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Arrangement



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Manual of best practices for a blended flexible training activity in architecture for higher education institutions



**UNIVERSITÀ
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di Ingegneria e Architettura



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA



Silesian
University
of Technology

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This volume returns the results of the Intellectual Output 03 of the research project "ArchéA. Architectural European Medium-sized City Arrangement", with the aim of analyzing and restating the state of the art achieved in the field of flexible mixed training in architecture, strongly encouraged by the emergency period of the Covid-19 pandemic. The result is a collection of good practices carried out internally and externally to the ArchéA partner network, in the context of higher education institutions, made possible by new virtual tools capable of mediating teaching and mixed and flexible learning around the disciplines related to the project.

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Manual of best practices for a blended flexible training activity in architecture for higher education institutions

edited by Enrico Prandi and Paolo Strina

Analysys of the Best Practices

Guest professors

Tomasz Bradecky
**Virtual and Parallel Exhibitions in Urban Planning Teaching.
Conclusions from the use of augmented and virtual reality**

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Fig.01a Large-scale mockups during the exhibition - models of the structure of the city of Bologna

Abstract

Presentation and project summary exhibitions in the teaching of architecture and urban planning, are an optional but integral element of the teaching process. By 2019, they constituted frequent events in the calendars of design and art-related studies. The introduction of remote technologies was unpopular and rare due to numerous limitations. The COVID-19 pandemic has forced the need to work and present teaching outcomes at a distance. Many of the exhibitions in 2020 and 2021 were performed remotely. The challenge of remote exhibitions in the field of architecture and urban planning is to convey the content related to the projects, and the form of their display is very often illustrative display boards and mockups. Various technologies are used for their remote presentation, such as virtual exhibition galleries, as well as augmented and virtual reality. This paper undertakes a discussion on the methods of implementing virtual exhibitions, their advantages and disadvantages, and the techniques used. There is also a description of 3 original exhibitions organized in the field of architecture, devoted to the structure of cities, two of which were organized in a mixed (parallel, hybrid) formula, during which participants presented elements of the exhibition, including physical models, through live transmission, while simultaneously presenting previously prepared, analogous models in augmented and virtual reality.

Keywords

virtual exhibition, urban planning teaching, hybrid teaching methods, augmented reality, city structure models

A virtual exhibition (VE) was earlier defined as an online Web-based hypertextual dynamic collections devoted to a specific theme, topic, concept or idea (Silver, 1997). A virtual exhibition (VE) is a Web-based hypermedia collection of captured or rendered multidimensional information objects, possibly stored in distributed networks, designed around a specific theme, topic concept or idea, and harnessed with state-of-art technology and architecture to deliver a user-centered and engaging experience of discovery, learning, contributing and being entertained through its nature of its dynamic product and service offerings (Foo, 2008).

A synthetic collection of artifacts, which incorporates multimedia and virtual reality technologies, alleviates the problem of storing, preserving and protecting the real artifacts and allows virtual spaces to contain a limitless number of exhibits, to which users have access at any time and from any place. (Spyros et al. 2013). Virtual exhibitions can be associated with a virtual museum. However, presenting a museum's collection online doesn't mean that museum's application can be defined as 'virtual museum' whether it has a real location or not. Likewise, the applications that give virtual navigation to visitors are not a virtual museum (Salar et al. 2013). At the same time, in virtual museums Virtual reality applications can create objects and situations those are not real and make the visitors feel in real environment (Salar et al. 2013).

The most usual virtual reality presentations only rely on mental immersion and are characterized by the display of 3D environment on a 2D screen.

(Cláudio A. P., Carmo M. B. 2013). However, there is a great diversity in terms of visualization and user interactivity in the available approaches, as a multitude of different technologies has been employed. (Spyros et al 2013).

Augmented reality technique has been explored either inside the museums or in the open-air in archeological sites. On-site virtual reconstructions can be presented outdoor in real environments to substitute physical rebuilding of historical remains, which could interfere with archeological research. (Cláudio A. P., Carmo M. B. 2013). Typically in architecture exhibitions we find presentations of mockup fragments and installations aiming to evoke and represent the absence of real architecture (Postiglione G. 2018 p. 53)

With the ubiquity of smartphones people carry a high-end interaction device with them at all times. Such technologies allow museum visitors to directly interact with an object, exhibit, or even an entire gallery, but might also provide access to the vast digital repositories that are available online (Lischke et al. 2014, p. 150). Physical exhibitions with online content can be called hybrid or parallel exhibitions. The Parallel Exhibits approach aims at creating a shared online and on-site experience where visitors are provided tools that enrich their physical (or virtual) museum visit using existing digital repositories and resources (Lischke et al. 2014 p. 151).

Currently, two directions of creating virtual exhibitions can be distinguished. In the first one, a virtual walk is generated through exhibition space. Many museums use interactive panoramic photographs of their interiors and 3D scans of selected exhibits. Similar effects are supported by web applications such as kuula, (www.kuula.co), artsteps (www.artsteps.com), the great advantage of which is intuitiveness and low degree of complexity.

