

# Interactive Experiences in the Stedelijk Museum

## A Living Lab Experiment with the CHESS Framework

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**Abstract**—This paper reports on a small-scale experiment conducted in the Stedelijk Museum Amsterdam (SMA), showcasing the effective use of CHESS research prototype for the creation and provision of personalized interactive museum experiences and highlighting the main results reached.

**Index Terms**—Personalization, Interactive Digital Museum Experience, Experiment

### I. INTRODUCTION

Personalization systems have been increasingly used in museums and cultural institutions worldwide as a way to offer enhanced experiences, tailored to the visitors' needs [1]. The CHESS approach describes an interactive, personalized storytelling framework. The CHESS research prototype was developed under the CHESS (Cultural Heritage Experiences through Socio-personal interactions and Storytelling) project (<http://www.chessexperience.eu/>), aiming to enrich museum visits through personalized interactive storytelling, so as to (re-)inject the sense of discovery and wonder in the visitors' experience. The CHESS system uses personalized information to create customized stories that guide visitors through a museum and employs mixed reality and pervasive games techniques, ranging from narrations to augmented reality on smart phones and tablets [2], [3].

CHESS follows a plot-based approach, where the story authors write and produce stories around pre-selected museum themes. Similarly to the making of a movie, the authoring of CHESS stories includes four main phases, namely scripting, staging, producing and editing. During scripting, the author chooses the main concepts, narrating characters, sketches the plot, and writes the narrative text. In staging, the author associates parts of the script with exhibits, paths and other spots in the physical museum space. Then, a set of multimedia resources is produced for the staged script, including audio-visual material, interactive images, games, quizzes or augmented reality applications. Finally, the author edits,

selects, and orders the multimedia digital resources to implement the final script into a storytelling experience.

So far, the CHESS system has been used to create stories for the Acropolis Museum, an archaeological site in Athens, Greece, Cite de l'Espace, a science theme park focused on space and its conquest in Toulouse, France, and Catalhoyuk, an archaeological site in Turkey [4], [5].

The experiment we describe here leverages the CHESS framework for the design and production of interactive experiences in SMA, a contemporary art museum. It was carried out by Antenna LAB (<https://www.antennainternational.com/>), in cooperation with members of the CHESS technical team and experts from the SMA. The purpose of the experiment was three-fold:

- Validate that the CHESS conceptual framework can be efficiently communicated to museum experts who are totally unfamiliar with the CHESS main concepts and workflows, so as to design new interactive experiences in a short period of time.
- Use the CHESS research system prototype for authoring and delivering adaptive interactive experiences to real museum visitors.
- Investigate the provision of content-based recommendations in a contemporary art museum.

In the following sections we describe the main work undertaken under all the main experiment phases, highlighting the main challenges and results reached under each one.

### II. EXPERIMENT BACKGROUND AND CONSTRAINTS

For the purposes of the experiment, the SMA delivered a set of existing audio guide digital productions, which typically provide information about the museum artworks, while in some cases contain general, historical information. A few of them are implemented as video productions but most are realized through audio narrations delivered by a human narrator and accompanied by images.

For this experiment it was decided to focus on the personalization aspect of CHES rather than the storytelling one. The reason for this choice was two-fold:

- Scripting (and corresponding production) of engaging stories is a really creative, time consuming task requiring several authoring refinement cycles and multi-disciplinary authoring groups (as verified by CHES studies and workshops) while the time schedule for the experiment was really tight.
- The SMA team was quite skeptical regarding the creation of fictional plot-centric stories and preferred to make “implicit”, information-driven stories using the existing productions in new ways.

The expressed skepticism clearly shows the need to publically provide successful examples of storytelling experiences implemented worldwide, so as to demonstrate and further disseminate to museum experts the remarkable results reached by adopting a storytelling approach.

### III. DESIGN OF INTERACTIVE EXPERIENCES IN THE STEDELIJK MUSEUM AMSTERDAM

Based on the aforementioned requirements and constraints, SMA and CHES experts cooperated to design interactive guided experiences, evolving inside the museum environment. Following the “one size doesn’t fit all” approach, the interactive tour was designed so as to enable visitors explore different artworks, presented through different narratives.

