What's in a Name: Gamifying the Intangible History of Larochette, Luxembourg

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The Larochette app is part of a larger interdisciplinary project to create a digital reconstruction of the town and castle of Larochette, Luxembourg. The paper discusses the creation of an app that serves to pique interest in linguistics and historical geography, traditionally dry subjects with little intrinsic appeal to children and the general public. This project harnesses this effect, presenting the results of the preceding landscape study in an interactive educational environment that rewards the user for engaging with the content. As the app allows natural movement and intuitive interaction, exploration and learning are prompted by curiosity. The goal of connecting place names to heritage is not explicitly stated, nor is it presented as an educational game. In short, this is the second phase of a collaborative case study in the digital experience of history, which is grounded in user experience design and informed by the historical and architectural expertise of the collaborators.

Key words:
Digital cultural heritage, gamification, toponyms.

CHNT Reference:
Christopher M. Morse and Marleen de Kramer. 2018. What's in a Name: Gamifying the Intangible History of Larochette, Luxembourg.

INTRODUCTION

Much as people learn to read a book, they must learn to read a landscape – its individual elements, its hidden connections, and its historical context. This project aims to make historic cultural landscapes – notably their structure, land use, relation of town and countryside, and key buildings – accessible to the public while also showing the variety of data that can help inform our knowledge. Its approach integrates the expertise of researchers in heritage science, linguistics, and information visualization to create and validate a scientifically accurate model of a historical and cultural landscape. It embeds the castle in its sociocultural context and highlights the tangible and intangible heritage that can be traced in the town's structures even today.

The digital reconstruction of Larochette castle and its historic environment supports a broader movement that integrates emerging technologies with heritage science and considers methods of evaluation and documentation that take into account the specific priorities of cultural institutions [de Kramer et al. 2018]. In this phase, the focus is on gamification, a powerful tool for outreach and dissemination. The final goal is the design of an educational game that reveals the connection between a town's past and the names of its squares, streets, and even car parks – a visualization of its intangible heritage.

Further development of the Larochette game builds upon experience fellow researchers have gained in a number of published case studies that explore the adoption of novel mixed reality and other 3D applications of heritage, such as a virtual reality exhibition featuring Cypriot engravings and Byzantine iconography [Loizides et al 2014], a gamified reconstruction of the Palazzo Fruscione-San Pietro a Corte archaeological site in Salerno [Andreoli et al. 2017], and an interactive installation to explore color in medieval illuminations [Correia et al. 2014]. These case studies, in addition to a recent survey [Papagiannakis et al. 2018], emphasize the strength of interdisciplinary collaboration and reinforce the need for iterative user testing and comprehensive assessment methodologies in the creation of serious games.

RELATED WORK

Gaming in cultural heritage has become an increasingly popular method to connect the public with historical places, objects, and ideas. These types of games are generally referred to as *serious games*, that is to say, games designed in tandem with pedagogical models that provide an educational experience alongside general entertainment [Zyda 2005]. A number of studies have shown the benefits of serious games and their effect on learning outcomes and retention [Wouters et al. 2013] and better attitudes toward learning [Vogel et al. 2006].

A recent study on interactive systems in cultural heritage [Koutsabasis 2017] revealed that almost one-third of reviewed systems (15 out of 53) consisted of varying types of educational or historical games. Moreover, 22.6 % of reviewed systems (12 out of 53) made use of 3D game engines, either as standalone PC-based applications or as immersive VR installations.

The present research draws on learning models designed for cultural heritage, notably the "Sandbox Serious Games" (SBSG) model [Bellotti et al. 2012], which immerses users within virtual environments and produces a series of localized tasks to encourage learning. This approach, derived in part from work on task-based learning [Willis 1996], has been re-conceptualized for use in cultural heritage contexts. It extends the project's reach beyond the academic realm to general audiences and brings the cultural landscape, with its tangible and intangible heritage, to life.

Mortara et al. [2014] differentiate between *cultural awareness* games, which attempt to educate users on intangible heritage, such as customs or beliefs, *historical reconstruction* games, which focus on faithful reconstructions of historical periods or places, and *heritage awareness* games which introduce virtual tourists to the tangible heritage (architecture, natural features, etc.) of a location. The Larochette app attempts to combine some of these approaches by creating opportunities for virtual tourism within a historical time period, while simultaneously presenting both the intangible and tangible heritage of a place based on empirical research.