The second direction is not just about virtualizing the exhibition area, but also the exhibition objects themselves, in the form of models accessible through dedicated apps and devices. In that trend, interactive solutions are often used to allow to experience virtual models in the exhibition space. Augmented reality models can be used successfully in architecture and urban planning education, as exemplified by the experiments carried out by Fonseca et al. (Fonseca et al. 2012, 2017).

Within the framework of the international project *ArchéA* - Architectural European Medium-Sized City Arrangement, three exhibitions were organized in 2019, 2020, 2021 at the Faculty of Architecture of the Silesian University of Technology in Gliwice, with the theme of city structure models. The first one (2019) was typically non-virtual in nature. The others were organized as parallel exhibitions in a hybrid formula, with elements of stationary and virtual exposition. The exhibitions were experimental in nature, unlike



Fig. 01b Public presentation, 28 May 2019; author: T. Bradecki

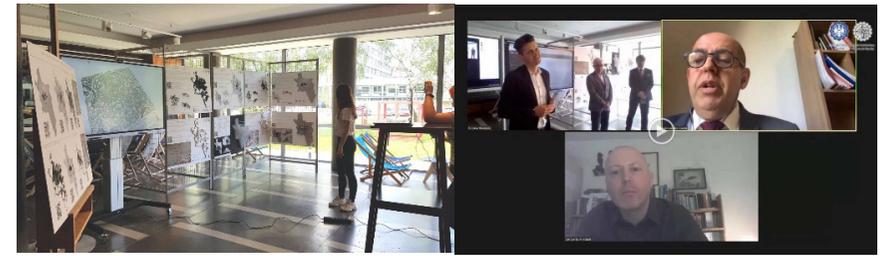


Fig.02a-02b Rehearsals of the exhibition elements: mockups, boards, touchscreen monitor, and broadcast video camera; author: T. Bradecki 2020; View from online broadcast; source: <https://youtu.be/Ke-CWUyHgqQ>

professional dedicated solutions used in museums. The presentations were made by amateurs (students and a university teacher), and therefore included certain necessary simplifications. This was done using apps available on desktop computers and smartphones. The Augment app (augment.com) allows you to view the models yourself in either on-screen view or augmented reality mode, i.e. it is possible to 'place' the model on any flat surface, such as a desk, and view it. The disadvantages of the application are the limitation of scaling and zooming capabilities and the medium level of model rendering (shadows, reflections). The sketchfab app (sketchfab.com) is similar to augment.com and, in addition to the augmented reality option, also offers image generation adapted for use with virtual reality goggles, i.e. a 3D walk. The application features no scaling limitations, and high rendering quality. However, the app has high hardware requirements and may not work on some devices. The teliportme app (teliportme.com) allows you to take panoramic (360) photographs using your smartphone and then share them so that they can be viewed interactively in the app. All of the above tools were used in the exhibits described below.

The exhibition dedicated to analysis of the structure of the city of Bologna was organized on 28 May

2019. Five models were presented in the exhibition, including density models, housing density (Fig. 01a). The on-site exhibition was attended by the presenting students, academic staff from the home university, invited professors from abroad, invited guests (Fig. 03b). The presentation of the models was recorded and streamed online. This exhibition should be considered a traditional one, where models could only be experienced at the exhibition site. This was complemented by a pre-recorded video devoted to the subject.

The exhibition dedicated to analysis of the structure of the city of Aachen was organized on 9 June 2021 in the form of a static transmission using a single video camera (Fig. 01a). The exhibition showcased 8 models available in augmented reality, 4 of which were also displayed as mockups, and it was complemented with boards with information on them. The number, complexity and size of the models, were limited by the need to complete the work individually, at home, due to the pandemic.

The on-site exhibition featured three academics and two students. Also, two professors from foreign universities offered remote comments on the event. The guests were viewed with the help of a ZOOM broadcast (Fig. 02b), and they received information



Fig.03a-03b Exhibition of elements of the Zabrze city structure models: models, charts, touch screens with centrally located video camera for transmission purposes; author: K. Fross

on the content of the exhibition beforehand. The presentation of the models was live-streamed with a pre-recorded video by the students. This was due to concerns about the difficulty and quality of transmission. During the broadcast, they demonstrated how to use the augment application using one of their models as an example.

The exhibition on analysis of the city of Zabrze was organized on 22 June 2021. The exhibition featured 12 models, including 8 mockups, as well as links and boards describing them in augmented reality. The number, complexity and size of the models were made possible by group work in the University's laboratory. The results of work are presented in a concise publication (Borowiecka M. Bradecki T. 2021), which includes direct links to augmented reality models, examples of how to use it and experience the models in the field, e.g., display the models at a scale close to real dimensions and compare the studied objects with the environment (Fig. 04a, 04b). The publication was made available online before the exhibition, and included links to all the 3D models and panoramas of the places that these models reflected (teliportme app). During the broadcast, guests were presented with ways of using augmented reality (augment, sketchfab apps) and virtual reality (sketchfab). The exhibition was attended by academic teachers, invited guests from the city of Zabrze, a group of 14 students, and the authors of the exhibition. Two commenting professors from foreign universities participated in the event remotely. The presentation of the models was recorded live, and opportunities to experience all the models were presented: mockups exposed on site, models on touchscreen monitors (Fig. 3a, 3b), augmented reality and virtual reality (VR goggles) models (Fig. 03c, 03d).