This is accomplished by defining a critical path (i.e. the shortest possible tour containing the script pieces that all visitors are expected to consume) and setting several optional sub-paths. Since the museum contains a set of “highlights”, the critical path was decided to include only the highlights; visitors can select which of the optional sub-paths they wish to enter through menus, thus choosing to what extent and in which cases they want to further explore the museum’s artworks and history. In addition, while a single route is currently implied in the SMA (based on the building’s structure and the labeling of the artworks), several alternative trajectories were defined, enabling visitors to traverse the museum in different routes.

Initially, the communication between the authors was accomplished through the design of flowcharts depicting the ordering of digital productions in an abstract level. Through a series of tentative discussions, clarifications and refinements over the flowchart, a first staged experience graph was formed, following the CHES storytelling model, for the representation of the envisioned interactive guided tour (Fig. 1).

From this point and on, this graph was used as the basis for the design of the Stedelijk interactive tours. Being able to represent the order of script pieces, their relation to the museum environment, as well as the branching points and sub-paths where visitor input is prescribed through dedicated menus, the communication between the designers was significantly facilitated. It was very interesting to observe that, while no formal training was provided over the storytelling model’s semantics and notation, the museum’s experts were quickly capable of understanding and leveraging it to represent and refine the envisioned personalized experience.

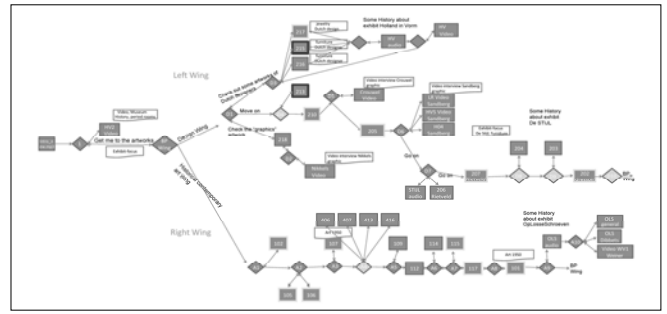


Fig. 1. Storytelling graph of Stedelijk interactive tour

Furthermore, a close examination of the original narrative pieces showed that they actually covered a variety of subjects and they were quite long (the audio production of each one lasted approximately three minutes). Aiming to increase visitor control over the presented content, the original narrative pieces were further divided and annotated so as to include a basic, small narrative piece for each artwork and set the rest as optional (through menus).

In order to proceed to a meaningful segmentation, the SMA team sifted through all the narrative content and identified seven main themes that were more or less repeating over the available narrative pieces: time and age, inspiration and vision, opinions, background information, descriptions, innovations and techniques. The existing audio productions were sliced up accordingly and the resulting narrative pieces were annotated according to these “themes”.

The main assumption behind this work is that visitors are not necessarily interested in all of these “themes” so they may lose interest before reaching the part they would actually be interested in. By slicing the narrative according to these broad themes, the visitors are enabled to select what type of information they want to get for each artwork. At the same time, the CHES system monitors visitor choices, interprets them as negative or positive feedback and updates visitor profiles, thus capturing visitor preferences over the defined themes. So as the experience progresses the visitor profile is enriched and it can be leveraged to suggest narrative pieces and artworks where the preferred themes are most dominant.

Overall, the design phase lasted approximately two weeks, reaching an advanced graph structure under the CHES storytelling model. This structure describes quite interactive tours guiding the visitor through the SMA in several different ways. The visitors can make many choices along the way controlling their visit, and sub-stories are activated or/and suggested based on what the visitor has previously chosen or skipped. While the SMA experts were not familiar with the CHES conceptual framework and no formal tutoring had been provided to them, they were capable of quickly grasping the main CHES concepts, envisioning a great variety of interactive tours in the museum and designing quite sophisticated interactive experiences in a very productive way.

