know as San Giovanni in Laterano. And although large parts of the scavi area have been archaeologically researched, many parts were not very well understood, nor were the interconnections of various building elements very clear. Moreover, large parts of the archaeological

Figure 1
Rome, San Giovanni in Laterano, interior to the west.
Photo: L. Bosman.



¹ From 2012 onwards reports of the Lateran Project were regularly published, see the publications listed under Haynes, I.P. in the

bibliography of Bosman/Haynes/Liverani 2020, pp. 549–550.

area are not visible or accessible because of large height differences. The aim of the Lateran Project was: to develop a fully comprehensive survey and analysis of the complex of archaeological material underneath the Basilica of San Giovanni in Laterano. The use of new, digital methods was fundamental in this research that stretched over more than ten years.²

With laser scanning and GPS-fixed data the whole of the archaeological area has been brought to life, with fascinating material to be newly studied. Since no complete and general documentation maps and reports were compiled when the area was originally excavated, mainly in the 1930s and some in the 1950s, now for the first time many elements of the excavation area could be seriously studied. With laser-scan technology, the area was recorded, which allowed us to study all kinds of elements that had not been accessible since they were first excavated.

At a later stage, I joined the team to offer considerations on the architecture of the early Christian Basilica, given that I had been working for some time on reconstructions of the Basilica in its initial phase during the fourth century. The reconstruction by Richard Krautheimer of the early Christian Basilica is generally accepted and certainly convincing, yet several critical items needed more clarification.³ These can be formulated in basic but crucial questions: what was the archaeological basis for the reconstructions of the shell and of the interior space of the Basilica? And, what do we know about the material and the color of the columns that were initially used?

My contribution to and main concern with the team of the Lateran Project was to build a 3D model, based on solid data in order to either confirm or correct existing reconstructions of the Basilica, and with as much detail as seemed both possible and necessary. Eventually this 3D model was built by Iwan Peverett, with myself, Paolo Liverani and Ian Haynes as authors. This made up a good team, since Peverett is trained as an architect and works with 3D programs to build detailed models, Liverani and Haynes

are archaeologists, and I am an architectural historian. Once the scanning of the scavi area and of the actual church building was finished, we decided to build a 3D model. It was Iwan Peverett who ultimately did the important digital 3D construction work. In several inspiring sessions the most difficult choices were tried and discussed in preliminary models, to evaluate the consequences for the architecture of these choices.

So the Lateran Project as a whole employed conventional methods combined with modern digital ones. As already mentioned, the lack of documentation of the digs in the 1930s and 1950s hampered further research and that is where modern techniques came in. Let me further explain my preoccupation with the reconstruction of the Basilica from the early 4th century. I felt unhappy with the western part of the ground plan as reconstructed by Richard Krautheimer. In that reconstructed ground plan the parts to either side of the main altar area, where, much later, the transept would be built, show L-shaped spaces which are not a feature of contemporary or older basilicas. On top of that, the history of the use of several column shafts was a fascinating point of interest. When studied in connection with each other both ground plan and column shafts could possibly add improvements to the reconstruction. Two column shafts of the *giallo antico* marble have supported the organ tribune in the northern transept since the late 16th century. The use of these columns can be traced back to the 12th century in the complex of San Giovanni in Laterano. The exact same type of these marble column shafts of 24 Roman feet (7.14 m) in length, 3 feet in diameter (0.89 m) and with 24 flutings are only to be found on the Arch of Constantine, which dates from 315.⁴ Knowing that Emperor Constantine was seriously involved in the planning and construction of the Basilica and that the Arch built in his honor could not very well have been realized without involvement of Constantine and his advisors, a connection between the building material used in both the Basilica and the Arch seems more than likely.

2 On the spatial history of the Lateran and the use of new research methods see, for instance,

Liverani 2020 and Haynes/Liverani 2020.

