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Leveraging the Transmedia Entertainment-Education Framework to Augment Tourists' Awareness of Local Values

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To the Fragments of Laura Team

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Abstract

Stories are used to explain aspects of ourselves or our culture and to engage people around shared values and practices. Recent developments in Digital Media technologies allow stories to be quickly created and shared widely. One example of this is Transmedia Storytelling (TS). It combines the capabilities of ubiquitous computing technologies, real-life experiences, and learner-focused pedagogy to create a unified entertainment experience. TS is becoming an increasingly important technique for the tourism industry as it can engage, inspire, and gather audiences online and offline. This is especially relevant during times in which people's mobility is increasing exponentially¹, and tourism development needs to take place in an open and sustainable manner, motivating the empowerment of local communities and protection of cultural/natural habitats. This research identified how Transmedia Storytelling and Entertainment Education approaches could be combined and unified into a single framework, laying the grounds to guide the design of experiences that involve entertainment, interpretation, education, and personal growth of tourists visiting particular destinations. In order to study this novel framework, a TS research prototype, called Fragments of Laura was designed and implemented, which incorporated the several elements of the novel Transmedia Entertainment Education framework. After extensive evaluations, Fragments of Laura proved to be a successful example of a Transmedia Entertainment Education experience that contributes to emotionally engaging its audience while delivering local heritage information and fostering empathy and respect regarding local heritage and community. Hence, the research directions presented throughout this document, in the format of a novel framework applied to a case study, aim to inspire and helps future designers (experience designers, marketing designers, cultural planers and even museum/cultural curators) to delve into designing storytelling experiences that impact positively not only upon the tourists' experience, but also the local communities.

Keywords: Transmedia Storytelling, Entertainment-Education; Narrative Persuasion; Sustainable Tourism; Natural Heritage; Location-Multimedia Stories, Hypermedia, Tourism Experience, Framework, Mixed-Reality, Virtual Reality.

¹ Research conducted prior to the COVID-19 Pandemic which has brought the tourism economy to a momentary standstill.

Resumo

As histórias são usadas como forma de explicar e retratar aspetos das nossas vivências e/ou da nossa cultura, fazendo com que as pessoas se envolvam através da partilha de valores e práticas. Recentes desenvolvimentos relacionados com tecnologias de medias digitais permitem que as histórias sejam criadas e compartilhadas de forma cada vez mais rápida e ampla. Um exemplo desta profunda transformação são as Narrativas Transmídia (NT) que estão a tornar-se uma abordagem importante no contexto da indústria do turismo, com o propósito de envolver, inspirar e juntar públicos tanto online como offline. Esta abordagem é particularmente relevante nos tempos em que vivemos onde a mobilidade dos cidadãos tem crescido exponencialmente² e o desenvolvimento do turismo necessita continuar de forma sustentável, motivando e potenciando as comunidades locais, ao mesmo tempo a proteção dos habitats culturais/naturais. Esta pesquisa segue uma abordagem híbrida entre as Narrativas Transmídia e o Entretenimento Educativo e como ambas as abordagens podem ser combinadas e unificadas em uma só abordagem que estabeleça uma base comum para conceptualização de experiências interativas que contribuam para o entretenimento, interpretação, educação e o crescimento individual de turistas aquando das suas viagens. Para estudar esta abordagem inovadora, um caso de estudo, intitulado de “Fragments of Laura” foi projectado e implementado, incorporando diversos elementos de Entretenimento Educativo numa perspectiva transmídia. Após extensas avaliações, “Fragments of Laura”, provou ser um exemplo bem-sucedido de uma experiência que combina Narrativas Transmídia e Entretenimento Educativo, contribuindo para descoberta de conteúdos relevantes sobre o património local, promovendo empatia e respeito em relação ao património local entre turistas e respetiva comunidade local. Assim sendo, a pesquisa apresentada ao longo deste documento, propõe uma nova estrutura para combinar as abordagens Narrativas Transmídia e Entretenimento Educativo que sirva de inspiração para futuros designers de experiências, gestores culturais e de museus que queiram aprofundar e providenciar novas experiências que tenham um impacto positivo na experiência dos turistas, mas também para a comunidade local.

Palavras-chave: Narrativas Transmídia, Entretenimento-Educativo, Narrativas Persuasivas, Turismo Sustentável, Património Natural, Hipermídia, Turismo, Realidade Híbrida, Realidade Virtual.

² Pesquisa realizada antes da Pandemia devido ao COVID-19 que fez com que a indústria do Turismo esteja momentaneamente parada.

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Acronyms and Abbreviations

ICT	Information Communication Technologies
TS	Transmedia Storytelling
EE	Entertainment Education
TEE	Transmedia Entertainment Education
UNESCO	United Nations Educational Scientific and Cultural Organization
EU	European Union
FoL	Fragments of Laura
T4C	Transmedia for Change
PE	Pervasive Entertainment
IEM	Immersive Engagement Model
E-ELM	Extended Elaboration Likelihood Model
CBTV	Community-Based Tourism Ventures
LAMS	Location Aware Multimedia Stories
AR	Augmented Reality
VR	Virtual Reality
MVR	Mobile Virtual Reality
MR	Mixed Reality
HMD	Head-Mounted Display
DI	Design Insights
ACM	Association of Computer Machinery
GPS	Global Positioning System
POI	Points Of Interest
GUI	Graphical User Interface
RtD	Research through Design
ERDM	Empirical Research through Design Method
EP	Experience Prototype
2D	Two Dimensional
3D	Three Dimensional

NS	Navigational Styles
UX	User Experience
UXQ	User Experience Questionnaire
GEQ	Game Experience Questionnaire
FG	Focus Group
IC	Identity Codes
TP	Touchpoint
MQS	Madeira Questions Scale
NTS	Narrative Transportation Scale
UESS	User Engagement Short Scale
FA	Focused Attention
PU	Perceived Usability
AE	Aesthetics Appeal
RW	Reward Factor
MTE	Memorable Tourist Experience
SPSS	Statistical Package for the Social Sciences
IQR	Inter Quartile Ranges
Mdn	Median
LBS	Location-Based Storytelling
CH	Cultural Heritage



1 Introduction

In this chapter we describe the motivation behind this research work, an overview of the research process, and the main contributions of this thesis.

1.1 Motivation

Stories are all around us and often told in order to inform, persuade, entertain, motivate, or inspire [TSRT00]. Through the act of storytelling, a cross-cultural understanding can be developed by sharing information that is ordinary and familiar to us with those who may find it unfamiliar. Stories can be used to explain aspects of ourselves and our culture, and to engage people in a discussion around those values and practices that are shared, and those that differ [KRPC00]. This ability that stories have to bring people together around a subject is especially relevant in times where Tourism is an activity within reach of millions [Wor17] and when the intense and disproportionate growth of tourism may generate damaging environmental and social effects³. Tourism pressures can generate

³ The research presented in this document was conducted prior to the outbreak of COVID-19. The pandemic, which has now impacted the Tourism industry since the response to curb the pandemic has translated into national lockdowns, travel restrictions and shutdown of borders, means tourism is one of the hardest-hit sectors and makes it hard to predict if the Tourism industry will recover. However, several measures have been adopted by countries to mitigate the effects of COVID-19 in tourism and support recovery [Stac00, Wor120].

friction between visitors and the local community, as visitors may adopt behaviours that go against the local culture or traditional values [Macc76, Tuss14]. Cities such as Barcelona, Venice, Lisbon, Amsterdam, to name a few, are threatened by “Over-Tourism,” a phenomenon that transforms the cities into “amusement parks targeted at tourists” and increases the friction between residents and visitors [RiMa00]. This friction may lead locals to dislike tourism and to develop coping mechanisms to avoid contact with visitors [FSPI08, Tuss14], generating unexpected consequences in the long run.

The pervasive adoption of Information Communication Technologies (ICT) in tourism has brought about fundamental implications to the way leisure-related travel is planned [BuLa08], and the tourism product is created and consumed [PrRa04, StSk03]. Broadly speaking, digitally aided tourism is concerned with the use of digital technologies to enhance the tourist experience: “Digitally aided tourism concerns the mixing of the real world with digital media designed to enhance the visitor experience.”[BQOR14]. The work of Neuhofer [NeBL15] analyses how ICTs are a catalyst for change and can transform the tourist experience. In fact, as early as in 1998, Pine and Gilmore predicted that ICTs would generate new types of tourism experiences due to interactive games, chat rooms and virtual reality. ICTs have fostered a transformation of tourists from passive to active, static to mobile and connected tourists, who co-create experiences in a technology-enabled experience environment [GFFO06, NeBL14, PrRa04]. Thereby, ICTs can support a range of culturally aware touristic activities, which can change existing experience and lead to new types of tourist experiences [GFFO06, Volo09]. Destinations need to continuously update and innovate their offers, [Cohe79, PiGi11] but “conscious tourism” is the desirable direction to take, in which the growth of the travel and tourism sectors continues with investment and development taking place in an open and sustainable manner, motivating the empowerment of local communities and the protection of cultural/natural habitats [BaMa10, Baud17, Sche99].

This research explores the potential in Transmedia Storytelling (TS) allied with Entertainment Education (EE) theories and how they can play a role in sensitizing tourists towards local values and the social good while providing rich entertaining and educating experiences. TS is defined by Henry Jenkins as “a process where integral elements of a fiction get dispersed systematically across multiple delivery channels for the purpose of creating a unified and coordinated entertainment experience”[Jenk08]. At the same time,

Singhal and Rogers [SiRo01] defined EE as “the process of purposely designing and implementing a media message to both entertain and educate in order to increase audience members’ knowledge about an educational issue, create favourable attitude, shift social norms, and change the overt behaviour of individuals and communities.” Tourists often search for information regarding their current or future destination through several types of media channels (web, tv, mobile apps). Consequently, the transmedia storytelling approach seems to fit their natural searching process [NJCW17]. The main strength of successfully designed TS is audience participation, engagement, and interaction, which can occur over different channels of communication. The main strength of EE is the narrative persuasion harnessed to educate and engage people on a wide range of issues, and ultimately even persuade them to take action [GrBK04, GrBr00].

The relevance and rationale for this research are grounded in the knowledge gaps within the area of TS experiences specifically designed for tourists. The identification of this gap is detailed in Chapter 2. Due to the complexity of Tourism experience, we propose to adapt current TS models and combine them with EE and Tourism experience theories. Therefore, this thesis research is centred on the proposition of a unified framework that serves as the basis to design experiences that stimulate tourists to create a closer relationship with local values, thereby promoting a more sustainable approach to tourism. The outcomes of this research are particularly applicable in sites where the natural and cultural heritage is a resource, and fragile ecosystems are at stake.

1.2 Research Aims, Questions, and Objectives

The overall research aim is to analyse how to combine TS and EE into a unified framework that makes users aware of the local values⁴ present in the destination's local context. By using a Research by Design approach [ZiFE07], the overall objectives of this research are:

1. To design experiences aimed at tourists by using the novel framework resulting from the TS and EE combined approaches. Such digital experiences will be designed to entertain while conveying a socially responsible message regarding a tourist destination.
2. Iteratively study and improve the Transmedia Entertainment Education experience, synthesising know-how to inform the future design of Transmedia Entertainment Education experiences targeting tourists.
3. Study the tourist experience while engaging with the novel Transmedia Entertainment Education experience in the real-world context.

Providing EE through storytelling in order to produce social change is not new, yet recent trends in TS represent a profound transformation in storytelling as it creates unified entertainment experiences across different platforms [Jenk08].

Based on the theoretical background, this research proposes an adaptation of two existing models [Thei00, What00] into a new unified framework, called Transmedia Entertainment Education (TEE) Framework, as explained in Section 2.4. The complexity of the tourists' experience as a target audience justifies the framework adaptation. When travelling for leisure, people search for specific experiences [PiGi99]. The framework takes this into account by aligning its offer with the tourists' needs and expectations. Finally, the experience should highlight, and prompt users to reflect on, the destination's local context, challenges, and values, in order to promote awareness.

⁴ In the context of this research it will be considered that the term "Local Value" regards anything that is worth preserving and sharing about a travel destination. This could be local flora, fauna, tangible cultural heritage (such as monuments) or intangible cultural heritage (stories, musical heritage, folktales).

The following research questions and corresponding objectives stimulate and underpin this inquiry:

Table 1-1 – Research Questions and Objectives

Research Questions
RQ1- What existing insights can be synthesized from existing literature to be adapted and integrated into the design of a TEE tourist experience?
RQ2- How to design a TEE Experience that delivers a memorable tourist experience while raising awareness towards local values present in the destination’s context?
RQ3- How does the evaluation of the FoL TEE case study enrich the proposed theoretical TEE Framework?
Research Objectives
RObj1 – Compile an exhaustive, state-of-the-art and theoretical background analysis in TS, EE, Location-Based Storytelling and Cultural Heritage for tourism purposes in order to synthesize insights that can work a comprehensive guide into the design of an experience that is based in the TEE framework.
RObj2 - To design and evaluate a TEE aimed at tourists, the primary goal of which is to deliver socially responsible messages regarding values present in a tourist destination.
RObj3- Reflect on evaluation results and the process of developing a TEE driven experience and discuss how it incorporates the different TEE framework elements in its design.

In order to test the unified framework, an original TEE experience, called Fragments of Laura (FoL), has been designed and produced according to the elements of the new framework combined with insights from current, related work (RQ1). The experience is then used as a case study to understand if the novel framework works according to defined goals, and, in particular, if it produces a memorable and satisfying contact between tourists and the local values (RQ2). Consequently, the final study is geared towards understanding if the TEE experience not only provides a memorable experience for tourists but also if tourists assimilate the message delivered by the TEE experience (RQ2). Finally, through reflecting on the findings of the final study, and lessons learned in the research process, we aim to understand how to consolidate TEE framework to be adopted by future research endeavours (RQ3).

1.3 Research Process Overview

The case study presented in this thesis document is contextualized within the tourism industry and the local values present in the Archipelago of Madeira, an established tourist destination and home to the Laurisilva forest (a UNESCO World Heritage site since 1999). It is often said that “Madeira Island lives and breathes of Tourism,” as its main source of economic income comes from tourism-related activities [AcKp15]. For small islands, like Madeira Island, tourism often represents an economic catalyst to enlarge their economy and overcome the disadvantages of smallness [Croe06]. However, the allure of islands such as Madeira is dependent on a blend of unique land formations, flora and fauna, and ocean and coastal resources, while over-tourism often contributes to environmental degradation (pollution, erosion, etc.) in small island-states, which are host to fragile eco-systems rich in biodiversity. It’s in this contradictory, dual reality of islands that rely heavily on tourism revenues but also struggle with the damaging effects of it, that this research has been developed. Part of the work presented in this thesis was conceived and developed within the context of two research projects: the EU funded Future Fabulators⁵ and the Beanstalk⁶ Research Project in partnership with the Madeira Promotional Bureau⁷.