In the described exhibitions, a similar scheme of

the didactic process was adopted: project-oriented teamwork of students, creation of a knowledge base and presentation materials, presentation preparation, summary exhibition. A similar process was already practiced in 2018 during the multi-person mockup work for the Upper Silesian Metropolitan Union (Bradecki T. Cabaj M. 2018). Working in real time on 3D models and augmented reality, has been shown to be effective during distance learning (Bradecki T. 2021) and this had a significant impact on presentation and performance.

Students involved in the didactic process and the exhibitions found the end result very satisfactory, even though preparation of the exhibition was an extracurricular element of the traditional course. The difficulty was preparing an explanation of what augmented reality is, and how to experience the models. The models that represent the structure of entire cities in data form (e.g. the housing density model) were often not fully understood (the cases of Bologna and Aachen). The most popular ones were models of the structure of public spaces (the case of Zabrze). This is confirmed by the statistics of the number of views of single models on the sketchfab.com platform. The infrastructure used for online broadcasting proved to be a challenge in implementing the hybrid exhibitions. Ideally, multiple cameras should be used at different points in the exhibition so that you can switch views to different elements. This was only achieved in the case of the exhibition devoted to Zabrze. Table 1 presents characteristics of the completed exhibitions: selected elements, tools used and their advantages and disadvantages.



Fig.03c-03d Exhibition - Models of the structure of the city of Zabrze: view from online transmission, experiencing models in virtual reality, presentation of the project; source: <https://youtu.be/a9qQA-lrOW4>

Tab. 1. The selected elements, applied tools and their advantages and disadvantages in the exhibitions dedicated to the models of the structure of the cities of Bologna, Aachen and Zabrze.

Subject of the exhibition	Bologna, 2019	Aachen , 2020	Zabrze, 2021
Exhibition type	On site	Hybrid	Hybrid
Number of physical/virtual models	5 /0	4/8	8 / 10
Dimensions of models	200x200 cm	50x50cm	100x70 cm
Technology	-	Augmented reality	Augmented reality, virtual reality
Portals and applications supporting technology	-	augment.com	Augment.com, sketchfab.com, p360
Study of the development area	Literature, remote, with the help of materials provided by a local research team	Literature, remote, with the help of materials provided by a local research team	Remote and self-testing in situ
Presentation of live models	None	Partial (one model demonstrated)	Full (selected models were demonstrated to guests)
Need to have an app	no	yes/no	yes
Estimated number of viewers	40 on site	70 during the broadcast 136 views (on 05.07.2021)	20 on site, 90 during transmission
Number of views of the presentation video	137 (on 05.07.2021)	220 (on 05.07.2021)	52 (on 05.07.2021)

The described cases can be considered as the best practices for a blended flexible training activity in architecture for universities. The effects of the work have continuation - elements of the exhibition dedicated to Bologna were exhibited during an event of international significance, i.e. 4 Design Days in Katowice in January 2020, attended by several thousand visitors. The exhibition and publication, made for the City of Zabrze, are to be presented in Municipality buildings. In all of the cases described above, the additional elements included videos presenting the content of exhibitions and information on how to prepare and use the models. These videos were very useful in conveying the general idea of the exhibition.

Conclusions

Presenting exhibitions in the real and virtual worlds is becoming increasingly popular. The pandemic era experience can be considered very valuable and stimulating for further experimentation. It should be assumed that presenting the results of work in the field of architecture and urban planning in the form of two parallel real and virtual modes, is becoming standard. The effects of augmented reality can be considered promising and developmental, especially when considering the technological development of applications and devices and the increasing ease of access to them. Interactivity seems to be quite important especially for the presentation of 3D models: large-scale touchscreens and augmented reality allow the models to be experienced freely. Virtual reality model presentations work better during on-site exhibitions: then the devices (VR goggles, software) are prepared, and those attending can

focus immediately on exploring the model. It can be stated that virtualization of exhibitions can be effective, provided that the methods, devices, and technologies used for virtual transmission are not complicated to use. The organization of hybrid exhibitions allows for a combination of on-site and virtual visitor experiences, which provides an opportunity for better dissemination.



Fig.04a-04b-04c Model of public spaces of the city of Zabrze viewed in augmented reality in the vicinity of the building of the Architecture Faculty in Gliwice, access to the model using QR-code, model at the exhibition site; authors: T. Bradecki, K. Fross

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In 2015 Tomasz Bradecki in the group of the best architects of 40 according to the propertydesign.pl magazine, in 2017 a member of the HOMEZONE nomination committee. Designer of many houses and public buildings projects, passionate for urban design, architecture and sports including climbing. Earlier design practice in Germany and United Kingdom.