3 Krautheimer/Corbett/Frazer 1977.

4 Bosman 2020, pp. 183–185.

Figure 2
Rome, San Giovanni in Laterano, Plan of
foundations in southwestern part, with
indication of wall B.
Drawing in Krautheimer/Corbett/Frazer 1977.

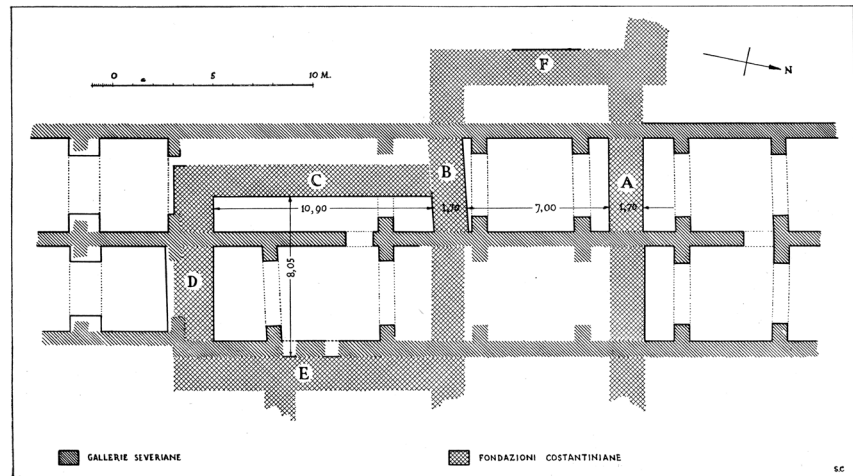
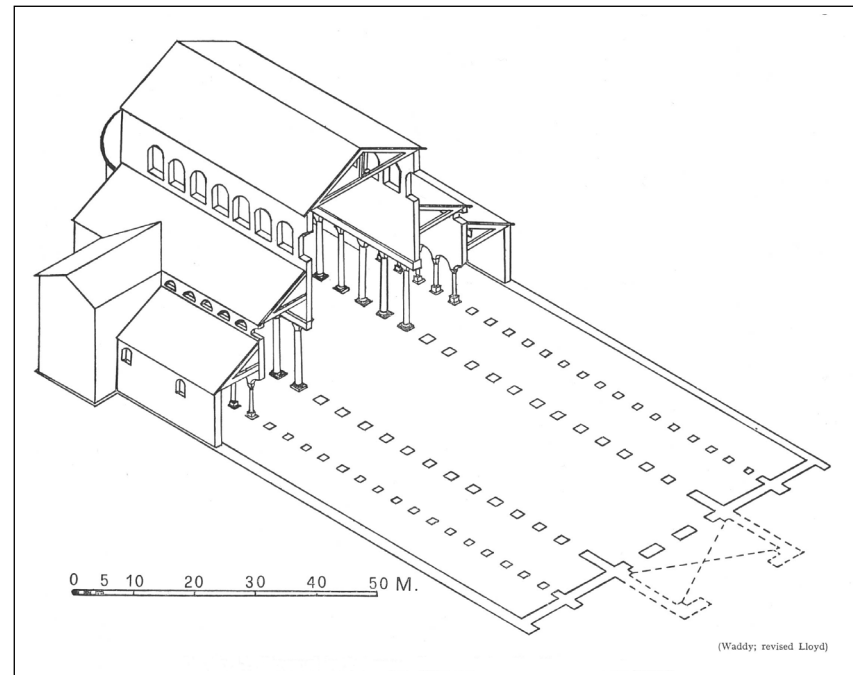


Figure 3
Rome, San Giovanni in Laterano,
reconstruction by Richard Krautheimer.
Drawing in Krautheimer/Corbett/Frazer 1977.