PROJECT DESCRIPTION

GAME

In the app, the user appears inside a small room high on the side of the castle, its windows shuttered. Directly in front of the user, a small table holds two blocks with symbols for "castle" and "rock," which can be picked up with the "Virtual Reality" (VR) controllers and combined. On the far wall, a second table holds a map, with the single name "Buerg Fiels" in its center. When the combined symbols are placed on this name, the shutters fly open to reveal enticing glimpses of a winding river flowing through the green, empty valley below. This simple interaction teaches the user the purpose of the game without an explicit, potentially intrusive tutorial, but rather through experimentation and exploration.

When this initial problem is solved, further blocks with symbols will appear on the shelves in the niche and the map populates with more place names, chosen for their multiple clear elements. Combining these and moving them to the appropriate places on the map causes 3D graphical representations of the places attached to the names to appear in the landscape.

To the primary target user group of children and adolescents, the interface will be intuitive, and progress will be easy to measure; learning how place names connect to history is implicit, but not presented as the major goal.

ENVIRONMENT

The game is located inside an enclosed wooden porch or oriel projecting from the eastern facade of the Great Hall in the Criechinger Haus, the private apartments of one of the noble families that co-owned the castle, rather than on top of one of the towers.This decision was made for multiple practical reasons: this oriel offers a broad view over the valley and all place names of interest. It has been physically reconstructed and can be visited today. Its dimensions – roughly 2.5 m x 5 m – are approximately the same as those of a typical Virtual Reality play area, meaning the user can move naturally and not need to learn a counterintuitive "teleport" control. An enclosed space with windows to look out of is less likely to cause vertigo in users. Finally, but perhaps most importantly: a scientifically accurate

educational game would require a complete, validated reconstruction of the castle if using one of the towers; in this case, only one room needs to be reconstructed.

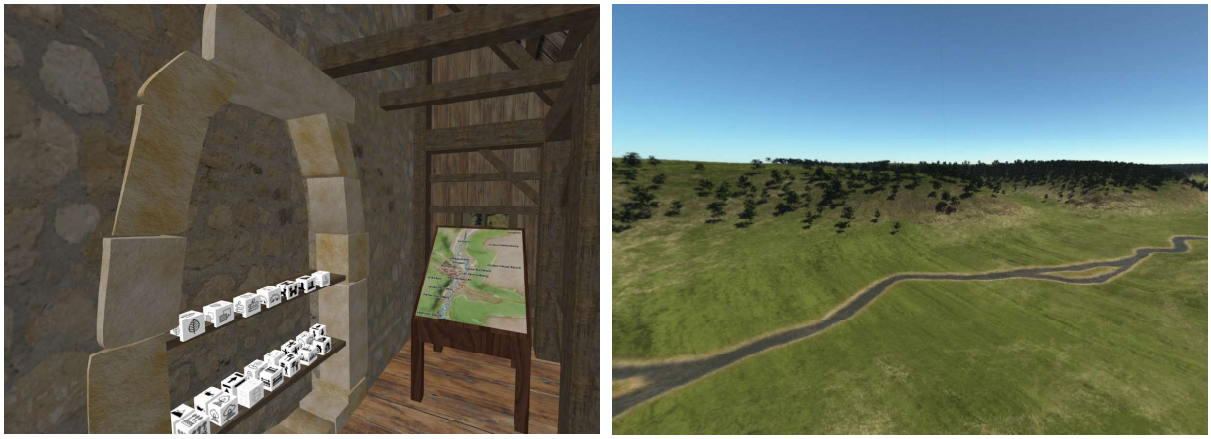

Fig. 1. Views of gameplay: room within the castle with map and symbol blocks (left), historical landscape (right)

Although a physically reconstructed room exists today, no record is available of the decision-making process for the reconstruction, so we cross-validated it using surveys of the ruins conducted in 1977, before the castle was partially rebuilt [Zimmer 1996]. The mostly-intact gable wall has a door leading out, a fireplace on the outside, and a window that looks across to the altar of the chapel in the tower on the northern side. The presence of the oriel is indicated by holes suggesting joists and rafters (their position makes them unlikely to be putlogs for temporary scaffolding) and four stone corbels to hold a lightweight floor. The original purpose of the room is unclear; Zimmer postulates that it was a latrine, though its size and placement above the path leading up from the town make that unlikely. The current interpretation given by the information boards in the castle declare it to have held the bath. A defensive structure such as a hoarding or brattice is also possible, though the provision or a fireplace is puzzling. The virtual reconstruction largely aligns with the physical reconstruction in situ, though some changes were made to the roof based on the location of the holes for the wooden beams.

The virtual room was given somewhat anachronistic paned glass windows (similar to the windows in the physical reconstruction) to allow users to see out, and a wooden door closing off the doorway to visually constrain the user to the space. The fireplace was repurposed as a niche to hold shelves for game objects.