It is important to highlight how the FoL conception, design, and development required a considerable amount of human resources and its development was only possible with the support and work of a multidisciplinary team composed of artists and programmers that worked under the Beanstalk Research Project. The development of the experience, following a Research by Design approach [ZiFE07], had a life-span of approximately four years, comprised of several stages and studies carried out over this time (see Figure 1:1). Furthermore, during the project development, my role was to co-develop the original story, interaction, and experience design of several prototypes, and to orchestrate several interim studies of FoL. Finally, I refined the FoL TEE prototype according to the new unified framework and proceeded to conduct an evaluation and data analysis in order to

⁵ <https://futurefabulators.m-iti.org/about/>

⁶ <https://beanstalk.m-iti.org/>

⁷ <https://apmadeira.pt/pt/>

answer the proposed research questions. Throughout the document the author’s contributions to the FoL prototypes are detailed in footnotes.

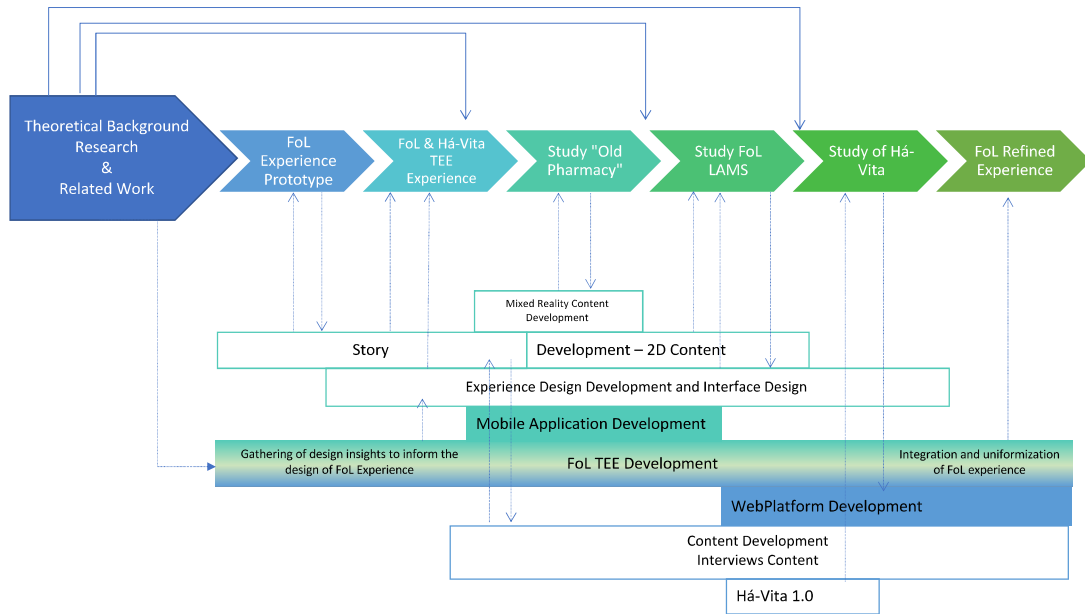


Figure 1:1 – Overview of the iterative research process that is documented in this manuscript. At the top are represented all the main stages/milestones followed, typically involving an evaluation.⁸

⁸ All images in this document were created by the author.

1.4 Contributions

The research process of this work consists of the following contributions:

1. The novel Transmedia Entertainment Framework.
2. A set of 13 design insights gathered from relevant, related work used to inform the design of experiences following the TEE Framework.
3. The design of the FoL, following the proposed TEE framework elements and design insights.
4. The evaluation of FoL TEE experience within a real-world context and visitors of Madeira Island.

1.5 Publications

Different aspects of the work developed under the scope of this thesis has been published in the following articles:

Journal Publication:

Dionisio M., Nisi V. (TBD – Currently accepted with changes) Leveraging Transmedia Storytelling to emotionally engage tourists in the understanding of local cultural and natural heritage. *Multimedia Tools and Applications*, Special issue on Sustainable, Empowering and Emotional Interactive Multimedia.

Full Conference Papers:

Dionisio M., Nisi V., Nunes N., Bala P. (2016) Transmedia Storytelling for Exposing Natural Capital and Promoting Ecotourism. In: Nack F., Gordon A. (eds) *Interactive Storytelling. ICIDS 2016. Lecture Notes in Computer Science*, vol 10045. Springer, Cham DOI: https://doi.org/10.1007/978-3-319-48279-8_31- Best Paper Nomination

Dionisio M., Bala P., Nisi V., Nunes N. (2017). Fragments of laura: incorporating mobile virtual reality in location aware mobile storytelling experiences. In *Proceedings of the 16th International Conference on Mobile and Ubiquitous Multimedia (MUM '17)*. Association for Computing Machinery, New York, NY, USA, 165–176. DOI:<https://doi.org/10.1145/3152832.3152868>

Dionísio M., Bala P., Nisi V., Oakley I., Nunes N. (2018) Step by Step: Evaluating Navigation Styles in Mixed Reality Entertainment Experience. In: Cheok A., Inami M., Romão T. (eds) *Advances in Computer Entertainment Technology. ACE 2017. Lecture Notes in Computer Science*, vol 10714. Springer, Cham
DOI: https://doi.org/10.1007/978-3-319-76270-8_3

Dionisio M., Silva C., Nisi V. (2019) Fostering Interaction Between Locals and Visitors by Designing a Community-Based Tourism Platform on a Touristic Island. In: Lamas D., Loizides F., Nacke L., Petrie H., Winckler M., Zaphiris P. (eds) *Human-Computer Interaction – INTERACT 2019. INTERACT 2019. Lecture Notes in Computer Science*, vol 11747. Springer, Cham
DOI:https://doi.org/10.1007/978-3-030-29384-0_46

Nisi V., Dionísio M., Silva C., Nunes N. (2019). A participatory platform supporting awareness and empathy building between tourists and locals: the Há-Vita case study. In *Proceedings of the 13th Biannual Conference of the Italian SIGCHI Chapter: Designing the next interaction (CHIItaly '19)*. Association for Computing Machinery, New York, NY, USA, Article 16, 1–10.
DOI:<https://doi.org/10.1145/3351995.3352049> Best Paper Award

Short Conference Papers:

Bala P., Dionisio M., Nisi V., Nunes N. (2016) IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality. In: Nack F., Gordon A. (eds) *Interactive Storytelling. ICIDS 2016. Lecture Notes in Computer Science*, vol 10045. Springer, Cham
DOI: https://doi.org/10.1007/978-3-319-48279-8_1

Dionisio M., Paulino T., Suri T., Autzen N., Schöning J. (2017). “In search of light”: enhancing touristic recommender services with local weather data. In *Proceedings of the 19th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '17)*. Association for Computing Machinery, New York, NY, USA, Article 97, 1–8. DOI:<https://doi.org/10.1145/3098279.3122140>

Bala P., Dionísio M., Trindade R., Olim S., Nisi V., Nunes N. (2017). Evaluating the influence of location and medium applied to mobile VR storytelling. In Proceedings of the 16th International Conference on Mobile and Ubiquitous Multimedia (MUM '17). Association for Computing Machinery, New York, NY, USA, 371–378. DOI:<https://doi.org/10.1145/3152832.3156617>

Doctoral Symposium Publications:

Dionísio M., Nisi V., Correia N. (2017) Leveraging on Transmedia Entertainment-Education to Offer Tourists a Meaningful Experience. In: Nunes N., Oakley I., Nisi V. (eds) Interactive Storytelling. ICIDS 2017. Lecture Notes in Computer Science, vol 10690. Springer, Cham
DOI:https://doi.org/10.1007/978-3-319-71027-3_43

Dionísio M., Nisi V., Correia N. (2018) Leveraging on Transmedia Entertainment Education to Augment Tourists' Awareness Towards Social Issues. In: Rouse R., Koenitz H., Haahr M. (eds) Interactive Storytelling. ICIDS 2018. Lecture Notes in Computer Science, vol 11318. Springer, Cham
DOI:https://doi.org/10.1007/978-3-030-04028-4_77

Book Editing:

Rouse, R., Dionísio, M. (2018) Looking Forward, Looking Back: Interactive Digital Storytelling and Hybrid Art Approaches. Carnegie Mellon University: ETC Press, Pittsburgh DOI:<https://doi.org/10.1184/R1/7406924>.

Book Chapter:

Dionísio M., Bala P., Nisi V., Câmara S. (2018) Bringing Locative Media Indoors: Strategies For Remediation In: Looking Forward, Looking Back: Interactive Digital Storytelling and Hybrid Art Approaches, Carnegie Mellon University: ETC Press, Pittsburgh, PA, 71-92

Art Exhibitions and Posters:

Silva, C., Bettencourt, A., Dionísio, M., Castro, D., Dionísio, D., Teixeira, D., Nisi, V.: (2017) Há-Vita: A transmedia platform about Madeira's nature and culture. In: 2017 Sustainable Internet and ICT for Sustainability (SustainIT). pp. 1–2 (2017).

DOI: <https://doi.org/10.23919/SustainIT.2017.8379813>.

1.6 Organization of the Document

The rest of this document is organized in the following way: **Chapter 2** describes the theoretical background that supports the proposal the novel TEE Framework. **Chapter 3** presents the related work around the intersection between TS, EE and Tourism experience. The chapter ends with a series of 13 design insights derived from related work to inform the design of TEE experiences. **Chapter 4** describes the stages of the development of FoL, the TEE Experience, and the implications of these interim studies into the final design of FoL. **Chapter 5** describes the final design of FoL as a TEE experience and **Chapter 6** is its evaluation study. Finally, **Chapter 7** addresses each of the research questions and objectives proposed by this research, then addresses its limitations and implications for future research, and the chapter ends with some final remarks.

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2 Theoretical Background

This section presents the theoretical components of the existing Transmedia Storytelling models, Entertainment Education theories, and Tourism experience. Subsequently, it explains how all the different theoretical building blocks are brought together into creating a unified framework in which Transmedia Storytelling and Entertainment Education work together to enhance the design of tourism experiences.

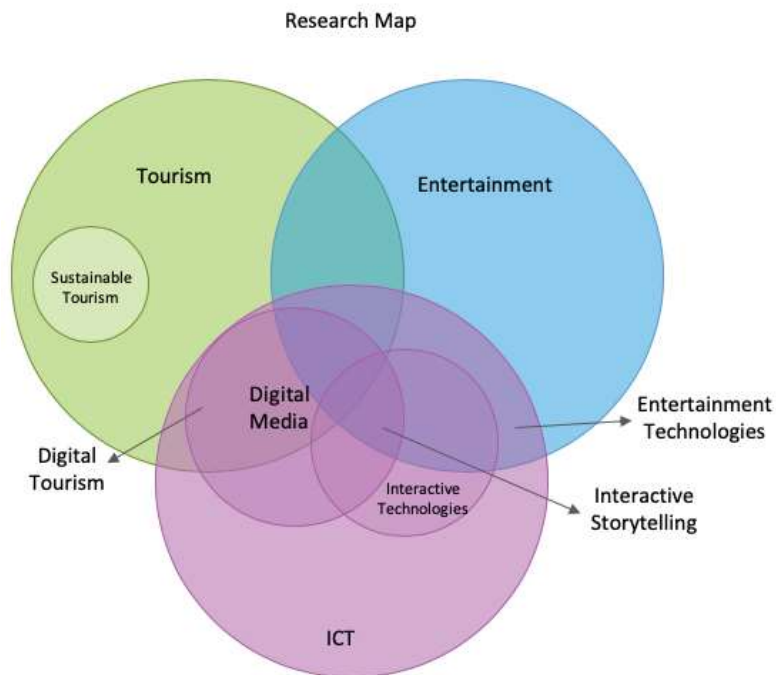


Figure 2:1 – Map of the intersection between the theoretical research fields this research is based on.

2.1 Transmedia Storytelling and its Various Approaches

Ever since Henry Jenkins brought Transmedia Storytelling (TS) to popular attention, in 2006, TS has been evolving and diverging and it has now become a popular genre and a playground for storytellers to act in and to create world-changing experiences. TS is not merely a tool to increase public understanding and acceptance of science and policy; it is also a means to actively shape science and policy with the public in mind and in hand [Quir00a]. Authors and producers agree that TS comes in many guises and it is hard to pin it down to one only [JaCM20]. However, in accordance with the scope of this research, this thesis has adopted Transmedia for Change (T4C) [Prat15] as its reference point.

According to transmedia consultant Robert Pratten, T4C is an “umbrella term that encompasses transmedia activism (change in society or community) and personal growth (change in lifestyle, personal development)” [Prat15]. It is a fundamental T4C principle that stories matter and need to be told to the right people at the right time so that they can have an impact on their lives and the lives of those around them [Prat15]. Based on this practice, Pratten founded a platform called *Conducttr*, to allow the creation of Pervasive Entertainment experiences [Mixe00, What00]. In 2010 he reflected in a blog post about how the evolution of TS should be called Pervasive Entertainment (PE) and defined it as “entertainment untethered and unencumbered by time, location and reality” [What00].

Pratten describes PE through an equation composed of four variables (see Figure 2:2). PE may start from a single-media; for example, a fictional story printed in a book, or a true story told through a TV documentary. The story then grows to encompass more media platforms, including those online and offline, more audience participation through digital and analogue media, and more touch-points. A touch-point could be online or a real-world place where the audiences come into contact with the entertainment piece.

In 2014, Weinreich, inspired by Pratten’s work in social change, presented a further evolution of Pratten’s equation: the Immersive Engagement Model (IEM) [Thei00] (see Figure 2:2), with the addition of the behaviour change component. According to Weinreich’s model, awareness and education are necessary, but usually not by themselves sufficient, to create real change. The ultimate goal of IEM is to create an experience that leads the audience towards taking some sort of action as a result of being engaged and

motivated; whether adopting a healthy or pro-social behaviour, changing how they treat other people, helping the environment, or actively joining a movement that aims to solve a social challenge.