This, in turn, gave rise to a new hypothesis that these columns—at least two of yellow marble, which are still to be seen, and at least one of white marble—had been used in the original Basilica from 312 onward. Of three possible locations, the one that was most likely was on top of the so-called “wall B,” which exists in the excavation area underneath the present southern transept of the Basilica, but which never featured in previous reconstructions (fig. 2).⁵ This presents the question of whether the columns could initially have been used as a continuation of the colonnades between both aisles on either side with “wall B” serving as

their foundational support on the south side. Coincidentally, the published and famous reconstruction drawings of the early Christian Basilica always obscure the part of the interior where I hypothesized the use of these column shafts (fig. 3).⁶ That was another important reason to desire a 3D model that would allow us to visualize the consequences of this hypothesis much better than line drawings would be able to do, since a 3D model does not obscure any part of the construction.

So at first I planned to prepare a 3D model with data from the famous *Corpus Basilicarum*

5 Bosman 2020, p. 189; Claussen 2008, pp. 26, 166.

6 Not only Krautheimer's drawing, but for instance also those in Blaauw 1994, vol. II fig.

2 and Brandenburg 2004, p. 261 do not show the architectural details in that specific part of the Basilica.

Christianarum volume by Richard Krautheimer along with the research team. I assumed that the least of my worries would be the essential data about the early Christian Basilica, which we imagined could be extracted from Krautheimer's book, but that turned out to be different. When assembling the remarks about the measurements of the Basilica and its details and re-calculating them a difference appeared, at first sight of minimal importance, but when calculated on the length of the Basilica of some 300 feet, the difference between the smallest and the largest foot was simply too inaccurate. Krautheimer apparently used a small foot of 0.294339 m and a larger foot of 0.298630 m, the distinction of which shows a difference of 1.28 m when applied to the 300-foot length of the Basilica.

The accurate data assembled and used by the Lateran project then showed their importance, which allowed us to reconstruct the Basilica more accurately than before. From the start, the aim for our 3D model was to use it as a research tool, which would stimulate new questions to be examined. Several of our aims with the model can be summed up as follows:

- to aid in my reconstruction of the western part of the Basilica where—in later centuries—the transept would be constructed, and where I reconstruct the continuation of the colonnades between the inner and the outer aisles;
- to research if the written sources about adornments such as altars, lights and other elements in the interior were reliable in their detail;
- to research the effects of the colorful materials used in the pavement, the wall revetment, and the column shafts;
- to research if it were possible—within the limits of serious scholarship—to reconstruct the Basilica in 3D by combining the original structure, scattered elements no longer in their original position, written sources, depictions, archaeological data, and additional GPR (Ground Penetrating Radar) data.⁷

The archaeological area underneath the Basilica houses lots of small elements like pieces of pavements, but for the majority of these scattered pieces it is unknown exactly where they were found. That makes it very difficult and mostly impossible to re-integrate such elements in a virtual early Christian Basilica.

But let us return to the yellow marble column shafts mentioned earlier. It is one thing to indicate the assumed position of these shafts in a ground plan, but to visualize how that position would affect the construction of the Basilica as a whole is another thing altogether. The foundation wall known as “wall B,” which I mentioned earlier, was never seen as part of any reconstruction of the early Christian Basilica of San Giovanni. Whereas this “wall B” was excavated and is still in its position, a possible and likely counterpart on the northern side is unknown, since in the northern transept no archaeological research has ever been undertaken. During research in January 2016, when Salvatore Piro of the Consiglio Nazionale delle Ricerche, well-known expert in GPR, surveyed important areas within the Basilica, it was possible to scan the northern transept area as well. The result of the GPR-research was extremely interesting, when Salvatore Piro told us that a wall or a foundation must be present in the position symmetrical to “wall B” found on the south side (fig. 4). That was of great importance, since it lent further credence to my reconstruction (fig. 5).⁸

We then had the material to build the 3D model, and during the construction of this model we had to decide on specific elements. An important starting point for us was that reference examples—used to understand and reconstruct specific features like windows—should predate or be concurrent to San Giovanni. Richard Krautheimer had been using another point of departure for his reconstruction: since San Giovanni is more or less 5/6 of the volume of the early Christian St. Peter's, he reduced the Vatican Basilica to reach a credible and acceptable reconstruction of San Giovanni. But there is at least one serious disadvantage to that approach. One can question the use of the

⁷ Cf. Piro et al. 2020.

