NOTES ON THE "CASTRUM VIRTUALE – JOURNEY THROUGH TIME IN THE FORTIFICATION OF KESZTHELY-FENÉKPUSZTA" DIGITAL EXHIBITION

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The temporary exhibition ["Castrum Virtuale"](#) opened on 14 September 2019 at the Balatoni Museum at Keszthely. The event was originally scheduled to remain open until 1 March 2020 but, because of the closure of museums during winter 2020–21, the exhibition was prolonged until 15 September 2020. The restrictions caused by the pandemic have also upset the museum world. Digitizing and transferring information and exhibitions online to the public was a challenge that came suddenly and had to be managed not only in the short term, but also had a long-term impact on the day-to-day practice of museums.

Although these changes were unexpected, the concept of our exhibition, even in its original version, was based on digital/virtual ideas and offered solutions for an innovative and expressive form of presentation. The title of the exhibition alone emphasizes our main goal, which is to use current technical opportunities to resurrect the remains of the Roman fortifications of Fenékpuszta. We thus created 3D models of each building and of the defences of the fortification, as well as some selected, significant archaeological finds. The digital elements were included in the exhibition by regular and touchscreen monitors, as animations and models. When, a year later, thanks to a further National Cultural Fund of Hungary (NKA) grant, we had the chance to put the temporary exhibition into a virtual space, we were able to easily transfer several elements of this exhibition to this new environment.

The exhibition shows the Roman monuments of the archaeological site at [Keszthely-Fenékpuszta](#), a *castrum* of almost 15 hectares that has been explored for more than 150 years. The special feature of this fortification of the mid-4th century AD is that here Late Antique and Early Christian traditions survived after the abandonment of Roman Pannonia until the mid-7th century AD.

Essentially, the virtual and temporary exhibitions follow the same concept. It consists of three units: the first room presents the reconstruction of the fortification, the second part the archaeological artefacts, and the third component shows the plans for an archaeological park. In this way, we have undertaken a journey through time. On the one hand, our aim was to reconstruct the past, the former buildings of the *castrum*, and to present the finds that belong to them. On the other hand, we developed a forward-looking visualization of the presentation of archaeological monuments at Fenékpuszta. These themes also form the basis of the online exhibition. During the implementation process, we had to build individual model groups digitally and then transform them into content that would be viewed in a web browser. Compared to the original exhibition, some selected 3D models were presented via [sketchfab](#) as animations.

1) Reconstruction of the fortification: Visitors of an archaeological site are always intrigued by the appearance of a site in the past, what different buildings looked like, who lived in them, and under what conditions. One of the great challenges of archaeological research is to answer these questions. This step requires studies beyond the evaluation of excavations, and careful thought needs to be given to the way and form the archaeological results are translated. A visual reconstruction – whether a 2D image or a 3D model

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– is the last step in the process of knowledge acquisition and it requires very comprehensive data collection. First, when creating such an image and bringing its whole context to light, many hitherto obscure but important facts emerge as having been missed. Usually, it is possible to see at this stage what and how many details should be added by other means, and identify doubtful aspects.

The reconstruction of the buildings of the fortification and of the *castrum* and its periods of use is the result of an intensive scientific exchange between archaeologists and architects. The analysis involved the study of contemporary examples as well as the evaluation of the excavations. Both provided information concerning the layout, the period of use, and the possible changes of form and function of each building. The layout of many buildings could be reconstructed clearly by combining the results of the excavations and of the georadar (GPR) investigations. For example, in the case of the Early Christian basilica or a granary, we were also able to draw the interior spaces (*Fig. 1*). As for other buildings, only some details of their layouts are known or their ground plan is questionable; in these cases we could only show a schematic draft of their exterior and in few instances we had insufficient data for a reconstruction. Several edifices in Fenékpuszta are known to have had two or three building phases. For example, the main building (no. 25) had three phases with different layouts and functions. Consequently we had to keep these phases in mind during the reconstruction process. The main concern when developing the 3D model of the fortification was to create an authentic appearance from both a long perspective and a close-up view. Therefore, the digital model provides a good basis not only for the presentation of 3D illustrations, but also for animations – such as the film presented in the exhibition, where we can observe the *castrum*'s buildings from a bird's eye view – and later even for VR headset-based interactive contents.