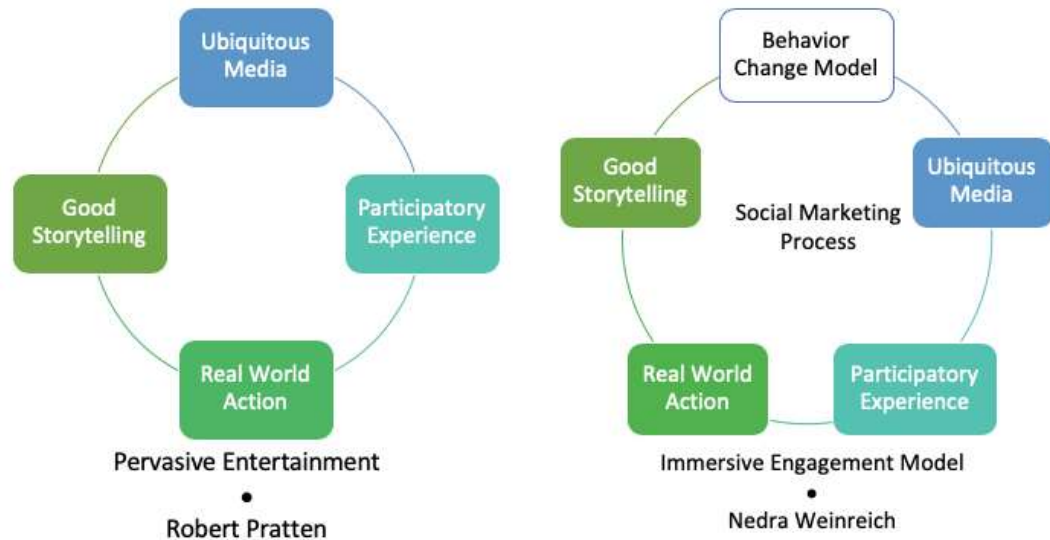


Figure 2:2 – Comparison between Robert Pratten’s Pervasive Entertainment Model and Nedra Weinreich’s Immersive Engagement for Change Model

While Pratten, in his reflection on PE as an evolution of TS, does not delve into the details of each of the components, Weinreich on the other hand, deconstructs each of the components in the following way:

Good Storytelling: A good story attracts audiences. To accomplish this, the crafting of the story is crucial, as is reflection on who the key characters are, what the conflict is, how the story arc develops, and how best to present different parts of the narrative to achieve a deep engagement. What makes a good story does not change, whether it be fictional or non-fictional. The characters of the story should be confronted with similar situations to those that the audience should be reflecting upon, and which make the characters take decisions, and then show the effects of those decisions, according to the message to be delivered.

Ubiquitous Media: Authors should make content available in places that the audience is already familiar with. Ideally, the story should integrate with their daily practices. Certain audiences are more likely to use particular channels more than others, but there should not be an assumption that reaching them on one platform is enough to make an

impression. The story touch-points could be their mobile phone, their Twitter or Facebook stream, a link to a website, a comic book or location-based markers. The content should make its way to the audience and should be encountered alongside the other chunks of information the audience have chosen to pay attention to. Furthermore, the selected platforms must work together to support the story.

Participatory Experience: there should be the opportunity for the audience to participate, something that encourages them to go beyond just reading/watching/hearing what was created, but rather leading them to create something of their own, something that brings them deeper into the story. This participation can take different formats, such as playing an online game, or attending a live event, or even sharing their own stories.

Real-World Action: Engaging people with stories should translate into some kind of change in the real world. Pratten describes PE as “[blurring] the line between real-world and fictional world.” The audience should be inspired to draw the lessons from the story world (real or fictional) and apply them in the real world.

Behaviour Change: It is fundamental to understand the pieces that need to be in place, both in the story and in the structure of the project, to meaningfully motivate the adoption of the key actions and promote behaviour change. Some different approaches and theories may be followed depending on the duration and purpose of the project.

PE and IEM are the first steps in laying common models for TS experiences that tell a story with the purpose of creating an impact in the audience and driving some kind of action. The next section looks into Entertainment-Education and how its development has brought together behavioural, communication, and learning theories to create change.

2.2 Entertainment Education

Entertainment and education have long been used in combination to bring about social change through storytelling. Many cultures have a rich oral tradition in which folktales with moral messages are an integral part of people’s non-formal education [Bass96]. Humans are pre-disposed to be influenced by stories [GrBK04, GrBr00] as “Humans are innate storytellers” [ScAb95].

As is the case with TS, the term Entertainment-Education (EE) has been defined in many different ways by many different scholars at various times [SiRo12]. It has previously

gone under names such as “Enter-Educate,” “Edutainment,” and “Infotainment,” but since the 1990s, the term EE became widely used after Singhal and Rogers’s aforementioned definition: “Entertainment-Education is the process of purposely designing and implementing a media message to both entertain and educate, in order to increase audience members’ knowledge about an educational issue, create favorable attitudes, shift social norms, and change overt behavior” [SiRo01]. EE is not a communication theory but a “communication strategy” intended to create a positive change among intended audiences. The difference between “Edutainment” and the EE concept is that, while “Edutainment” procures knowledge and information, EE goes one step further by trying to achieve a behaviour change [KhAh14].

Embedding educational messages in entertainment is not new. EE, as a communication strategy [SCRS03], relies on the use of a variety of old and new mass media such as radio and television, and it has been popular among international health promotion program planners since the 1950s. EE strategies have been integrated into drama TV series, and other forms of entertainment, in countries as diverse as Mexico, Turkey, India, South Africa, and Columbia, touching especially upon health issues such as domestic violence, AIDS prevention, reproductive health, and family planning [HHBM08]. Ever since then, EE has emerged, and has been acknowledged as, a major tool for social change throughout the world [SCRS03]. Research suggests that EE may offer a more effective way to influence attitudes and behaviour than traditional persuasive messages because viewers are involved with their narrative structure [Moye08]. Therefore, audiences tend to be less resistant to socially responsible messages when these are conveyed via entertainment media.

2.2.1 The Role of Narrative Persuasion in EE

Green and Brock’s research [GrBr00] revealed greater attitude change among readers who were “transported” into the narrative world: “To the extent that individuals are absorbed into a story or transported into a narrative world, they may show effects of the story on their real-world belief” [MFMP11]. Slater elaborated the Extended Elaboration Likelihood Model (E-ELM) [SiRo02] to measure how “the narrative format of entertainment-education messages can increase transportation into a story, reduce counter-arguing, and increase persuasion” [SiRo02]. Moyer-Gusé extends the theorizations relating to

narrative persuasion and EE by developing the “Entertainment Overcoming Resistance Model” identifying that character involvement is crucial to narrative persuasion [Moye08].

According to his research, there are five types of involvement:

1. Identification with characters
2. Wishful identification (a viewer wishes to be like the character)
3. Similarity (the extent to which a viewer feels that he or she is similar to the character)
4. Parasocial interaction (a pseudo-relationship between a viewer and a media figure)
5. Liking (having a positive attitude toward the character)

Each type of involvement (e.g., identification, similarity) overcomes various types of resistance and thus leads to attitudes and behaviours changes consistent with EE. Furthermore, Slater, Rouner and Murphy [MFMP11, SiRo02] acknowledge the central role of emotion in EE, especially when it uses an extended serial format, which provides substantial opportunity for emotional investment in fictional characters.

2.3 Understanding Tourist Experience

Understanding the core of what an experience is, is crucial to understanding what a tourist or traveller experience is. Damasio conveys, in the title of his book, that experience is “the feeling of what happens” [Dama00]. Pine and Gilmore, defined experience from a business perspective: “Experiences are events that engage individuals in a personal way.” From a consumer perspective an experience is something enjoyable, engaging, and therefore a memorable encounter [PiGi99]. While seeking a structured formula to study tourism experiences, Oh, et al. [OhFJ07] analysed the four dimensions of the touristic experience (the entertainment, the education, the esthetical, and the escapist dimension) [PiGi99] as conceptualised by Pine and Gilmore (see Figure 2:3).

Looking along the tourist participation axis, entertainment and aesthetic experiences are placed in the passive participation range of the scale, whereas educational and escapist dimensions are a reflection of active participation. Along the absorption-immersion axis, the tourist typically “absorbs” entertaining and educational experiences at a destination while they “immerses” him/herself in the destination environment through aesthetic or escapist experiences. It is essential to clarify that, in this context, Pine and Gilmore define absorption as “occupying a person’s attention by bringing the experience into the mind,” and immersion as “becoming physically (or virtually) a part of the experience itself” [PiGi99]. These four dimensions of an experience are quite flexible, and an experience can take characteristics from each of the dimensions.

Furthermore, according to Oh [OhFJ07], the educational and escapist dimensions of the tourist experience are not recognized by travel agencies. While both dimensions are active realms in the way that the customer needs to be engaged in the experience, this is an essential factor for the companies to consider, since it is the active engagement that leaves the lasting impression on the customer, and which is likely to lead to the customer’s loyalty. In addition, Pine and Gilmore explain: “to truly create an educational experience, a tourist must increase his knowledge and/or skills through educational events that actively engage the mind (for intellectual education) and/or the body (for physical training)” [PiGi11].

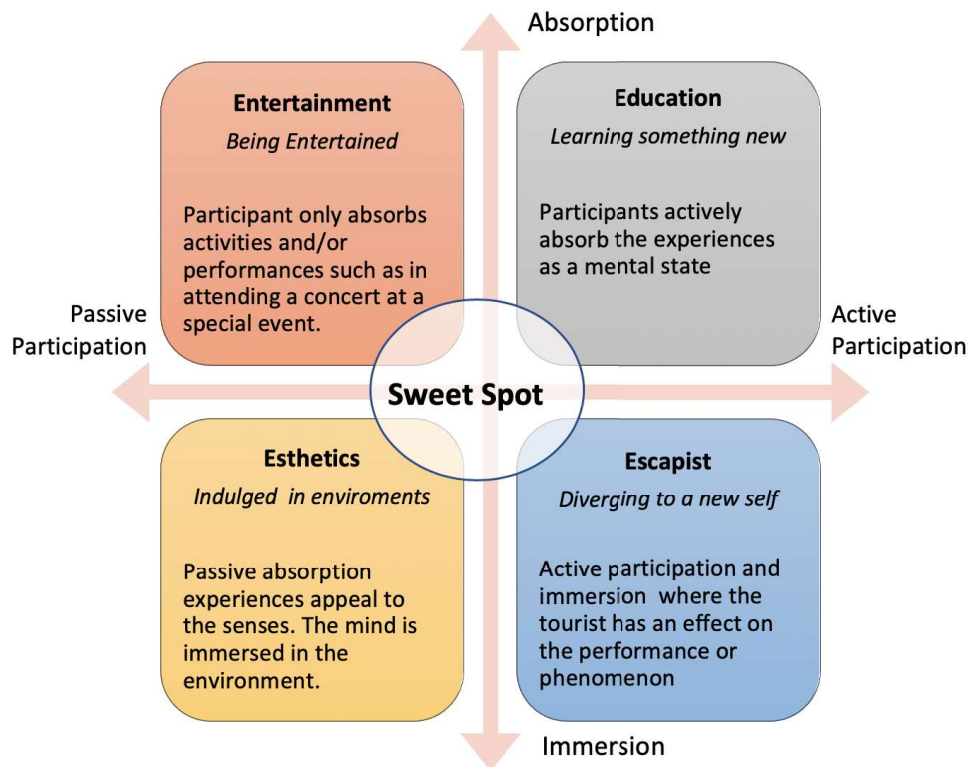


Figure 2:3 – Four Realms of the tourist experience (adapted from Oh and Pine and Gilmore)

On a similar note, with regard to the tourism experience and behaviour, Caldito et al. highlight how providing tourists with a memorable travel experience is a multifaceted endeavour where several factors come into play and these factors can be grouped around three main components:

1. The physical environment where the experience is delivered
2. The need to involve tourists and make them actively participate in the experience
3. The need to facilitate tourists' self- development and growth [CaDI15]

Moreover, Kim et al.'s study reveals that individuals who perceive a tourism experience as memorable often recall seven experiential dimensions: 1) Hedonism; 2) Refreshment; 3) Novelty; 4) Social Interaction and Local culture; 5) Meaningfulness; 6) Knowledge; 7) Involvement [KiRM12].

It is possible to find common ground between Caldito and Kim's research attempts to operationalize the factors that make up memorable tourist experiences, summarised below in Table 2-1.

Table 2-1 – Summary of the elements that make a Memorable Tourist Experience as derived from Caldito’s and Kim’s theoretical work.

Caldito’s Main Components and Factors for a Memorable Experience	
Components	Factors
Physical Environment	Theming the experience and setting the stage Engaging Tourists five senses Respecting authenticity and singularity of the location
Involve tourists	Facilitating a safe environment Managing each touch point and service encounter to enhance the experience Offer a wide range of alternatives to choose from Surprising tourists
Facilitate personal growth	Proposing challenges that match tourists’ skills Planning activities to connect tourists with local communities Aligning the experience with positive cues that match tourists’ values
Kim’s et al Dimensions of Memorable Tourism Experience dimensions	
Hedonism	People primarily seek enjoyment (hedonism/pleasure) while “consuming” tourism products (experiences)
Refreshment	Sense of freedom, refreshing and revitalizing experiences, basically a reversal of everyday activities (a no-work, no-care, no-thrift situation [Cohe79])
Novelty	Desire to experience something new, or “some other things” that cannot be found in their home destinations [PeMo86]
Social Interaction and Local Culture	Learning about local culture, including residents’ way of life as well as the local language, significantly enhanced memorable holiday experiences
Meaningfulness	Some individuals consider a tourism experience an inner journey of personal growth and self-development, rather than the mere consuming of sights, faces, and place
Knowledge	People travel in response to the urge to acquire new knowledge and understanding of the destinations they visit (particularly as this pertains to geography, history, language, and culture)
Involvement	Involvement of the tourist is the main element at the destination site and is fundamental to the existence of the site [WoMa08]

The elements highlighted by Caldito and Kim are linked to the current trends in the tourism business revolving around the “search for authenticity.” This topic has been widely debated within the scholar’s community [DeSo00, Wang99]. Part of the authentic experience involves more meaningful interactions with locals [PPCM00]. Furthermore, authenticity is connected with what van Nuenen [Nuen16] approaches as “the modern discourse of anti-tourism, which consists of a desire of travellers to reach beyond superficial experiences that tourism industry fosters.” Increasingly, tourists’ ambitions move towards

experiencing local life and being like locals [Macc73, Macc76]; there is a desire to experience “being one of them” [Goff02], or at least having access to possible intimacy with locals. Aligned with the anti-tourism narrative, MacCannell, talks about how the term “tourist” is increasingly used as a “derisive label for someone who seems content with his obviously inauthentic experiences.” [Macc73]

A key factor, often overlooked in the past, is the planning and development of tourism experiences with the involvement of local community [Murp13]. As Murphy points out, residents can provide helpful input in decision-making processes and they must be actively involved in tourism planning and developments [Murp13]. The locals’ involvement is crucial in ensuring that visitors get an unforgettable, pleasant tourist experience, while at the same time enabling the community to derive benefits from their visits. The concept of “Community-based tourism ventures” (CBTV) refers to initiatives that aim to care for the environment (eco-tourism) as well as ensuring the empowerment of local communities [Sche99]. The call for community participation is based on the assumption that participation lessens opposition to development, minimises negative impacts, and revitalises economies [HaBP02]. Bringing this local involvement into the design of tourism experiences should be considered a desirable approach to sustainable tourism as a means to respond to the challenges of providing a high-quality experience for visitors and socio-cultural well-being for destination communities –respecting social identity, enhancing social capital, local culture, social cohesion and pride [ChSi06, Saar06].