⁸ Bosman 2020, pp. 189–190.

Figure 4
Rome, San Giovanni in Laterano, GPR survey
by Salvatore Piro.
Image by Lateran Project, S. Piro.

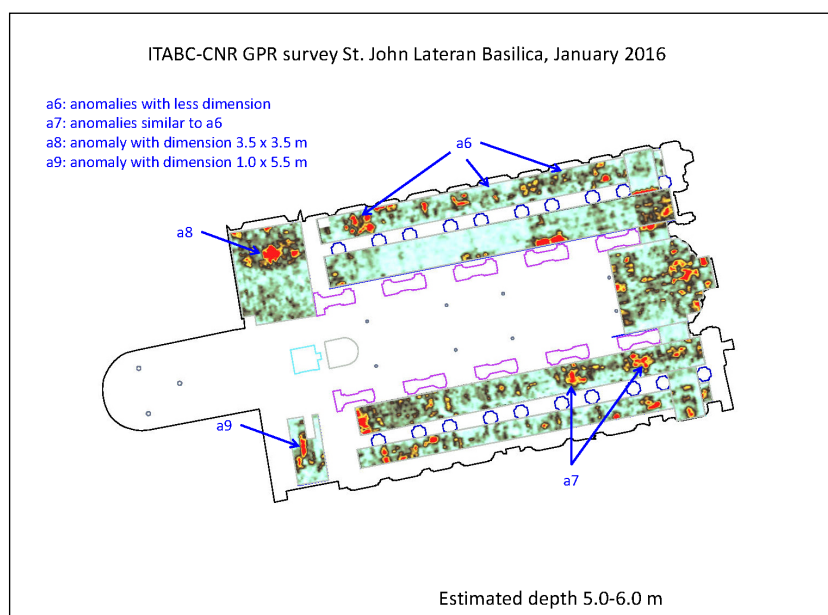
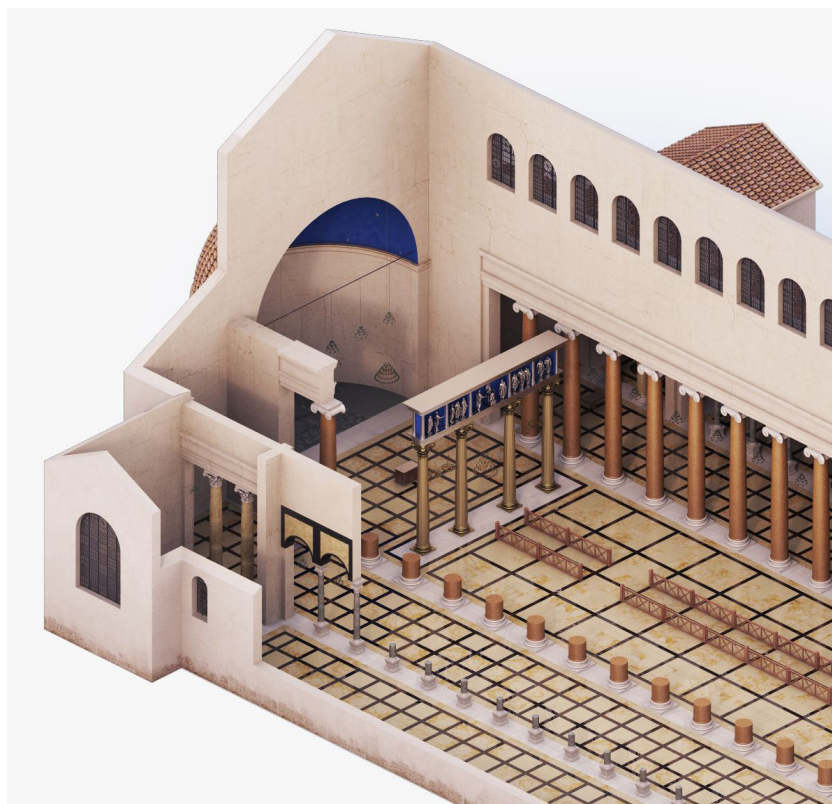


Figure 5.
Rome, San Giovanni in Laterano, open
axonometric view of southwestern part.
Reconstruction by L. Bosman; 3D model and
image by I. Peverett.