### IV. STORY CREATION WITH THE CHES PROTOTYPE

The CHES Authoring Tool (CAT) was used to import the designed experience into the CHES system, going through the scripting, staging, editing and production phases:

- The interactive script graph was entered into the CAT, script units were annotated according to the selected themes, labels and images were entered for each menu choice and branching conditions were set.
- Navigation between the various points of interest was implemented through the production of annotated images, highlighting the target destination in the appropriate parts of the experience.
- For each narrative piece an audiovisual CHESS activity was produced; in case of video productions the corresponding digital files were uploaded to the CHESS server. In case of audio narrations, the CAT was used to create audiovisual productions, synchronizing the audio files to the presentation of selected image files.

To avoid the “heads down effect”, a simple audio symbol was employed in some cases, indirectly prompting the visitor to observe the artwork at that points, rather than the screen.

As soon as the import was completed, the tour was uploaded on the CHESS server and the SMA team was able to preview and test it in the museum environment. It is worth noting that the audio segmentation procedure worked surprisingly well – the sliced audio files were perceived as individual narrative pieces and not like audio files sliced and stitched together.

Then a series of refinements gradually took place, such as menu label adjustments (keeping a common notation and vocabulary among the choices), interface modifications (matching SMA’s artistic template), ordering of script units, conditions on optional sub-paths and annotations of narrative pieces according to the defined themes. New versions were uploaded almost every two days, enabling to test the tour’s flow and overall quality. In total, 8 new releases were uploaded over a period of two weeks.

## V. EXPERIMENT DESCRIPTION AND RESULTS

The designed experience took place in the ground floor of the SMA. For the purposes of the experiment, Antenna LAB provided 10 iPad tablets and configured them so as to operate with the CHESS framework. Via a wireless connection with the CHESS server, visitor choices were monitored and analyzed, updating visitor profiles and making personalized recommendations of narrative pieces throughout the visit.

To investigate the effects of the personalized recommendations to the visitors’ experience, Antenna LAB decided to compare it to the Antenna audio guide, a traditional audio guide experience that is currently provided within the SMA. To address significant differences in several aspects of the experiences provided by the two systems (i.e. different content, interface, functionality, system latency, etc) the CHESS system was re-employed for implementing a baseline version that simulates the Antenna audio guide.

The baseline experience provides no guidance within the SMA; a list of artworks is presented, titled according to their labeling in the museum. The visitor selects an artwork from the list and the corresponding digital content is displayed.

On the contrary, the personalized experience guides the visitor throughout the museum, while enabling him to make choices of artworks along the way. Recommendations of artworks and narrative pieces are provided in both versions, maintaining an identical look and feel; in the baseline experience recommendations are performed in a random way while in the latter they are based on the derived visitor profiles.

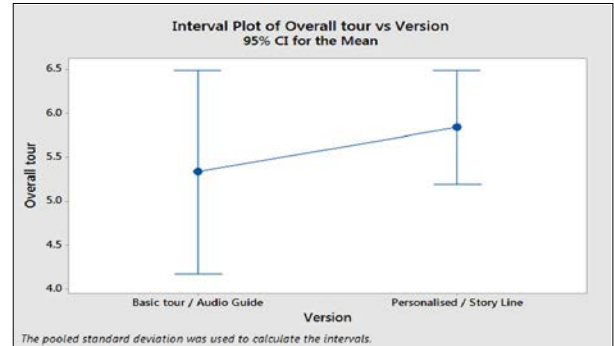


Fig. 2. Overall rating of the baseline experience (on the left) and the personalized experience (on the right)

The experiment took place from November 21, 2014 to December 15, 2014. Within a carefully designed testing environment, the Antenna LAB team handed out the iPads and offered free tours to the participants of the study. To construct a control group, half the iPads provided the baseline experience and half the personalized one. After the tour, a semi-structured interview took place, with questions including demographic and history data (such as age, gender, prior visits to the SMA, etc), as well as rating (scale of 1 to 10) and commenting on several aspects of their experience.

In total 61 visitors participated in the user study, from a variety of age groups, as indicated in Table I; 23 of them were male and 38 female, while 21 visited the SMA for the first time, 24 visit the museum more than once a year and 16 visit the museum more than 4 times a year.