There is no magic formula to operationalize a tourism experience. Different tourists look for a diverse range of experiences, whether it be an authentic local experience [Macc76], an adventure, or even just the opportunity to make a difference at the destination. These opportunities can only be created through a process of visiting, learning and enjoying activities in an environment away from home [StSk03]. The tourist experience is an internal and personal process in which each person creates his/her own experience based on backgrounds, values, attitudes and beliefs brought to the situation [Pren04].

2.4 Towards a Transmedia Entertainment Education Framework for Tourism Experiences

This section brings together the TS models and EE theories for the enhancement of the tourist experience. The first two sections of this chapter brought to the attention the PE and IEM models and how EE and TS could benefit from each other; for example, by combining the narrative and educational theories of EE with the participatory capabilities and the use of the ubiquitous media of TS. The tourism industry should aim to provide high-quality experiences while avoiding to create friction between locals and tourists.

Despite the general capacity for stories to deliver important messages, not all stories are sufficiently engaging to hold the audience's attention for long enough for the message to be absorbed. In particular, cultural heritage locations tend to use narratives in a quite narrow way, with the sole purpose of communicating the findings and research conducted by the domain experts of a cultural site or collection. Further efforts should be put into adding emotional resonance or impact [NJCW17] to narratives. Inspired by Pratten's and Weinreich's models, this research asserts that the combination of EE and TS experiences can play a role in sensitising tourists towards local natural and cultural values, while providing rich entertaining and educating experiences. To achieve this, a novel framework is proposed: the *Transmedia Entertainment Education Framework* (TEE) (see Figure 2:4). This unifies EE theories and TS models to support the design and evaluation of experiences that incorporate entertainment, interpretation, and education, and to stimulate the personal growth of tourists visiting particular destinations.

Part of the novelty of this framework consists of adding *Tourist Motivations* and the *Destination Local Values* as **Inputs** in the framework. The experiences designed according to the novel TEE framework should prompt users to reflect on the destination's local context and challenges. The experience should lead to an **Output** where tourists had a *Memorable Experience* of the designed experience/artefact while contributing towards the increased *Awareness towards Local values* and the *Social-Cultural Well-Being of the Local Destination*.

At the core of the framework, is the TEE experience designed that should take into account the integration of the four components - *Storytelling, Real-World, Participatory Experience, Ubiquitous Media* – as working together.

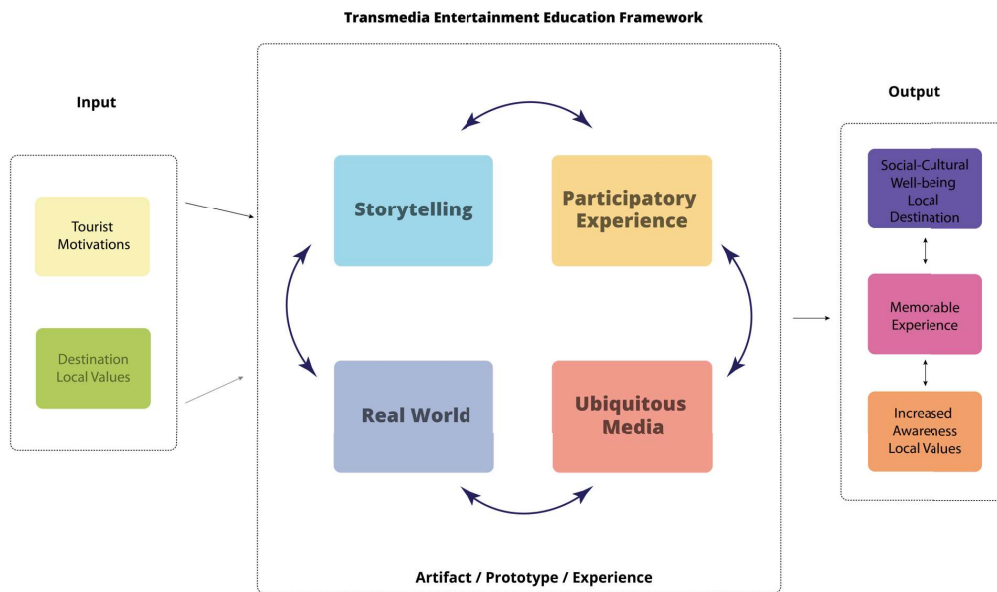


Figure 2:4 – The novel framework proposed for designing a Transmedia Entertainment Education for tourism experiences.

The rest of this section describes the TEE framework components in detail.

Tourist Motivations: Providing tourists with memorable and satisfying travel experiences is a complex task that requires an understanding of tourist motivations and expectations. The starting point for designing a TEE-based experience should take into account the desires of tourists and what they are seeking. When travelling for leisure, people search for specific experiences and these may vary considerably from one tourist segment to another [PiGi99]. Different segments may exhibit different expectations, but there are some basic common components to a memorable tourist experience (see Section 2.3).

Destination Local Values: To contribute to the sustainable development of touristic destinations, TEE-framed experiences should empower and take into consideration the local community and the local values in which it will develop. It is fundamental that the authenticity and singularity of the place are respected and serve as the basis of the experience.

Storytelling: The TEE framework emphasises the complexity of the storytelling, the depth of the characters, and the meaning of the conflicts and drama occurring in the story. A well-designed and developed story is an effective way to influence attitudes, and more effective than traditional persuasive messages because viewers are involved with the narrative structure [Moye08]. Furthermore, viewers are involved not only with the storyline but also with the characters [Moye08]. A story developed for a TEE experience should be inspired by the destination's local culture to maximize the connection between the tourists and the local, contextual, values that need to be enhanced and brought to light.

Ubiquitous Media: Before, during, and after their journey, travellers engage in several types of media (web, mobile apps). The TEE framework encourages designers to offer experiences through the media that the audience is familiar with. For example, the TEE experience could reach the audience through their mobile phone, their Twitter or Facebook stream, a link to a website, YouTube, or even location-based markers and events. As derived from TS notions, the selected platforms must work together to support the story and consider how tourists would encounter it in their travel experience (before arrival, during the stay, or afterwards).

Participatory Experience: In TS, participation is a core element. It is an opportunity for the audience to go beyond just reading/watching/hearing what was created, and enable them to participate by interacting with the content, or creating their own. While it seems quite unrealistic to expect that tourists will devote time to writing something, or creating a video, there should be opportunities for participation for those who are most enthusiastic about the story/experience. Participation may occur, especially if the provided opportunity enables the tourist to gain a rich and authentic picture of the place.

Real-World Action: There should be a blurred line between the real world and the fictional world in TEE experiences [What00]. This could be visualizing a character from the story in a real world setting, for example, or the character sending a text message to a participant's mobile phone, thereby bringing the story off the mobile phone and into their real life. In any case, in order to raise tourists' awareness of the destination, there could

be an opportunity for them to draw a lesson from the story world (real or fictional) and apply it within the real world.

Social-Cultural Well-Being of the Local Destination: a TEE experience should be designed in a sustainable way that contributes to the well-being of the local destination or at least done not to endanger or disturb it. Taking inspiration from Community Based Tourism, this can be achieved in several ways [Sche99]. The TEE experience needs to respect the location's social identity, enhance local culture, social cohesion, pride, and, if possible, social capital (by promoting engagement with local businesses).

Memorable Experience: This is the desired outcome from the visitor point of view. It refers to their feelings and emotions experienced during the TEE experience. Visitors should have a positive experience and feel like the time that they have dedicated to the TEE experience was worthwhile [KiRi14].

Awareness Towards Local Values: While undergoing the TEE experience, visitors should be more aware of what is to be appreciated in the destinations. This should inspire them to behave more sustainably and respectfully during their stay.

2.5 Chapter Conclusions

This chapter presented the theoretical components of the existing TS models and EE theories and identified a research gap in applying these to the design of tourism experiences. Subsequently, the Transmedia Entertainment Education Framework (TEE) is presented in an effort to unify EE theories and TS models, to support the design and evaluation of experiences that incorporate entertainment, interpretation, and education, and to stimulate the personal growth of tourists visiting particular destinations. Finally, a detailed description of each of the TEE components is provided.

3

3 Related Work

The Related Work chapter consists of five sections. The first section explains the goals of this chapter. The second section addresses how entertainment technologies have been used to both entertain and educate tourists and the third section reports on transmedia storytelling experiences designed for a tourism audience. The fourth section presents how information communication technologies and digital media have transformed the tourism experience, in particular, to fulfil the tourists' desire to achieve an authentic experience. The fifth and final section concludes the chapter, distilling 13 design insights derived from the related work.

3.1 Related Work Goals and Objectives

The goal of this chapter is to present the practical work developed within the overlap of three main research fields: Tourism, Entertainment, and, in particular, Interactive Computer Technologies, all delve into the related works focused in the overlap of:

1. Digital Media, Sustainable Tourism and the Tourism experience
2. Digital Media, Interactive technologies, Entertainment-Education and Tourism experience
3. Digital Media, Interactive technologies, sustainable tourism and Authentic Tourism experience (see Figure 3:1)

As a result, the related work review presented in this chapter was guided by these main objectives:

1. To identify and learn from the current research work that combines entertainment technologies to bring awareness, entertainment and education to tourists
2. To identify how Transmedia Storytelling has been used to enhance the Tourism Experience in both the academic and professional field
3. To understand how digital media and interactive technologies are shaping and transforming current trends in tourism experiences
4. To gather lessons learned from previous related research applicable to the proposed TEE framework, in order to inform the design of a TEE experience

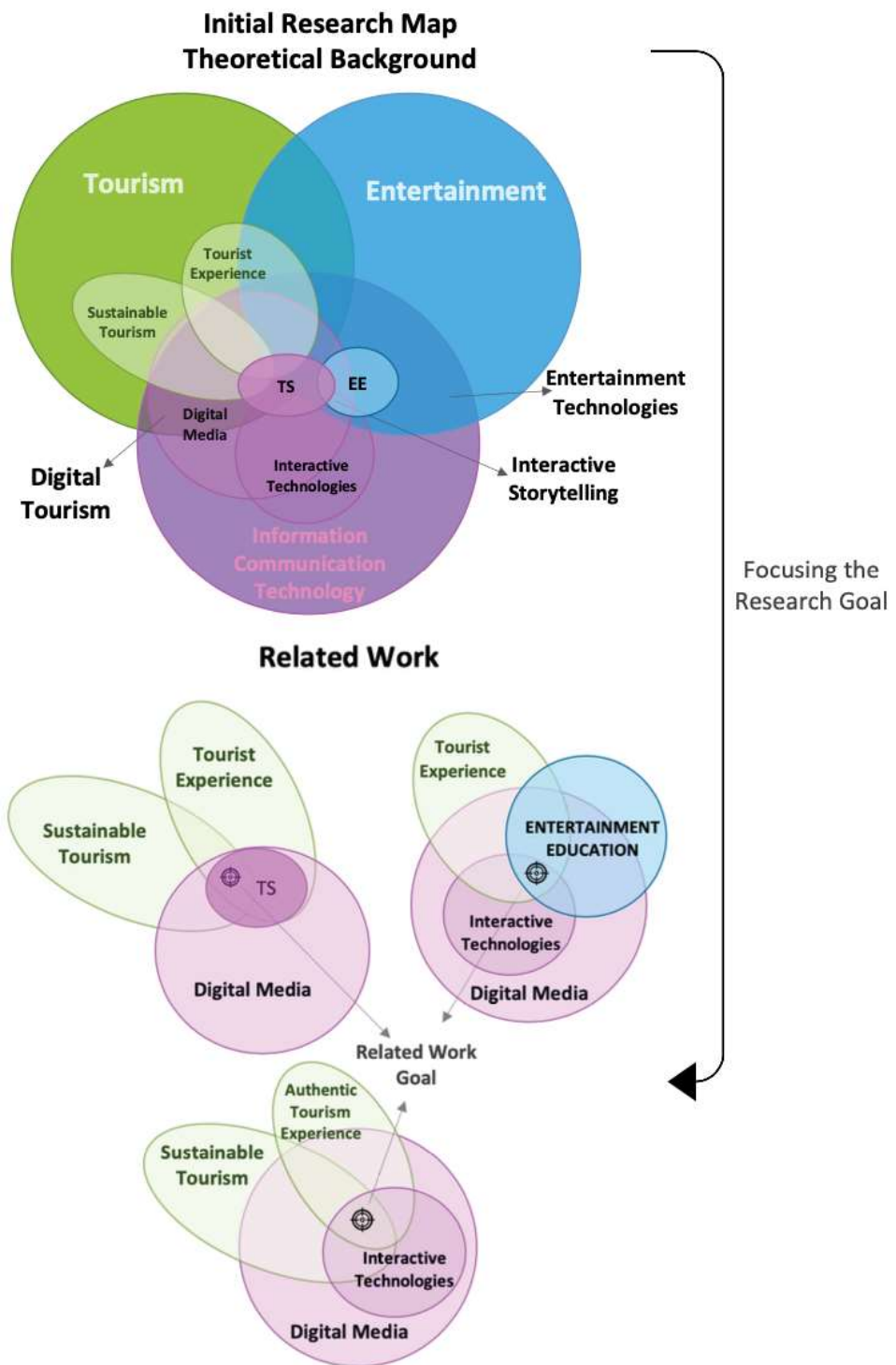


Figure 3:1 – Left: Venn diagram illustrating the overlap of the different research fields this thesis touches on. Right: Three Venn diagrams illustrating the narrowing of the high-level research fields into more detailed ones.