The room was modelled in *Autodesk 3ds Max*[1], using architectural drawings based on those from the 1977 survey as a reference. To keep the polygon count low and allow the finished app to run smoothly on a number of devices, the geometry is simple and detail is mostly provided through textures with bump maps, though individual, existing stones were reproduced around the wall openings for added realism. Wood and stone textures were chosen based on the local landscape; some even taken from photographs of the castle itself.

The landscape was modelled in *Terragen*[2], based on the results of the preceding study [de Kramer et al. 2018]. It was rendered at high resolution using a spherical camera at the point where the viewer would be standing – with a 5 km radius, the 5 m movement allowed is negligible – and the rendering applied to a spherical skybox. This again significantly reduces the polygon count while presenting a photorealistic perspective of the landscape. As the landscape was represented in summer, with lush vegetation and ripening crops, the position of the sun was calculated for high noon at midsummer solstice in 1550, which minimizes shadows.

All symbols come from the *Noun Project*[3] and are used under license. They were chosen to correspond to name elements accurately – for example, they include a water mill rather than a windmill for the "mill" symbol.

[1] https://www.autodesk.com/products/3ds-max/overview
[2] https://planetside.co.uk/
[3] thenounproject.com

CONTENT

As the game is intended to show the connection between toponyms and landscape features, it highlights those features alluded to by names that can be found today – in street names, on maps, on signposts and in the local collective memory [de Kramer et al. 2018].

In its simplest form, the game would consist only of players matching symbols to names. Instead, names composed of multiple elements were chosen. This adds a layer of challenge by making users combine symbols to create full names. However, it also expands the learning effect – users are shown common elements and can infer their meaning. This helps with contractions, like "Birkelt" for "birch field", but also allows them to extrapolate meanings of common elements and apply them to other toponyms they encounter. This is enforced through repetition of certain symbols.

The 3D symbols for the map will be abstract models rather than photorealistic accurate reconstructions of each part, so they will have a relatively low level of detail.

PLATFORM

The app will showcase historical research, but also serves to demonstrate how modern technology can be used as a teaching tool at open days, lab tours, and conference visits. It is designed to provide a realistic experience in virtual reality, especially the astonishing sensation of depth when viewing the landscape from high above. As it is designed for the HTC Vive, interactivity is made possible using two controllers.

The virtual reality experience can easily be set up and run with two people and a power source; an internet connection is not necessary, as the app is stored locally. However, this presents a barrier to dissemination, as it relies on specialized equipment and operators. Consequently, a web-based version that can be viewed on computers or mobile devices will also be developed, which will use touch or mouse controls for navigation and interactivity.

The first version of the app used *A-Frame*, a web framework that allows fast and simple implementation of virtual reality project, and which supports the import of objects and textures, and uses native elements for movement and behaviors. Due to technical issues, this will need to be changed to another, more complex platform as the game is developed.

PROTOTYPING & DEVELOPMENT

CHALLENGES

A-Frame[4] was useful for the initial proof of concept insofar as it provided a portable, web-accessible, immersive environment for initial user testing. Nevertheless, it is not suitable for the envisioned game. Initial testing encountered a series of problems with the physics system, which is currently a separate plugin, and revealed that the system was designed for native objects and is not compatible with the more complex geometries generated in other programs. It will not, in its present form, allow the interactivity needed.

Instead, the content will be ported to a gaming engine such as Unity, which has support for complex geometries and prefab scripts for interaction and movement. It can be exported as *WebGL* for online display, and as a local app for use with common VR hardware.

INITIAL USER TESTING

The project has undergone two phases of early user testing: first in Cyprus during the EuroMed 2018 conference, and again in February 2019 at the *Forum Z: Who's Afraid of the Digital?* event in Luxembourg City.

At EuroMed, conference participants tried an early version of the immersive VR experience where they were able to walk around the castle room and view the landscape through the windows. This initial test revealed that the controllers provided necessary visual orientation even without interaction, and users felt safer holding them. Since interactivity was extremely limited in this version, it was difficult to gauge the interest of people in the app versus in the novelty of the VR experience itself.

[4] https://aframe.io/

During the *Forum Z* event in Luxembourg City, researchers and industry professionals had the opportunity to play an analogue version of the Larochette game, followed by full immersion in the VR prototype. The analogue Larochette game consisted of a paper prototype featuring a printed map from the game and all of the associated symbols. Participants were instructed to match the symbols with the location on the map as they would in the real game. During the event, fifteen people who tested both the analogue and the virtual reality game were asked to provide feedback. This consisted of written comments/suggestions about the VR prototype and an additional form for participants to draw symbols that they felt best represented the names of places.

