

# Chapter 21

## ARCO: Building Virtual Museum Exhibitions with Flex-VR

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### ABSTRACT

*In this chapter, a virtual museum exhibition system, called ARCO, is presented. ARCO enables museum staff to create, manage and display virtual exhibitions of museum artifacts in rich 3D and multimedia forms. Such exhibitions can be accessed both internally within the museums and remotely over the Internet. Due to the use of a novel approach to building configurable virtual reality applications, called Flex-VR, virtual exhibitions in ARCO can be easily and quickly built by museum staff, even if they do not have experience in 3D design and programming. The chapter provides an overview of the ARCO system, a description of the virtual exhibition design process and examples of virtual exhibitions built with ARCO.*

### INTRODUCTION

Cultural heritage as an application domain can largely benefit from the use of interactive 3D and virtual reality technologies. Most museums do not have the space and resources required to exhibit their whole collections. In addition, the nature and fragility of some of the objects prevent museum curators from making them available to the public. Also, the interaction of museum visitors with the exhibited artifacts is usually very restricted, e.g. they cannot look at the artifacts from all angles,

compare artifacts or study them in different contexts. In this respect, virtual reality technologies can offer great help. These technologies provide solutions that enable visualization of 3D digital models of museum artifacts in either purely virtual or digitally reconstructed environments. They also allow visitors to interact with the models in a variety of ways.

Modern museums already exploit various multimedia technologies to attract visitors – both visitors coming to the museum in person and visitors on the Internet. For the first type of visitors museums prepare on-site interfaces, such as kiosks, permitting them to browse through museums’

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digital collections and access information related to the physical exhibitions. For the second type of visitors museums prepare extensive websites describing the collections, often connected with virtual exhibitions of objects.

In most cases, these interfaces are based on either HTML or Flash technology and are mostly limited to 2D content. This form of presentation does not enable creation of fully-featured virtual exhibitions. Museums are keen on presenting their collections in a more appealing and exciting manner. Therefore, many museums have already started developments with some form of 3D presentation of objects. In most cases, these are only projects at an initial stage, but the number is rapidly growing and it is evident, that museums start to recognize the potential offered by these technologies.

Two main difficulties that museums, and other cultural heritage institutions, encounter while trying to widely adopt virtual reality technologies into their standard way of operation are: (1) efficient creation of 3D models of artifacts and (2) building virtual exhibitions based on these models.

Significant technical progress has been recently made in the area of 3D scanning. The technology becomes better, faster and more affordable. It can be expected that in the near future museums will be able to routinely create high-quality 3D models of their artifacts. The availability of 3D models of artifacts is a prerequisite, but it is only the first step. For wide adoption of the VR technology, museums need efficient, cost effective and simple methods of creating virtual exhibitions based on their collections of 3D models. The work on setting up an exhibition should be performed by museum staff (e.g., curators, historians, educationalists), who cannot be expected to be IT experts.

At the same time, the system must provide museum visitors with an intuitive human-computer interface based on well-known metaphors. Users should be able to interact with digital content easily and naturally like they can interact with objects in the real world. Everything that does

not meet these criteria will not be understood and – therefore – will not be generally accepted.

In this chapter, a virtual museums system, called *ARCO – Augmented Representation of Cultural Objects*, is presented. ARCO enables museums to create, manage and display virtual exhibitions of cultural objects accessible both within the museums – on local computers or information kiosks – and remotely over the Internet. Virtual exhibitions created with the use of ARCO have a form of rich multimedia 2D or 3D web content.

The design of the ARCO system is based on a novel approach to building 3D applications, called Flex-VR. The use of Flex-VR enables building configurable virtual exhibitions, i.e. exhibitions which can be easily assembled from independent reusable components, such as 3D models, templates and behavior scripts. The process of assembling an exhibition is quick and easy making it possible to create virtual exhibitions by museum staff, even if they do not have experience in 3D design and programming [Walczak, Cellary, White, 2006][Walczak, Cellary, Prinke, 2008][Walczak, 2008].

The Flex-VR approach consists of five inter-related elements:

1. *Flex-VR content parameterization*: a method of parameterization of content and interactive or automatic on-request instantiation of content based on parameterized presentation templates.
2. *Flex-VR content structuralization*: specific organization of VR content based on a novel *Beh-VR* model, which enables composition of interactive behavior-rich scenes from independent components, called VR-Beans. The appearance and behavior of VR-Beans in virtual scenes are controlled by scenario scripts encoded in a novel XML-based language, called VR-BML [Walczak, 2009a].
3. *Flex-VR content model*: a high-level generic persistent VR data model, which enables efficient creation and manipulation of VR

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