3.2 Entertaining Tourists Through Meaningful Experiences

In the past two decades, continuous improvements in the capabilities of mobile smart devices and the uptake of connectivity have provided fertile ground for the flourishing of experiences that augment contemporary urban spaces [SoSu09, Souz06] with layers of information and multimedia content [BCBH06, ZCWY14]. Many of these experiences have the goal of connecting and educating audiences/players in local cultures and histories [Farm13]. Several projects over that time have explored the association of digital media with specific locations [BWMO12, CACM05, PKCI08] or objects [NWDO04] for tourism purposes in particular [DBNN15, DiNL10, NiCD16].

Location-aware technologies and augmented reality, allied with the power of storytelling, have been successful approaches in allowing participants to immerse themselves in a destination while supporting meaningful visitor engagement [DBNN15, NiCD16]. Some of these experiences have materialized as Location Aware Multimedia Stories (LAMS), presenting multimedia narrative content related to specific locations through the use of location-aware mobile technologies [HaWM18, NiOP10, NWDO04]. The goal of LAMS is to augment urban settings and neighbourhoods with locally relevant multimedia stories in order to encourage the local community's sense of place, as well as to inform non-residents about local realities and attract visitors to less touristic areas and off the beaten tracks [NiOH06, Pitt11].

Other location-based stories and games approaches combine augmented reality with history [CiBa07, CiMc12, WuWa11], providing visitors with interactive installations [CRRM14], and exciting scavenger [Stra00] and treasure hunts [Brom00] during which (virtual) characters recount the history of a place and give background information. Up until now, mobile Augmented Reality (AR) applications have had a practical advantage when compared to Virtual Reality (VR) in the tourism context [FrSL05], since tourists would not possess the head mounted devices or computers required to interact with VR during their travels. With Mobile Virtual Reality (MVR) [Guge16] new avenues open up for the use of VR on-the-go that can be explored in entertainment experiences aimed at a tourist audience [NDBG19, NDHF00].

Erik Poppe et al [PoGS17] defined MVR as a “system that creates the illusion of participation in a simulated environment, rather than external observation of such an

“environment, by replacing real sensory signals that the user perceives with simulated sensory signals through the use of portable technology.” In the context of this research “portable technology” is a technology that only requires a smartphone and/or wireless HMDs to display the simulated environment, and where the users can move freely without cords attached; this enables the expansion of VR into other contexts and offers a new range of experiences. MVR can take VR away from controlled environments, such as household and laboratory settings, and “into the wild” of urban spaces, providing opportunities for seamless interactions across the continuum between the real and the virtual [MiCo99].

The current bulk of existing work combining VR and the tourism industry focuses on virtual travel [SISa16] and is designed to be seen in a specific environment (e.g. home, classroom), based on the realistic representation of reality [MFGR12] and to replace the tourism experience, not necessarily to complement or augment it. In this way, there is relevance in exploring how MVR has the potential to offer a unique experience to tourists, not as substitutional tourism but as a way to enhance the experience of visiting a location. A promising example is shown by the work of Minocha [MiTT17], as educators discuss the benefits of using Mobile VR during physical field trips. Among the highlighted strengths of this combined approach were the facts that; children could view details not visible to the eye (e.g. geology and rock formations); see different points of view of the scenery; had the opportunity to observe what that location is like under a number of different conditions (e.g., in different seasons).

Moreover, the use of storytelling to render community memories and traditions can help build a sense of identity in local communities [Dion15, NiHa00, Shel05]. However, achieving that meaningful integration of culture and touristic experience can be hard to accomplish. Often, the authenticity and unique cultural identity of a location starts to be portrayed in a distorted way; for example, by targetting specific markets and tourism trends [ALTH10, SaPa02]. Achieving a balance of respect for the culture with providing tourists with the opportunity to learn about and appreciate the culture is the core of the challenge for meaningful entertainment experience aimed at tourists [Shel05]. Entertainment Education practices and theories could be placed at the benefit of tourism.

More recently, EE programs have opened up, from providing content that used to focus on family planning, health and hygiene, HIV/AIDS, to include other social issues that

confront challenges of modern societies, such as teenage problems, the safety of children, girls and women, environmental issues, as well as others. Efforts have been made to promote pro-social messages through media such as radio, film, print, music, television and the web [SCRS03, SiRo12]. Nevertheless, literature reports that EE still has a long way to go in terms of adopting new technologies, thereby capturing a broader and more diverse audience. Singhal and Roger note that future attempts should embrace a stronger fusion between traditional forms of communication with modern technology [SiRo12].

There is a real potential in taking advantage of the rapid expansion of mass media channels, and the accompanying proliferation of entertainment technologies provides unprecedented avenues for reaching millions of people with pro-social messages [KhAh14], including an audience of tourists. Salvat et al gives one clear example of the need for EE applied to the tourism industry [SaPa02]. Salvat, while studying tourism features in the French Polynesia islands, highlights the fact that the education of tourists is critical for the islands' sustainability, as tourists need to learn about the unique cultural and environmental features of the islands and to adapt their behaviours accordingly, otherwise the ecosystem of the island might suffer irreparable damage [SaPa02] (e.g. several of the islands have closed to visitors to determine if the ecosystem can recover from the damage suffered [Phil00]).

However, Novacek points out that there should be more concerted efforts in linking the scientific and conservation communities with the public and these must be made through the use of new channels that accompany the current media trends, otherwise the public may not fully grasp the problems causing biodiversity loss [Nova08]. Novacek's points regarding the use of new technologies to raise awareness towards biodiversity, align with the suggestion by Singhal and Roger as to how EE programs should embrace a stronger combination of traditional forms of communication with modern technology [SiRo12]. The dissemination of educational messages using new transmedia formats has the potential to engage vast audiences, and in the particular context of this research, the tourist audience.

The next section presents a selection of works where TS has been applied to tourism and how it can create positive social change by designing stories that educate and engage people on locally relevant issues, and even ultimately persuading them to take action.

3.3 Transmedia Storytelling in Tourism

Webber asserts that storytelling can be a promising method with which to communicate a city experience to a tourist and has emphasized how storytelling is an essential element for experience design [Webe00a]. The use of a story, creating engaging main character, increases the audience's connection and involvement, as they can help in meaning-making and mediation of touristic sites or events [NJCW17]. Some case study projects showcase how TS has been applied to enhance the tourism experience. For example, The Roswell Experience, a location-based story told across 32 locations in Roswell, New Mexico, uses a fictional alien to introduce visitors to the area's rich and unusual history [Prat12]. Bear 71 [Maka12], a fully immersive, multi-platform, interactive social narrative created by the National Film Board of Canada, traces the intersection of humans, nature, and technology. Participants explore and engage with the world of a female grizzly bear via webcams, augmented reality, geolocation tracking, motion sensors, social media, and other platforms and channels. More recently, in Portugal, the TravelPlot Porto project successfully makes use of TS to publicize local brands, while informing and entertaining tourists [FeAQ12].

Moreover, the transmedia interactive documentaries, *Welcome to Pine Point* [Welc00], *Safe Beaches, Shellfish, You (SBS&Y)* [Quir00b], and *KLUB* [HoVi20, RoDi18] are TS projects that were not purposefully created with tourists in mind. However, they provide insightful experiences regarding locations (Pine Point City, New Hampshire, Maine, and the Skaraborg region in Sweden) allowing for diverse approaches to the sense-making of a place. *Welcome to Pine Point* explores the aftermath of the mine's closure, including residents' loss of their homes, the resulting national diaspora, and residual environmental damage. A range of transmedia techniques (poetry, interviews, photos, videos, visual reconstructions) provides a rich space for readers to co-perform the experience of living in Pine Point [Welc00].

The project *Safe Beaches, Shellfish, and You (SBS&Y)*, combines written reporting with photography, documentary audio-visual material, interactive graphics, and immersive experiences, including "photospheres" - images of 5 beaches in New Hampshire and Maine presented through scrollable 360° imagery enhanced by a sound piece of the beach

environment. Both interactive works connect journalism with critical performance to address complex sustainability issues through collaboration between diverse public participants.

The project, KLUB [HoVi20, RoDi18], uses transmedia storytelling techniques and gaming elements within an AR enhanced book series and related media (board games, locative experiences). KLUB engages families in Sweden's local cultural heritage revealing how history, time, and space can all converge to tell stories in new, co-located environments.

Taken together, these projects and their media points provide opportunities for the audience to imagine themselves at these locations/times and to allow the co-creation of a lived sense of understanding [Quir00b] of the world around us [Prat15].

3.4 The Impact of Digital Media in Changing the Tourism Experience

The relevance of authentic experiences in tourism was defined and discussed in section 2.3. This section explores how ICT and digital media advancements have contributed to the broader discussion around creating authentic experiences [Macc73, Macc76] for tourists [PiGi11, Tuss14].

The interactions possible between locals and tourists have been developed in many forms, and through different applications and services (e.g., Couchsurfing, Airbnb, HomeAway [Chun17]) and situations, either online or offline [MoWC10]. More recently, some services, such as CityFlocks, AskLocal, [Ask100] and Loqal [Loqa00], are concerned with providing recommendations and advice based on locals opinions, so that tourists get unbiased, genuine answers from local experts. Locals are turned into guides (see vayable.com [Thin00], Urban Buddy [Jaff00], Spotted by Locals [Spot00], Secret City Trails [Blog00]), offer travel experiences recommendations, reservations, and discounts with local businesses, home-dining opportunities, and solving riddles to uncover unique locations.

In an academic context, Moyle et al. have explored the cultural interactions between local communities and visitors. The authors found that locals have a variety of motivations for social interaction with visitors, ranging from the solely economic, to having a genuine

desire to share culture and traditions, thereby avoiding superficial and hostile contact. However, the most common reason for interaction was found to be economic [MoWC10]. Despite the numerous applications and rich scholarly discourse on the need to connect locals with tourists, the importance of the storytelling aspect in this exchange is rarely mentioned in the overlap between ICT and Authentic tourism experience literature. To fill this gap, and as part of the contribution offered by this thesis, 13 design insights have been distilled from the literature review of works that encompass tourisms, storytelling, and education. These insights are presented in the next section.

3.5 Synthesized Insights in Support of the Design of TEE Experiences

Scholars agree on the complexity of the tasks involved in developing experiences that encompass narrative, real-world location [HaWM18], mixed-reality technology [RoBa17], and games enhanced with narratives [NJCW17]. In an effort to address this complexity, and as a partial contribution from this research thesis, 13 design insights (DI) have been derived from the synthesis of literature review. The methodology followed to gather the DI was inspired by the work of Frich et al. [FrMD18].

The initial step was the search for publications utilising the keywords “Transmedia Storytelling,” “Entertainment Education,” “Tourism experience,” “Sustainable tourism” in two online databases: the ACM library, and Google scholar. The first was chosen as being the digital library with the most thorough database of computing and information technology literature, and the second to help broaden the search to cover works related to tourism that might not be included in the ACM library.

This search yielded around 1,100 results on Google Scholar and around 200 results on ACM Library. A narrowing down process based on the author keywords and the abstract content was carried to filter the list for relevant sources within the context of this research thesis. The works selected contained in authors keywords’ one of following terms: “authentic experience,” “local communities,” “local values,” “heritage tourism.” In the abstracts, the terms “design,” “technologies,” “process,” and “interaction” were used. These terms were chosen so that the list of works to be analysed would have a strong component of practical work showcasing some kind of design process using technologies and interaction methods geared towards building tourism experiences focused on providing authentic experiences showcasing local values/heritage or communities. Furthermore, any duplications between the two databases were also removed.

This process yielded a final list of 86 related work publications, analysed in further detail using the software Margin Note⁹. With the help of software, mind maps for each related work were created, and a broader mind map was created, gathering insights from several sources into the same space. However, due to the scarcity of evaluated working

⁹ E-book reader with tools for book annotation, mind mapping and flashcards. <https://www.marginnote.com/>

prototypes in the fields of Transmedia Storytelling, Entertainment-Education, and Sustainable Tourism, there was a need to complement and expand the search for insights. In this second round, the aim was to search for insights within the cultural heritage and museums experience fields. The terms searched in the author's keywords were: "guidelines, tourism, interactive storytelling," "guidelines, tourism, game," "guidelines, tourism, transmedia storytelling," "guidelines, tourism, cultural heritage, museums." The list of relevant articles was narrowed down by selecting abstracts mentioning the terms "user evaluation," "pilot testing," "design guidelines/insights." These terms were selected to gather design insights derived from projects that went through some user evaluation. This yielded another list of 74 works to then analyse with Margin Note. Once again, individual mind maps were created of each work. Related works that contributed with design insights were then grouped into one bigger and broader mind map.

Figure 3:2 illustrates one section of the mind map created for the design insights (DI). Each grey container represents a research paper which is color-coded according to the TEE element to which it relates. For example, the dark blue insights related to Storytelling, the green are insights related to Ubiquitous Media. Similar, or overlapping, insights were combined and then matched to an element from the TEE framework. In the end, this process yielded a total of 13 DI, as explained in Table 3-1.

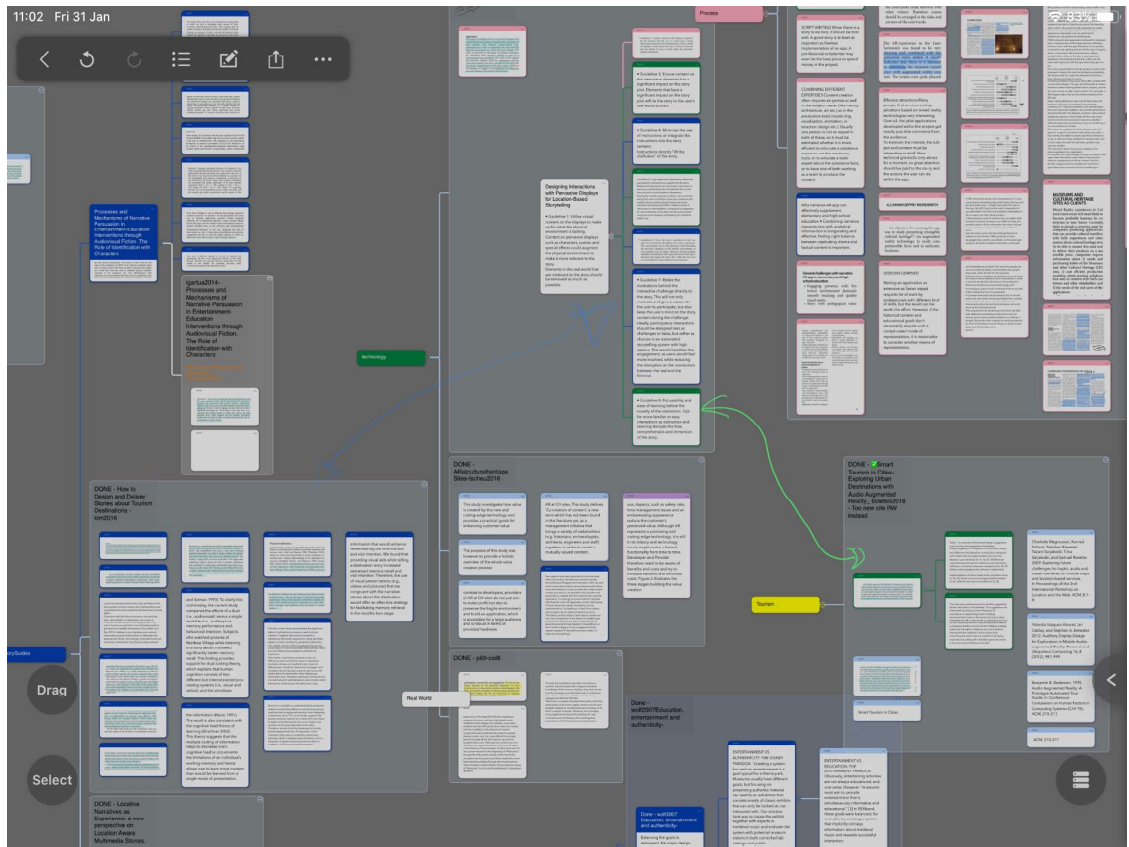


Figure 3:2 – Screenshots from Margin Note software, illustrating the how the software supported the process followed for the related work review.