TABLE I. PARTICIPANTS AGE PROFILES

Participants Age Profiles	Age Range					
	< 21	21-30	31-40	41-50	51-60	> 60
Number of participants	4	14	8	12	9	14

The experiment results were analyzed statistically in order to look for regression, cause-and-effect and relations between type of the experience and overall rating. Our findings show that the average overall rating of the personalized experience outperforms the baseline, although there is not a clear preference observed. However, the standard deviation of ratings for the personalized experience was much smaller, which points to a more stable experience compared to the baseline (Fig. 2). Notably, visitors that visit the museum more often are likely to rate both the experiences higher (Fig. 3).

A peculiar find was that male visitors rate the experience lower than their female counterparts (Fig. 4).

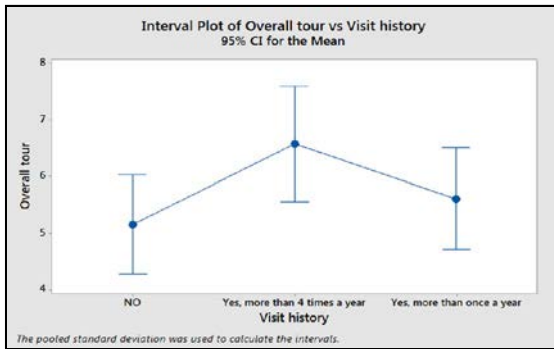


Fig. 3. Participants rating with regard to prior visit history

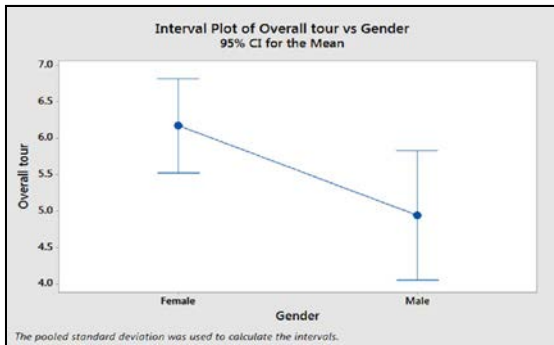


Fig. 4. Participants rating with regard to gender

A factor that significantly influenced the overall rating of the experience was the navigation within the museum. It seems that the simplistic approach of annotated images didn't satisfy visitors' expectations on that front and their experience was affected in a negative way.

A qualitative analysis of the visitors' comments shows that most visitors were not acquainted with the themes that curators used to annotate the narrative pieces. In addition, visitor preferences seem to be influenced by a variety of factors that were not modeled under this experiment, such as the color, form or the artist of the artwork. Finally, the extent to which the participants like "personalized content" seems to be influenced by general behavioral or cognitive traits, such as learning behavior, wish to feel in control, operate in secure environments, actively explore or follow concrete instructions.

## VI. DISCUSSION AND CONCLUSIONS

While carried out in an extremely tight time-frame, our experience from the aforementioned experiment showed that the CHES research prototype can be successfully employed by museum experts for the creation and delivery of interactive museum experiences. CHES concepts were successfully communicated to the SMA experts, who quickly designed a sophisticated interactive experience, going through all the authoring phases and reaching a high quality digital, interactive experience. Several refinements and new releases took place over a short period of time, verifying that quick prototyping is an essential feature of systems like CHES.

In addition, the CHES prototype was used to create a second type of experience, simulating a traditional audio guide. The development of this experience was completed in a couple of days, since CHES enables to efficiently re-use parts of an existing experience so as to create, experiment and compare it to alternative versions. The system was used for over a three weeks period, providing two different types of experiences to real visitors of the SMA.

The experiment results show that the design of personalized, interactive museum experiences is a very demanding task requiring the consideration of several aspects. To adapt to the increasing visitor expectations and needs, museums have to reframe their current offered content structures, allowing visitors to make choices and customize their experience to their needs. At the same time, museums need to consider the different traits and goals of their visitors, providing a variety of content, in a way that suits them. Our experience in the CHES project showed that the specification of visitor personas (i.e. archetypes) through ethnographic studies and interviews can serve as a valuable tool towards this direction [6], enabling museums to model their visitors so as to proceed to the design of different experiences.

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