

PREPRINT – Final version with illustrations published:

Loebel, J.-M.: Interaction with Games by Means of Emulation in the Museum Context
In: Deutsches Filminstitut - DIF e.V. (Ed.), Lenhardt, E.; Rauscher, A. (editors): *Films and Games: Interactions*. Berlin: Bertz and Fischer, 2015. ISBN: 978-3-86505-242-1, ISBN (German Version): 978-3-86505-241-4, pp. 230-233.

Interaction with Games by Means of Emulation in the Museum Context

Jens-Martin Loebel, [bitGilde IT Solutions UG](#) (haftungsbeschränkt)
<loebel@bitgilde.de>

Digital objects are the commodities of the Information Age as well as being valuable cultural and scientific resources. They are thus part of our digital cultural heritage, but their preservation and accessibility represents one of the major challenges to our society. How can digital objects be suitably presented and be made available? How can our digital heritage last and be adequately preserved? The Gesellschaft für Informatik (German Informatics Society) has recently declared this to be a “Grand Challenge”¹ and this highly interdisciplinary task is the subject of numerous research and preservation projects.

The preservation of digital data is thereby not a single event, but rather an ongoing process. Digital storage devices, for instance, are significantly less durable than those for analogue media. Data stores must be copied periodically and transferred to the latest generation of storage media. In addition, the underlying hardware and software — operating systems, drivers, programs, and data formats — are subject to constant change. Furthermore, there are a growing number of mostly proprietary file and data formats that represent a far greater problem. Digital data must be decoded in a manner that can be perceived by individuals: Data and file formats that exist as stored bitstreams are represented via software and, where necessary, further components. Ways must be found to keep all software components — objects, player applications, supplementary programs, drivers, and operating systems — permanently usable across generations of computing and software systems. Maintaining complex and interactive digital artefacts such as computer and video games carries with it additional requirements due to their high level of interaction and their associations with many media elements such as image, sound, video, and 3D. At the same time, preserving the look-and-feel of the game and the dispositif arising from software and hardware, including the input and output devices, the reception area as well as the historical performance practice comes to the fore.

¹ Cf. www.gi.de/themen/grand-challenges-der-informatik/digitale-kultur.html, accessed February 1, 2015.

Emulation as Preservation Strategy

The method of emulation has proven itself to be the only viable way to preserve the properties of this class of complex digital objects comprised of obsolete computer systems.

Emulation as software technology is widely used in computer science and is a well-tested technique. Originally developed in the 1960s by IBM to run old programs on newly introduced and not backward-compatible IBM 360 computer architecture, emulators bridged the temporal and technological gap between two computer systems.² An emulator is a special software program that mimics part of the properties of a computer system. At runtime, the emulator translates machine commands from one system into corresponding semantically equivalent software commands of another system. Such an emulator is capable of executing the software of system A, for instance, an obsolete home computer or video game device, on system B, for example, a current PC to produce ideally the same output. In the gaming field the development of such emulator programs is primarily driven by a community of enthusiasts that are networked over the Internet and interact with each other with the aim of preserving the games and concomitant systems of their childhood and youth, making them permanently playable. It is effectively a collateral benefit that today open source emulators created by hobby developers now exist for almost any obsolete system. Conservation through emulation is essential in preserving the character of complex digital objects and allows for an authentic reproduction.³

Challenges in the Exhibition Context: A Prototype for the Film Museum

For the exhibition *Films and Games: Interactions* stations were developed where visitors could play game scenes interactively. In addition to the consideration of comparative film sequences, the direct control of certain game scenarios from different times and different systems is necessary. In a first prototype of the hardware and software, the company bitGilde IT Solutions UG determined the conceptual and technical challenges.⁴

² Cf. Stuart G. Tucker, "Emulation of Large Systems," in *Communications of the ACM*, vol. 8, no. 12 (1965), pp. 753–61.

³ Jens-Martin Loebel: *Lost in Translation—Leistungsfähigkeit, Einsatz und Grenzen von Emulatoren bei der Langzeitbewahrung digitaler multimedialer Objekte am Beispiel von Computerspielen* (Glückstadt, 2014), accessible via www.translation-gap.de, accessed February 18, 2015.

⁴ www.bitgilde.de, accessed February 18, 2015.

The system is based on only those open source emulators that are specialised for the execution of digital games. In addition, the code of emulator programs was extended to save the state of the emulated “virtual” system automatically and restore it at startup (so-called save states). To generate a save state, the current state of the processor and all system components as well as the contents of the system and the graphics memory are collected and then saved in serialised form in a file.

In this case, the focus was on developing an automated loading system for the save states, embedded in a menu with web and scripting control. The basic idea of the prototype was to develop a framework that demonstrates the feasibility of the concept and provide an extensible architecture.

The version in the museum sector also had further requirements. Care had to be taken to ensure the ease of maintenance and the interchangeability of parts and components, and the robustness of hardware that is subject to continuous use. This was achieved through the installation of standard PC components and game controllers, built-in and not visible to visitors. At the same time, the total cost could be further minimised through the use and extension of free software. In order to run, emulators inherently require a system that is significantly more powerful than the original emulated system. Here, a choice had to be made in terms of balancing the power requirements with minimising the heat and sound (generated by the system ventilators) of the PCs. To ensure a constant flow of visitors, the game ends by means of magnetic sensors when visitors return the controllers to the exhibit. The length of the game time is also limited.

The menu and the script control have been realised as dynamic webpages connected to a local web service. As a result, this separates the design and user interaction from the rest of the system. Menu and design can be customised as needed without special technical knowledge.

The web application runs on the Firefox browser, which has been placed in a special kiosk mode for exhibitions, and public places. This makes it possible to precisely determine the interaction with visitors and hide the underlying system in the exhibition. It is planned that the results and the prototypes will be published under a free license to allow for diverse reuse.