Table 3-1 Design Insights for TEE experiences.

TEE Framework Component	Design Insight	Description
Storytelling * Tourist Motivations * Real-World	Authentic storytelling (DI 1)	Tourists are interested in local stories and information about the destination; thus, being exposed to local stories, they will gain a rich and authentic picture of a place [DBNN15, FeAQ12]. Locals' anecdotes are interesting material for tourists, especially if they contain details such as character names, and factual or spatio-temporal cues [ChHK12, KiYo17]. Depending on the nature of the designed experience and thematic topic, use of real places of historical setting is appreciated [Webe17b]. Audio effects and characters' voices are crucial in creating atmosphere in a convincing story [NiOH06, PKCI08]. Physical props can also add a tangible, playful, aspect and at the same time, act as vital pieces of evidence of the story. These details will function as authentic cues that lead people to perceive stories as authentic [PKCI08].
Ubiquitous Media * Real-World * Storytelling	Transition between physical locations and digital content (DI 2)	Descriptions of the physical world promote users' natural and spontaneous interactions within the space [BGKR09]. A narrator (storytelling device) as a context enhancer can connect different TS technologies and make the experience more homogenous. The narration can direct the audience's gaze in the appropriate direction to familiarize themselves with the setting before the beginning of the story [NiCD16, NiOH06]. Vibration alerts and visual markers in the locations to trigger content seem to be a successful strategy to support the transition of user attention from physical features to digital content [BeMA12, CoHu09, DBNN15, OKGB07]. The use of physical props could also be used as input or to trigger content, enabling the blend of a location and digital content through a physical prop [DBNN15, PKCI08]
Real-World * Storytelling	Points of interest (POI) of the experience (DI 3)	Places should be chosen in relation to tourists' interests and motivation, and to add value to the tourist journey; Very prominent landmarks strongly influence the trajectory of the users [BGKR09]. Hence, when designing, it is essential to incorporate existing landmarks that tourists may already have an interest in visiting. However, the locations where the application or content is

		<p>supposed to be used/consumed should be away from main pathways so that tourists do not block pathways and do not disturb others around them [HSTW17]. Location-based experiences (tours & games) are very dependent on the accuracy of GPS, so if using GPS technology as a support for location-awareness, avoid points of interest (POI) with scarce GPS coverage [NJCW17]. Visual markers or self-reporting location strategies can work against GPS inaccuracy and promote exploration of surrounding spaces [NiCD16, Uncl00]</p>
Ubiquitous Media	Content engagement through mixed reality Technologies (DI 4)	<p>Specific aspects of the mixed reality, such as the 360°, 3D/VR environments, and AR can be appreciated as they contain an extra level of interaction and exploration to delve into, making the experience more exciting and amusing [NJCW17, TsBu16, Webe00c, XuBW17]. The opposite can also happen if the audience is not familiar with the technology, or the application does not provide sufficient onboarding [NJCW17]. However, to maintain interest, the subject and content must be appealing as the novelty effect of the technology soon wears off. Attention must be paid to how interactivity is adding to the story and helping it to move forward (how displaying a certain character, scene, special effect augments the physical environment to make it more relevant to the story). The use of virtual content should not repeat information already available but make up for what the physical environment is lacking [DBTN15, HSTW17].</p> <p>Usability and ease of learning should have priority over the novelty of the interaction. More familiar or easier interactions should be favoured, so as to increase the comprehension of, and immersion in, the story [Desi00]. Tracking/rendering/connection problems still happen frequently (especially in busy locations/attractions); experiences should be able to adapt to these situations and allow users to choose alternative solutions (e.g. a 360° video clip can be offered instead of the AR view) [HSTW17].</p>
Storytelling *	Multimedia content assimilation	<p>Mobile content and stories should be short, dynamic, and informative [RBOS19]. When possible, divide content in sub-stories/mini-tales that can be watched independently, possibly</p>

Ubiquitous Media	(DI 5)	<p>lasting around ½ minutes [PaDi14]. Text can be displayed, however, when considering mobile experiences audio might be a better option (users “listen” to the text). When writing the story script, it is important to consider the difficulties in focusing on lengthy dialogues, especially if a real, noisy city is the experience setting. The audio media should be enhanced with captions to make a narrative more understandable [KiYo17, NiOH06, NJCW17]. Combine both visual and audio information channels as they offer an effective strategy for facilitating memory retrieval in the recollection stage [Maye09]. Video, AR, VR can all be used to deliver stories but are expensive to develop; a more accessible option could be to generate videos by playing images in a sequence, combined with audio.</p> <p>Stories should be developed to include positive experiential cues, and story characters can be used to communicate emotion and raise the level of involvement with the narrative [GrBK04, GrBr00, Moye08] and the local. For example, a main character’s story about successfully overcoming adversity, which is enlightening and didactic, and a gratifying illustration of good triumphing over evil, could prompt positive emotions [KiYo17].</p>
Storytelling * Ubiquitous Media * Tourist Motivations	Accommodate different audiences (DI 6)	<p>Tourists visit diverse locations on diverse occasions and with different people, such as with families, in groups, as couples, or alone [HSTW17]. The experiences should be flexible enough to satisfy the diverse needs and conditions of the visitor, in particular, if they incorporate several components (searching markers, handling tablets/mobile phones, physical tokens etc.) [CiMc12, PKCI08, XuBW17].</p> <p>Different formats in the transmedia whole can attract different people and allow them to find stories that better suit their needs. Experiences that make use of a non-linear narrative give the possibility to tourists to be more flexible and engage in the experience wherever they are [ScBF14].</p>
Tourist Motivations	Rewarding experience (DI 7)	<p>The challenges and goals of the experience need to be clearly defined. Instant feedback is crucial to keep participants engaged and enable them to progress in the experience. Continuously</p>

		rewarding tourists is good practice; they feel intrinsically rewarded by discovering, and exploring, unknown places. It builds up well-being and will keep them involved in the accomplishment of the challenge and finishing the experience [Webe00a]. Games or gamification techniques can be a successful approach for tourists, especially if it possesses a reward system in which they are awarded for accomplishing a task included in a story, or reaching a destination [NJCW17, XuBW17].
Tourist Experience * Ubiquitous Media	Cognitive load (DI 8)	The experience's demands on the audience's cognitive load should be kept in mind at all times [BoCh18]. Learning new technologies to handle content such as AR or VR, while grappling orientation in real spaces, can overload the participant's mind and render the experience unpleasant. GUI should be simple, re-using known interaction strategies whenever possible [Desi00]. The audience should have the time to familiarize themselves with the setting before the game or story content starts, otherwise they might miss content and feel confused about what they should be looking at [NiOH06, Webe00a]. Tourists should be able to skip play locations when they do not align with their interest or are too difficult to "play." The experience should not last more than 2 hours [FeAQ12, LiGG13].
Storytelling * Participatory Experience	Levels of participation (DI 9)	The experience should foresee different levels of participation. Participation can range from visiting a website or a specific location [GaOt13]. Tourists can opt to visit two or three POI, or they can get more involved and follow the experience before, during, and after, their trip [FeAQ12]. Tourists could co-create the narrative by interacting with the main character of the story (receiving email, texts, etc.) or the experience could offer alternative stories and interpretations [HSTW17, NJCW17].
Overall TEE Experience	Production team and methods (DI 10)	Creating interactive stories and games require interdisciplinary teams with creative and technical skills (like history, architecture, art, storytelling, gaming; production, software development, modelling, visualization, animation, interaction design etc.) Experts from one discipline (e.g. Historians) should try to become familiar with the requirements and language terms related to other

		disciplines (e.g. Designers) in order to provide suggestions that will advance the production [HSTW17, PaDi14]. Service design tools and methods [HoEv07] can help in the design and production of TEE experiences [NiOa09].
Tourist Experience * Ubiquitous Media * Storytelling	Media distribution channels (DI 11)	The essence of the story should be kept simple so that everyone can follow and understand its core, but hidden content can be created for the more curious [Phil12]. While content can be unlocked when the tourist enters a particular location, it is important to enable access to content even afterwards; for example, when the tourist is back at the hotel [NJCW17]. Distribute parts of the stories in various media channels so they can compose a larger story and fictional world, and to stimulate the search for the other extensions [FeAQ12, NJCW17].
Tourism Experience * Authentic Experience	Local community involvement (DI 12)	Ethnographic methods and field research should be used before the creative concept is fully formed. These methods can reveal opportunities for design and innovation. Because the local community has strong ties with local, natural, social, and cultural environment, their involvement in the design may facilitate the integration of community's feedback to the experience or reaction to the story [KaCe16]. Furthermore, their early involvement can eventually lead to community adoption of the project and the sustainability of the experience [NiHa00].
Ubiquitous Media * Tourism Experience	The experience is as good as its weakest part (DI 13)	Technical and usability problems can spoil the experience; for the most part, in tourism experiences the user will be first-time users. It is important to assist tourists [BoCh18, HSTW17]. This could be done in many ways, like tutorial screens, videos, printed instructions on the site, or even personal assistance. Tell what to look for, make the essential control functions obvious and easy to notice. Ideally, instructions should be kept to a minimum and, if possible, integrate them in the story as direct instructions [Desi00, HoMG02]. The application should detect when the user is having problems and propose solutions (e.g. Taking too long finding a POI, opening media, GPS connection problems) [HSTW17].

3.6 Chapter Conclusion

There is quite a large body of work dedicated to studying how new entertainment technologies and narrative can be put in the service of sustainable forms of tourism. The body of work presented in this chapter focuses on understanding how new technologies and digital media have been used so far to deliver entertainment experiences supporting tourists in understanding a destination's cultural and heritage values. The 13 design insights gathered from previous research integrate the theoretical TEE framework in informing the design of an experience that connects visitors with a destination's values and residents. As this research thesis moves forward into describing the design of the TEE prototype, these insights are used as informative guidelines to achieve a balanced experience between entertainment and education.



4 First Iteration of the TEE Prototype: Fragments of Laura

This chapter explains in detail the rationale of the research approach. It then describes the first prototype of Fragments of Laura, an experience based on the TEE framework. Subsequently, it describes several interim prototypes and evaluations that were conducted in order to refine the experience. Finally, the chapter highlights how Fragments of Laura encompasses all the TEE framework elements.

4.1 Overview of the Methodology of the Research

“Research through Design” (RtD) is described by Zimmerman et al. as an approach “where designers produce novel integrations of HCI research in an attempt to make the right thing: a product that transforms the world from its current state to a preferred state” [ZiFE07]. The objective of this approach is to achieve a balance between research and making, and to create a research prototype that communicates a research contribution. Therefore, the product prototype acts as an instrument of design knowledge enquiry [ZiFE07].

In the particular context of this research, a variant of RtD called “Empirical Research through Design Method” (ERDM) [KeBr09] was followed. The goal of ERDM is to create experimental variability in the product prototype to formally test the underlying

theoretical design questions in a real-world context. ERDM ideally starts by framing a hypothesis based on input from literature review, or inspirational tools such as context mapping or a specific technology. Then, various prototypes of artefacts or interfaces are developed and tested based on structured principles and underlying hypotheses of interaction. A second iteration of the prototype might be developed based on important findings. This process can be repeated several times until the right prototype is developed by which the formularized hypothesis can be tested. Finally, the prototype should be evaluated through an experiment where the target users interact with a fully functional prototype running in a real-world context. Furthermore, if the research question and resulting prototype involve longitudinal experience, it should be tested in the field, otherwise (and if applicable) context-simulation laboratory settings might suffice.

The following sections explain in detail the initial design and iterations of the Fragments of Laura TEE experience corresponding to the ERDM stage where various prototypes of artefacts or interfaces are developed and tested.

4.2 The Experience Prototype of Fragments of Laura Transmedia Story¹⁰

In the following sections, the story and experience design and first evaluation of the initial prototype of Fragments of Laura are described.

4.2.1 Overall Conceptual Design of the First Fragments of Laura Experience

The Fragments of Laura (FoL) experience was designed with the goal of raising awareness of participants regarding the natural and cultural heritage of the Island of Madeira. For this purpose, the fictional story is based on a combination of historical events, weaving science, traditions, and the folklore of the Island. Despite being set in the 19th century, many of the situations the main character faces, such as natural disasters, invasive species,

¹⁰ Conspicuous parts of the text below have appeared in the published co-authored article: Dionisio M., Nisi V., Nunes N., Bala P. (2016) Transmedia Storytelling for Exposing Natural Capital and Promoting Ecotourism. In: Nack F., Gordon A. (eds) Interactive Storytelling. ICIDS 2016. Lecture Notes in Computer Science, vol 10045. Springer, Cham DOI: https://doi.org/10.1007/978-3-319-48279-8_31
The work was initiated under the Future Fabulators Project, EU Culture funded project EU Culture Funds (2013-1659/001-001 CU7 COOP7) Consortium: Time's Up, Madeira-ITI, FoAM, Alt Art, Coordinated by Time's Up (Linz, Austria)
<https://futurefabulators.m-iti.org/projects/laurisilva/>

and the endangerment of the natural patrimony of the Island, are still relevant to our times. In presenting the fictional story, the goal is to entice the audience into contemplating the richness of the Island and reflecting on the sustainability of its patrimony by linking the proposed fiction with current reality.