2) Structure of the virtual exhibition space: In this group of spaces, the elements of the extant temporary exhibition have been reproduced as a digital model and placed in the virtual exhibition space (*Fig. 2*). This includes the interactive display content described above, as well as graphics, posters, descriptions, plus 3D-printed and traditional handmade models created from the reconstruction models. Taking advantage of the technical possibilities, some of the models are presented as interactively rotatable 3D models in the new space.

The virtual path allows us to move away from the spatial and technical constraints of a specific museum and to incorporate elements that are slightly removed from reality, such as background effects, e.g. the defences of the *castrum* disappearing into the mist. Not only does this give the virtual exhibition a sense of a journey through time – in which the

Fig. 1. Reconstruction of the interior of the Early Christian basilica (6th–7th century AD) of Fenékpuszta (Building 14). © Narmer Architecture Studio (Gábor Nagy, Zsolt Vasáros, Orsolya Heinrich-Tamáska, Roland Prien)

Fig. 2. Digital modelling of the exhibition elements in the virtual space. © Narmer Architecture Studio (Gábor Nagy, Zsolt Vasáros, Orsolya Heinrich-Tamáska, Roland Prien)

visitors have the feeling of walking between buildings of a bygone era – but it also conveys an idea of the scale and dimensions of the fortification. Furthermore, this virtual reconstruction also allows us to expand the web content, so that the results of ongoing research can be added later to what is already presented.

3) Digitization of archaeological finds: We had already created the photogrammetric documentation of selected and important finds from the recent excavations for the temporary exhibition. This involved photographing and software processing of the artefacts to reproduce their shape and create models with authentic colours, which would be viewed as 3D moving images.

Other artefacts could only be placed in the virtual exhibition's showcases by using 2D photographs. We shaped them by digital modelling and coating the surfaces with photographic textures (*Fig. 3*). As this is very time-consuming, only a selection of the artefacts originally shown in Keszthely were transferred to the virtual exhibition.

4) Visualization of the archaeological park: To present the archaeological park, we had to transfer the current situation of the *castrum's* area and its surroundings to a digital level, and consider the local terrain conditions, including the conserved ruins and the nearby Lake Balaton. The area was mocked up at a level
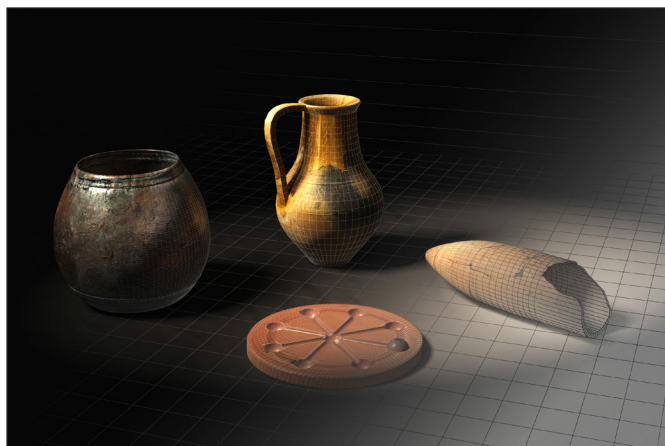

Fig. 3. Finds modelled by digital techniques with overlaid photographic texture.
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Fig. 4. Digital modelling of the archaeological park in virtual space.
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that will later provide a good basis for multi-view VR-headset content, where visitors could explore the space in a manner that is similar to the current virtual exhibition (*Fig. 4*). During the suggested visitor's tour, digital information and images, as described in section 1, are linked to each building.

Looking to the future, we made various architectural proposals to present a vision of an archaeological park at Fenékpuszta, based on ideas from other archaeological parks in Europe that feature Roman monuments. The granaries near the western and southern gate of the *castrum* appear as full reconstructions, rebuilt in stone. In contrast, the central triumphal arch and the northern gate have been reconstructed partially, using an open steel skeleton framework. The layout of other buildings is marked by vegetation grown to a greater height, clearly separating these buildings from the gravel surrounding. The central multiphase building of the *castrum*, Building 25, is protected by a modern architecture: under it, the original ruins can be visited, and the roof may be used as a viewing platform.

Although the Castrum Virtuale exhibition recalls the past, it points to the future, even if the archaeological park in this form is yet only a vision. Nevertheless, via the current online presentation, these plans and the related archaeological research activities should reach a wide audience beyond Hungary; the German and English versions of the exhibition ensure that it is represented internationally. At the same time it is hoped that it will attract the interest of local decision-makers in future developments.