Vatican Basilica as model for the Lateran one, since the construction of the latter began some ten years before that of the former. We wanted to avoid this reversal of chronology.⁹

We made use of concept models to discuss various elements, like the volume of the whole Basilica, and the roof on the aisles, which also in past reconstructions led to the question of

whether each side aisle was covered by separate roofs, or a continuous one on either side. The semi-circular windows in the upper walls separating the inner from the outer aisles which began to appear in reconstructions apparently modeled after the famous fresco of the interior of San Giovanni in Laterano by Filippo Gagliardi in S. Martino ai Monti were not seriously

⁹ On our reconstruction see Bosman *et al.* 2020, pp. 145–150.

questioned in the past. However, in our view the fresco, interesting though it may be, shows too many inaccuracies in the representation of the interior to accept details like the semi-circular windows as proof for the existence of such windows in the Lateran Basilica. The building itself does not show any signs or remains of such windows and it should not be forgotten that Gagliardi painted an interior that he himself had never seen—his fresco is a “reconstruction.” Ultimately this meant that we rejected the fresco as a reliable source for scholarly reconstructions, accordingly the semi-circular windows were rejected as well. Hence they do not appear in our reconstruction model.

The 3D reconstruction model we built is meant to invoke new insights and new questions, one of which is the viability of generating a detailed 3D reconstruction in color. According to some colleagues, such a 3D model might look “perfect” and complete in such a way that—instead of inspiring new questions—it would appear so convincing that no elements or details are questioned anymore. One can also wonder about the importance of conveying information about details of the modeling process. For us, considering the purpose of the model has offered guidance in these matters. One of the main advantages of a colorful and detailed 3D model like ours, is that we feel the need to explain and justify the choices we have made. In the past, it seems that by presenting a reconstruction in the format of a black-and-white line drawing, the need to explain and justify specific choices was given far less attention, but the basic starting point remains the same. Every kind of reconstruction is meant to visualize the most likely possibility to the eyes of the author, whether it is a black-and-white line drawing or a color 3D reconstruction, and, in both cases, the choices that were made should be explained. 3D digital reconstructions and visualizations have made this point more important in modern scholarship. In our volume on the Lateran Basilica we tried to be transparent about the choices we made, several of which are discussed in this paper as well.

Let me briefly mention a few of the most important choices that were made. For the number of windows in the clerestory we simply opted for one window for each bay, which seems reasonable; this is not a new kind of design for such a basilica. Our initial floor was criticized at the September 2016 conference and rightly so. Here, however, a serious challenge is that not many examples that can be used as inspiration are known. The Basilica Ulpia and Basilica of Maxentius / Constantine were important buildings in their time, both predating the Lateran Basilica, and their floors have been reconstructed in a very reliable way. For the revision of the initial reconstruction of the pavement we used these two models and the result is now much more in harmony with those two other floors.

Once we rejected the Gagliardi fresco as a reliable source, we lost the only evidence for variations in the types of capitals present in the nave. A post-medieval source mentions ionic capitals and because no older written or visual sources inform us about the capitals, we have chosen to adopt uniform rows of ionic capitals. This is a choice with important repercussions because the diverse capitals deployed in earlier reconstructions of the Lateran Basilica had been cited by some scholars as an important example of the *varietas*—a notion that now needs to be revisited.¹⁰ We have chosen to reconstruct an apse without windows, to stay close to the architecture of the apse of the Basilica of Maxentius/Constantine. At least much later in the Middle Ages windows were cut in the apse wall, but the unknown presence of those windows in the fourth century made us decide to not include windows. We know parts of the walls above the arches were clad with marble, but its color, height and pattern are unknown, which led us to reconstruct these interior elements in a simple manner. In 3D visualizations the point of view of human beings is not always taken into account. For the reconstruction of the lighting equipment this was an argument to reach a certain level of detail, the addition of atmospheric elements was yet another way to get closer to the way visitors