The fictional story was conceived using a classic, Aristotelian dramatic arc, in which the protagonist, Laura Silva, undergoes a series of adventures culminating in a significant event that should set the audience off on their final quest. Laura Silva is a young woman who escapes a difficult childhood in an orphanage to receive medical training from her adoptive father, who is the village doctor. She stows away on a transatlantic voyage but eventually returns to pursue her life's work studying, cataloguing, and defending Laurisilva's unique forest. Her notes and samples are kept in a vast herbarium – an annotated and illustrated book of medicinal plants – but Laura and the book go missing, apparently swept away in the historic flood of 1803.

Via the transmedia experience, visitors embark on a quest to find the ancient book of knowledge and its author Laura. Finally, the audience uncovers a series of possible story endings, which translate into different future scenarios and that raise the question, What impact will past knowledge and present actions have on our shared future? The experience and story were envisaged as unfolding using a location-aware mobile platform, traditional media such as handwritten journals and letters, and interactive artefacts to be placed in significant locations as part of the immersive experience.

The next section reports on the users' scenario that illustrates the FoL experience from the audience point of view.

4.2.2 Conceptual Scenario of the Fragments of Laura Experience

At the beginning of the FoL experience users are shown a video in a designated room at the “*Estalagem da Ponta do Sol*,” an eco-friendly hotel overlooking the bay of a small Madeiran village. The video features Horacio, a scientist from the future who travels back in time to ask for help in his search for Laura Silva's lost herbarium. In this fictional future, the natural heritage of the Laurisilva forest is under threat and the herbarium contains encyclopedic knowledge of the forest's rich biodiversity, as well as invaluable samples of the endemic medicinal plants themselves. If the herbarium is brought to the future,

it can be used to regenerate the forest as it once existed. In return for this help, the audience are given a glimpse into the future: how would the future of the Madeira Island natural heritage look if the book is found, and what would happen instead if it was not? The audience has two hours to find the book before Horacio disappears. Those who accept the challenge are given a special device (smartphone) at the reception desk of the hotel and directed to the first location where they will find some clues as to the whereabouts of the famous botanist, Laura Silva. The story unfolds as the audience walks through the village, from the top down to the pier, and ends up behind the old pharmacy, having followed Laura's adventures and discoveries, her victories and misfortunes. In the course of the experience, the audience learns how various local plants can be used as remedies. They also learn how the natural heritage of the forest has been degraded and exploited in the past. Towards the last point of the story, the audience learns how a major flood, significantly exacerbated by widespread and rapid deforestation, destroyed many of the villages on the south coast with Ponta do Sol hit particularly hard. An old pharmacy, belonging to Laura, was washed away and, with it (in our story), Laura and her wealth of knowledge. Standing by the river outside the pharmacy, the audience discovers that there was a lab situated on higher ground – visible from where they stand – that was untouched by the flood. As a final step in the experience, audience members who are willing to walk up to the location where the lab was, can check whether Laura's herbarium is hidden there. They find a digital note, telling them that they had found the herbarium and that they can send it directly to Horacio. Those who did not take this final step will finish the experience at the pharmacy, leaving Horacio empty-handed.

Once the experience is finished, the participants will receive, on their mobile device, a 360° VR animation giving them a glimpse into the future of the Island. These animations should prompt participants to reflect on the future of the natural heritage of the Island, but also to enjoy the 360° VR experience itself, as they learn how important nature is and connect with the local heritage of the Island.

4.2.3 Experience Prototype Development

Before moving into the technical production and development of the story, it was important to examine initial audience reactions. A specific Experience Prototype (EP) [BuSu00], explained in the next section, was designed to be evaluated by a group of experts composed of, in the first instance, visiting artists, designers and storytellers, in order to get feedback on story flow and immersion, and in the second instance, with local expert botanists and biologists to test the credibility of the scientific information distilled through the story. In the initial EP, the use of technology was limited, as well as the mix of different types of media, in order to elicit feedback and critiques from users without unnecessary distractions caused by a switch between media.

4.2.4 Methodology

Experience Prototyping is a well-known technique used in many different areas of design to communicate design concepts, and to understand and test the flow of the user experience through physical space and across different media and means [BuSu00]. This technique was adopted to understand some key aspects of the transmedia story, such as its experience and storytelling flow, how better to attract and engage the audience, how to connect the scenes to the physical locations, how to balance the different media elements, and, finally, how to make the scientific and historical information understandable to a general audience.

4.2.5 First Fragments of Laura Experience Prototype: Insights and Results

The EP was designed to be tested in the setting of Laura's fictional story, that is the village of Ponta do Sol, a trendy tourist destination on the island for those looking for a closer base to engage on nature trails and Levada walks. To deliver the experience, a probing booklet was printed out and given to each of the participants (see Figure 4:1). This booklet illustrates step-by-step how the mobile application will deliver the experience. A group of 11 participants, including storytellers, designers, biologists, artists, and engineers, was invited to test the experience. The process started by introducing the goal of the

experience prototype and how to use the booklet. Then, it was introduced the researcher’s role during the experience, and explained what would be expected from the participants. Participants were asked to express their thoughts during each phase of the experience, either directly to the researchers or by adding comments in the booklet itself.

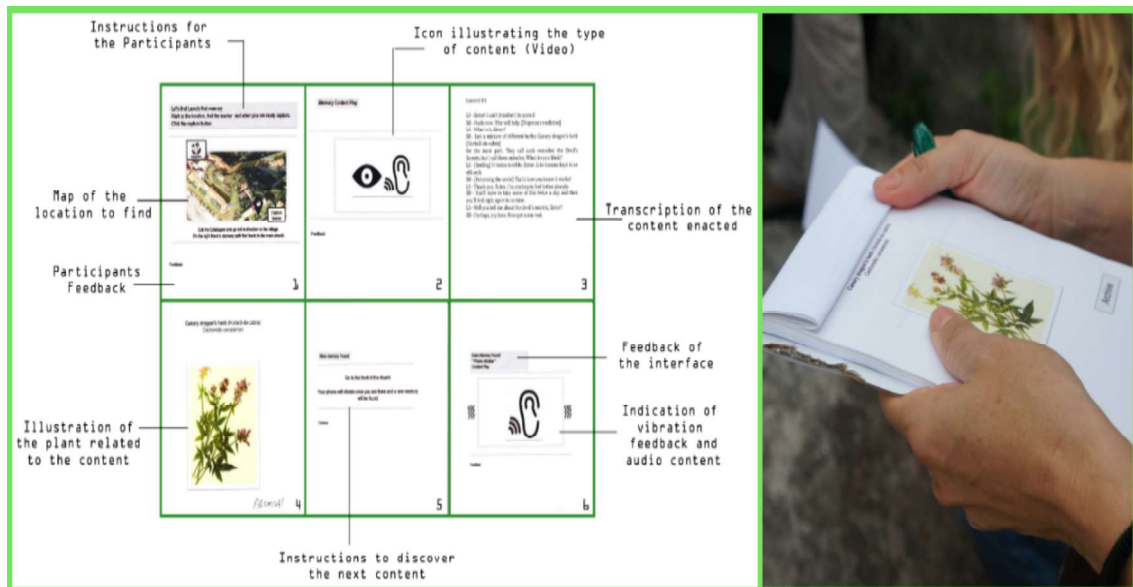


Figure 4:1 – Illustrative images of the experience prototype booklet. Left: Outline of several pages belonging to the booklet; Right: One of the participants holding the booklets used during the experience prototype.

The EP guided 11 participants through each point in the story; experimenters were performing the various characters and the relevant dialogues in different locations of the village, in order to render the story as faithfully to our original vision as possible. During each stop, before moving on to the next point, participants had a few minutes in case they wanted to write down comments about what they had just experienced. At the end, all feedback was collected in three different ways: through notes taken during the experience by the researchers; through the feedback that participants wrote in their booklets during the experience; and through an hour-long group discussion conducted and recorded indoors after the experience was concluded.

4.2.5.1 *Research Insights*

In general, the EP was well received. Participants saw it as a useful way to get to know the village (with which most were unfamiliar), to engage with the physical surroundings, and learn about the Laurisilva forest as valuable natural capital providing a range of ecosystem services. The feedback gathered will be important for further iterations and in order to understand it more clearly the feedback is organized into three main sections: story-related feedback, media-related feedback, and experience design feedback.

Story Feedback: Participants enjoyed the story and generally wanted to hear more details. Some participants suggested presenting the story in a more fragmented, less linear, way and then design a “post-experience moment” where the complete story is delivered in a linear way. Moreover, participants suggested that some story fragments needed to contain a better “hook” to the next fragment so that users would feel the desire to move forward to the next location and find more story pieces. Other participants suggested improving the dramatic arc of the story by adding more moments of suspense and by creating moments of empathy with Laura, the protagonist. Finally, several participants suggested that the story needed to have clearer and stronger anchors to each of the physical locations.

Media Feedback: Participants were excited by the possibility of interacting with real artefacts and encouraged us to push for more interactions with real objects left in the real world for the audience to find, touch, smell, and taste. One participant suggested that it would be interesting to be able to obtain the recipes of herbal folk remedies to use at home, or perhaps to be given herbal teas as a souvenir of the experience. During the group discussion, mixed opinions emerged on the topic of audio versus video as a way to deliver the story content. It became clear that some users preferred to have audio only so that they could focus their attention on the actual physical locations rather than looking at a screen, while others wanted the video so that they could connect more strongly with the characters and have something to focus. One user said: “When listening to the audio I don’t know where to look – video gives me a focus.” More than one participant mentioned the use of Augmented Reality as a means to see how the village locations looked in the

18th century. Augmented Reality would also strengthen the link to the locations. One user said: “I would like to be given magic powers to see through the walls and into a doctor’s office from back then.”

Experience Design Feedback: Participants suggested that the distance between different story points placed at different locations was too great. The ratio of time spent walking between points, in other words, and time spent with the experience content itself, should be more balanced. The ideal solution would be to find secondary activities for the “in-between” time: to give users a task to focus on as they walked, for example, or to feed them more of the background story via audio. Participants enjoyed the “treasure hunt” aspect of the experience, and several wished that it could have been expanded with even more “treasures” planted. This relates to the fact that many participants indicated that a higher level of individual agency was desirable; they wished to interact and engage more with the locations and the people who live and work in the village. It was generally felt that tasks requiring users to talk and meet with people while looking for clues and following the story would enrich the overall experience. One suggestion, for example, was that it would be interesting for users to have to go into a local shop and ask for something; to gather real clues. Participants wished they had to make more choices that directly affected the experience in some way – if they had to be more actively involved. More autonomy when it came to finding locations and walking around the village would also be welcome.

Moreover, if one story location point was visible from another, users would not have to rely so much on a map, screen, or guide to navigate, but could use visible landmarks for guidance. Finally, comments suggested that a greater sense of urgency was needed in the experience as a whole and that users had to be reminded from time to time why it was so important to reach the end goal of finding the herbarium. The audience appreciated very much the factual nature of the scientific information provided during the experience, hence a close collaboration between storytellers and botanists is a sought-after characteristic of such a project. Last, but not least, the experience prototype was successful in giving the authors, as well as the audience, a full impression of the story flow and its

interactive dynamics, collecting feedback for improvements before reaching the development stage.

4.2.6 Implications for the Next Iteration of Fragments of Laura Experience

Distilling the extensive feedback received on-site, and afterwards in the recorded focus group, resulted in a set of main reflections and refinements to improve the FoL prototype.

These included:

1. Strengthening the plot of the story by adding scenes to increase coherence and suspense
2. Adding audio to accompany the audience when moving from one story point to the next, filling in background information for the participants
3. Including Mixed Reality (AR/VR) to allow participants to see the action taking place behind closed doors, or in a different time or space, and allow for more participant agency (in the story world)
4. Creating more connections with the local community while highlighting some contemporary aspects of the experience

4.3 The Design of Fragments of Laura According to the Novel Transmedia Entertainment Education Framework

The feedback and insights learned from the EP were applied to evolve further the design of FoL narrative and experience, for the enhancement of the tourist experience. The fictional story of Laura Silva was adapted to work partly as a Location-Aware Multimedia Story (LAMS), where the audience is guided through the exploration of physical locations to unravel the narrative and gain knowledge about the history and the heritage of the Island. The FoL LAMS¹¹ experience was reallocated to Funchal, Madeira's capital. Because of its high cultural and historical value, Funchal is one of Portugal's main tourist attractions, providing a better launching pad to inspire and involve tourists in future evaluations of the experience. Furthermore, due to its richness of landmarks and historical buildings, it provides closer links between the fictional narrative, the real-world locations, and the Island's local values.

Users' feedback from the FoL experience prototype highlighted that participants wished to interact and engage more with the locations and the people who live and work in the village. In response to that, a hypermedia platform was envisaged to complement the LAMS experience, collecting a variety of scientific facts about the Island's natural heritage and edited as video interview clips. The hypermedia component was named *Há-Vita* and was also produced in close collaboration with the Beanstalk research team¹².

¹¹ The development of FoL LAMS was part of the MADEIRA 14-20 FEDER funded project Beanstalk, (2015-2020). Consortium: Madeira-ITI, Madeira Promotional Bureau. The team effort involved six researchers (two programmers and two artists, one researcher with tourism background and myself). One programmer was responsible for the implementation of the Laura's Pharmacy while the other was responsible for implementing the mobile application. Two artists developed all the 2D and 3D assets for both Laura's Pharmacy and the 2D Motion Comics, the tourism researcher contributed with helping in researching historical facts and connection with landmarks. My contribution to the prototype focused the development of the overall concept and user experience of narrative (bringing in theoretical considerations into the practical work, conducting of brainstorm sessions, contextual research to enrich the story flow, writing dialogues, sound recording) conducting the respective evaluations described in the chapter.

¹² The team working on this component was comprised of: a graphic designer, a developer, and two digital media researchers with a journalism background, a tourism researcher and myself. The journalism researchers and the tourism researcher were responsible for collecting the video interviews. Subsequently, the interviews content was edited by myself with the help of the tourism researcher who was present during the video interviews. Then graphical designer added in animations and graphics, sounds and subtitles. The graphic designer worked closely with the developer to outline and deploy the web portal. The journalist researcher and myself were responsible for the overall conceptual design of the platform and several iterative evaluations and publications.