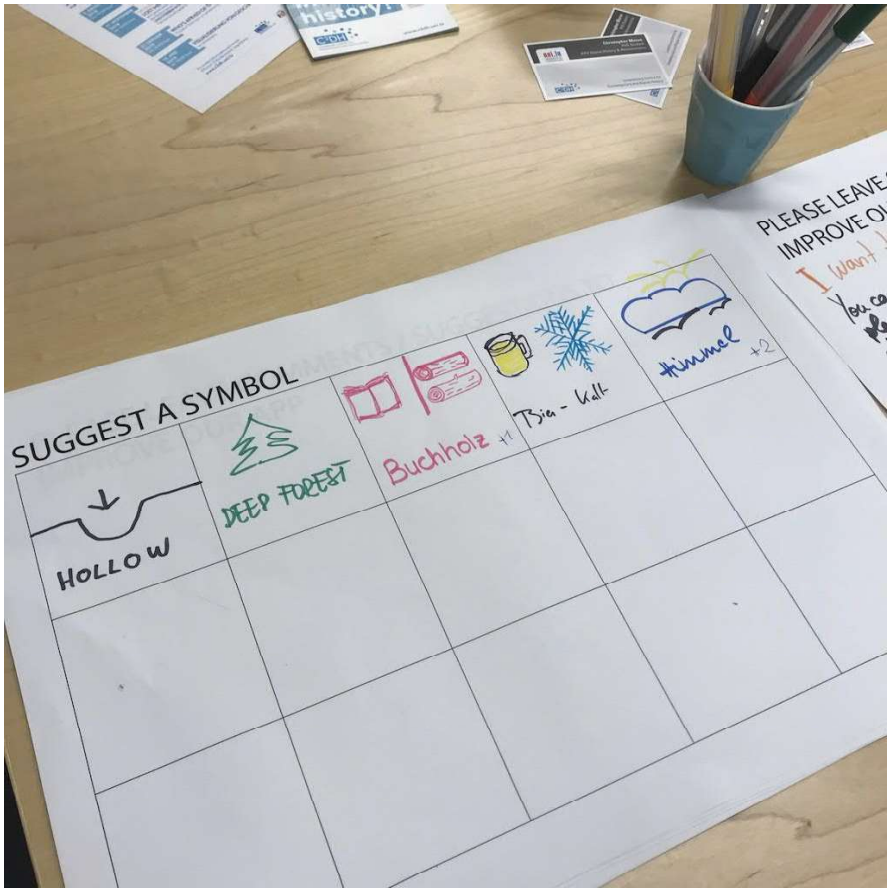

Fig. 2. User provided suggestions for symbols to represent different toponyms in the game

This test revealed that the difficulty level of the game needs to be adjusted for the average user. Useful changes include: clearly separating the names into elements, marking irrelevant prepositions, optimizing symbols, and providing feedback when elements have been combined correctly. Providing a list of names alongside the symbols so they can be matched while all are visible is also potentially a useful improvement. Alternatively, symbols could be matched to elements and then combined automatically, rather than combinations matched to full names – as some elements repeat – this would decrease the difficulty, like a crossword providing some letters through answers to other clues.

CONCLUSIONS

While virtual reality remains an emerging technology, users are often drawn to try it for the novelty alone. The app seeks to capture that interest and transform it into interest in local heritage without explicit teaching. This requires a subtle approach, a *meaningful environment* and a *suited and intuitive interaction paradigm* [Mortara et al. 2014] that harnesses the user's curiosity and subtly guides them to explore the setting and discover rewards for completing tasks without ever stating them outright. To keep the user's attention, the app will require careful balancing to be

challenging but not frustrating. The premise is, at present, easily understood, but requires fine-tuning of the user interface and interactivity and level of guidance to meet this ideal.

ACKNOWLEDGEMENTS

We would like to thank the Centre for Contemporary and Digital History (C²DH), the Institute for History (IHIST), the Human-Computer Interaction Research Group, and finally the Fonds National de la Recherche, which funds the doctoral program of which this collaboration is a part. Special thanks to our colleague, Sam Mersch, for his assistance in the initial landscape study.

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Imprint:
Proceedings of the 23rd International Conference on Cultural Heritage and New Technologies 2018.
CHNT 23, 2018 (Vienna 2019). http://www.chnt.at/proceedings-chnt-23/
ISBN 978-3-200-06576-5

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie
Editorial Team: Wolfgang Börner, Susanne Uhlirz