¹⁰ The notion of *varietas* has been proposed by Beat Brenk, cf. Brenk 1996. For the

anonymous source see: An., ‘Relazione dello stato nel quale si trovava la Basilica

Lateranense’, in: Lauer 1911, p. 585

may have seen and experienced the space. The positive and negative views on this specific feature and the scholarly debate about it may be brought forward by a model like ours (fig. 6).

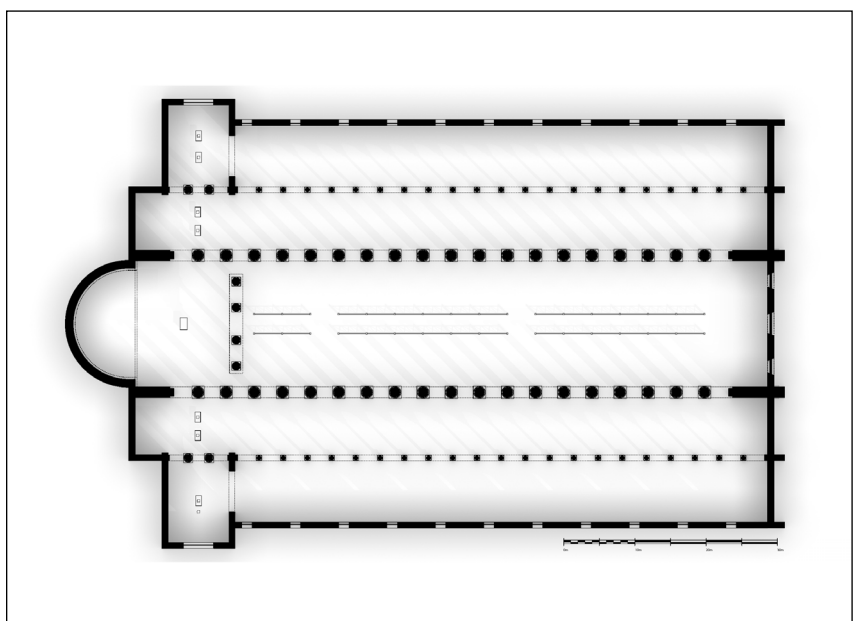
The main results of our joint project, which includes conventional methods and analysis, GPR-research, laser scanning with GPS fixed points for greater accuracy, 3D modeling for greater insight in architectural possibilities may now be summarized. The understanding of the connection between previous structures, namely the domus and castra, and the early Christian Basilica has been brought to a better and much more detailed level. Our 3D model of the Basilica helped to understand how the reconstruction of the newly added colonnades would be possible since the 3D model no longer obscures the specific architecture

and construction of this area, unlike previous reconstruction drawings published by several scholars. Likewise, we have ventured some interpretations about the effect of this revised architecture, specifically the colonnades, not only on the ground plan, but also on the way space was understood and experienced. Unfortunately, the specific function and use of the spaces on either side of the main altar area are unknown, but it seems likely that the seven altars mentioned in the *Liber Pontificalis* were placed in these spaces (fig. 7).¹¹ And finally, while we still do not know the exact thickness of the walls of the fourth-century Basilica, digital measurements throughout the actual Basilica confirmed that the original Basilica was largely built in a very accurate way in the first quarter of the fourth century.

Figure 6
Rome, San Giovanni in Laterano, interior of the Constantinian Basilica.
Reconstruction by L. Bosman, P. Liverani, I. Haynes and I. Peverett.



Figure 7
Rome, San Giovanni in Laterano, Ground plan of 4th century.
Reconstruction by L. Bosman, P. Liverani and I. Peverett.



¹¹ Blaauw 1994, pp. 143–146.

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