These two distinct media channel components of the FoL TEE experience were kept independent but still related so as to attract a wider variety of audiences, thereby minimizing the risk of the audience feeling that they had missed out part of the experience. This was inspired by other transmedia projects universes (cross-overs and spin-offs such as Marvel Universe; Conspiracy for Good, Grey’s Anatomy and Project runway) [Ther00] that provide multiple avenues for audiences to experience different aspects of the story worlds. Extra efforts were made in order to ensure that the visual language of both components was coherent. This was done by using similar aesthetics, textures, colours, materials, and overall visual style (see Figure 4:2). The choice of giving the hypermedia component its own identity was also aligned with the plan to perform preliminary evaluations of the two main components of the transmedia experience. In this way, participants would not feel like they are missing out one component while testing the other.

The next sections detail the adjustments made to the design presented in the experience prototype and the initial working prototypes of the two distinct media channel components of the TEE experience. Section 4.4 details the design of FoL LAMS and related evaluations. Later on, in section 4.5, more details about the design process and evaluation of Há-Vita, (the FoL Hypermedia platform) are given.

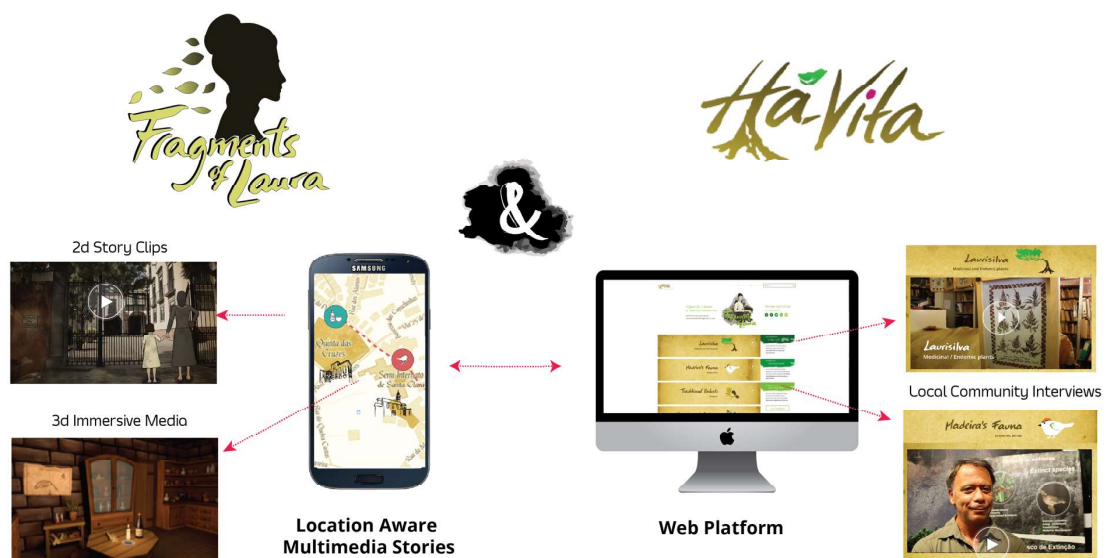


Figure 4:2 – The two distinct media channel components of the TEE experience: FoL LAMS and Há-Vita

4.4 Detailing the Fragments of Laura Location-Aware Multimedia Story

4.4.1 The Narrative Adaptation

The narrative and story plot of FoL was adjusted to a new location; this adjustment was made to reflect the richer historical landmarks present along Saint Peter's parish in Funchal (Madeira's capital) and the information gathered by interviewing the locals for the hypermedia platform. As a consequence, some fictional elements and characters were changed, while others were dropped entirely. For example, the fictional character coming from the future, Horacio, and his quest for Laura's herbarium was supplanted with further details of Laura's infancy and her journey in preserving and studying the local forest and its medicinal potential.

In this newer version, Laura is orphaned in the 1803 flood and this tragic event is now featured at the beginning, instead of the end, of the story. Laura spends her youth being raised by nuns until she is eventually adopted by a wealthy English lady who sees a lot of potential in her. Instead of escaping as a stowaway, as in the previous version, Laura now goes to England to study among some famous naturalists. After a few years abroad, she comes back to keep studying the medicinal potential of Laurasilva plants and set up a pharmaceutical lab to help the local community. However, the forest is endangered as deforestation keeps increasing. She does what she can to safeguard it, but she is not appreciated by all members of the small, Island community. She falls in love with the English researcher and botanist, who will end up saving her life, at the cost of having to leave her beloved Island. The story concludes with an open ending that leaves space for hypothesis on her future and her legacy.

By presenting the fictional story interwoven with real fact and locations, its goal is to entice the audience to contemplate the richness of the Island further and reflect on the sustainability of its patrimony by linking the proposed fiction with the current reality.

4.4.2 Mobile Platform Experience Design

The FoL LAMS experience is composed of seven touchpoints of interaction along the streets of Saint Peter's parish, allowing for the progression of the plot and exploration of

the physical settings. Six of these touchpoints are realized as 2D multimedia video (see Figure 4:3– Bottom), while one is an interactive 360° VR reconstruction of Laura’s pharmacy, dating back to the 19th century. Details about this touchpoint are given in 4.4.3.1.



Figure 4:3 – Montage of the several types of multimedia content that comprise the FoL LAMS. Top: Interactive VR reconstruction of Laura Silva’s pharmacy, where it is possible to see several 3D objects dating back to the 19th century; Bottom: Frames from the 2D multimedia videos using a motion comic as a form of animation.

The FoL LAMS mobile application makes use of a map interface with icons representing interaction points. Each touchpoint is associated with a story clip and a meaningful location, and each icon on the map interface is unique and representative of this association. Participants, supported by the map interface, must find the desired locations by walking along a specific route in the city, see Figure 4:4. Once they are close to the desired location, the mobile phone will vibrate, triggered by a Bluetooth beacon indicating that they are in

the correct story location. The content then is unblocked, and the user can press the corresponding button to watch the story clip.



Figure 4:4 – High fidelity prototype of Fragments of Laura Mobile Application

After watching each story clip, a synthesized interview clip, based on the Há-Vita platform's recorded conversations with local scientists and local knowledge holders, is proposed to the participant. The participant can choose to watch it, or save for later viewing (see Figure 4:5). Furthermore, the clips work as an invitation to explore the full version of the interviews that can be found on the hypermedia platform.

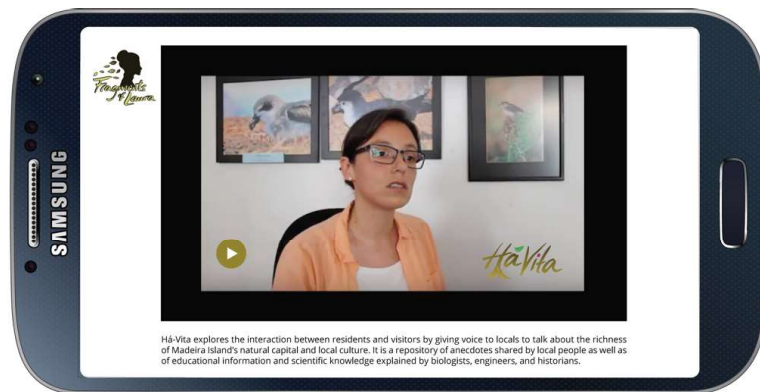


Figure 4:5 – Screenshot from the FoL mobile interface that is presented to participants connecting the fictional content of Laura Silva's story with the hypermedia platform summarized clips derived from interviews with locals.

4.4.3 The Development of the Interactive VR Touchpoint: The Reconstruction of Laura's Pharmacy¹³

The interactive VR touchpoint of the FoL experience was designed as a 360° immersive narrative scene to inform users about the medicinal properties of several plants and remedies typical of the Island. It underwent two main iterations in line with the two versions of the story (the first one set in the small village on the west coast of the Island, and the second one set in Funchal, the capital of the Island). In order to promote clarity in describing the prototypes they are referred to: The Old Pharmacy (the first one) and The Pharmacy (the second one). These iterations are a result of feedback gathered during user evaluations. This process was necessary to ensure the most successful outcome in terms of user experience with the interactive VR reconstruction of Laura's Pharmacy.

The next sections summarize the design of both prototypes, the main outcomes from the evaluations, and how they contribute towards the goal of ensuring that the storytelling, the ubiquitous media, and the real-world components of the TEE framework, are integrated successfully in this touchpoint of the FoL LAMS.

¹³ Conspicuous parts of the text below have appeared in the published co-authored articles:

- Bala P., Dionísio M., Nisi V., Nunes N. (2016) IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality. In: Nack F., Gordon A. (eds) *Interactive Storytelling. ICIDS 2016. Lecture Notes in Computer Science*, vol 10045. Springer, Cham DOI: https://doi.org/10.1007/978-3-319-48279-8_1
- Bala P., Dionísio M., Trindade R., Olim S., Nisi V., Nunes N. (2017). Evaluating the influence of location and medium applied to mobile VR storytelling. In *Proceedings of the 16th International Conference on Mobile and Ubiquitous Multimedia (MUM '17)*. Association for Computing Machinery, New York, NY, USA, 371–378. DOI:<https://doi.org/10.1145/3152832.3156617>

4.4.3.1 Old Pharmacy: The 360° Immersive Narrative Touchpoint

The first prototype of the interactive VR reconstruction of Laura’s pharmacy was called The Old Pharmacy. In this interactive VR touchpoint, Laura Silva, the main character, acts in first person, reacting to characters’ demands while the participant witnesses her actions. She is asked by a neighbour to make a traditional medicinal drink called “*Poncha*.” In order to complete the task, Laura needs to search through her establishment to find the right ingredients. The participant is a spectator as he watches Laura preparing the drink and talking to the neighbour. During this process, the participant can look around the virtual environment (360°) independently from Laura’s actions, while is informed about the qualities and benefits of several medicinal plants through the dialogue between characters (see Figure 4:6). This content was designed in VR to immerse participants in a 19th century pharmacy and learn what kind of herbs and tools were used back then.



Figure 4:6 – Screenshot of the Old Pharmacy 360° narrative showcasing Laura Silva in her establishment and a neighbour asking for “*Poncha*,” the medicinal drink.

4.4.3.2 *Two Evaluations of The Old Pharmacy*

Two different evaluations were conducted with this prototype, each with distinct goals. With the first evaluation, the goal was to gauge the audience's understanding of the narrative happening in the 360° VR, and how could it be improved to become more engaging. The second evaluation of The Old Pharmacy had the goal of understanding if the experience of watching a 360° VR narrative was affected by the location in which the prototype was experienced; and to what extent the medium (tablet or head-mounted display) on which the narrative is presented affects the experience. Figure 4:7, provides a summary of both evaluations where, on the left side, it is possible to see a screenshot from the first evaluation and data captured during the visualization of The Old Pharmacy narrative. On the right side it is possible to see images from the second user studies showcasing the two different conditions (On-site versus Off-site using a tablet, and On-site versus Off-site using a Head Mounted Display (HMD) under which they watched the narrative. Further details of the measures and methodology have been published in the articles mentioned in footnote 13 and included in this thesis, Appendix A and Appendix B.

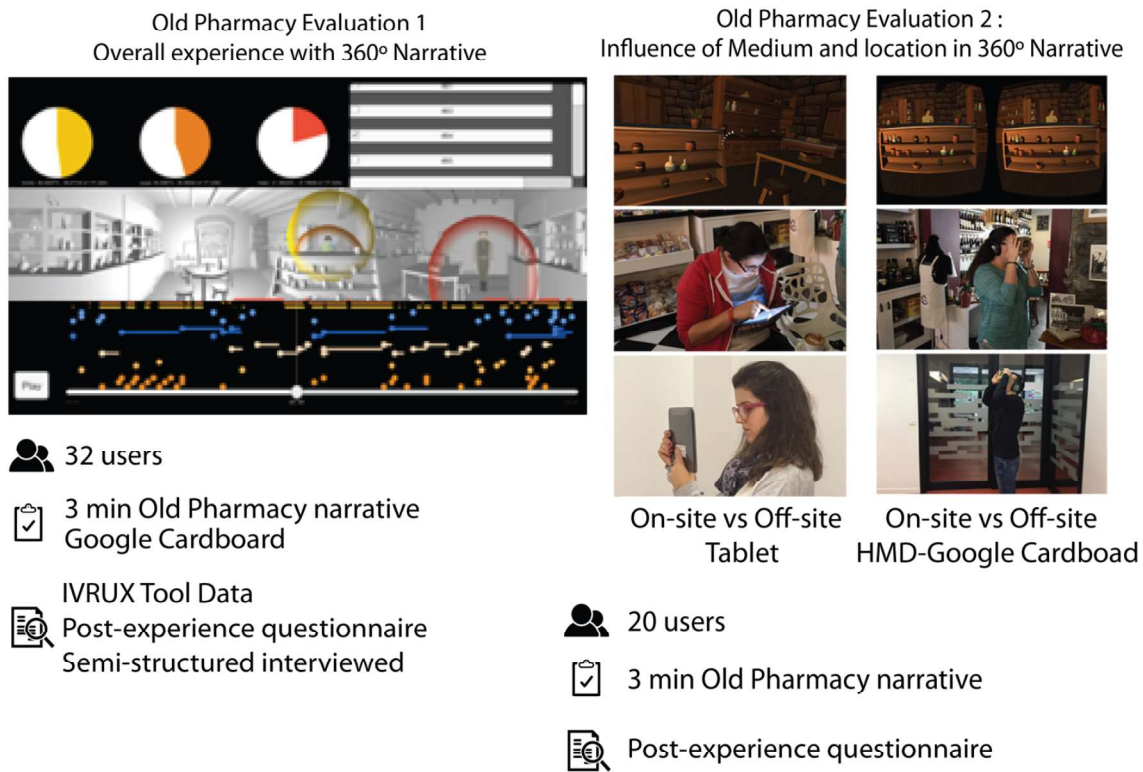


Figure 4:7 – Summary of the details of the two evaluations conducted with The Old Pharmacy prototype. Left: Screenshot from data captured during the visualization of The Old Pharmacy narrative; Right: Images from the second user studies showcasing the two different conditions.

Focusing on the main takeaways relevant to the scope of this research, data from participants highlighted the need for several adjustments in the story flow and pacing [BDNN16, BDTO17]. Users wished for a deeper engagement with the narrative and a greater sense of agency/freedom to explore the virtual world [BDNN16] of the pharmacy. Furthermore, it was concluded that the location where the user is when watching a 360° narrative affects the user experience [BDTO17]. It was also concluded that the medium used to view the 360° narrative does affect the experience; using the tablet as a medium is more demanding when taking the experience on-site. Furthermore, handling the tablet is more physically demanding due to the need to have arms extended throughout the duration of the experience. Another detail to take into account is that when the experience is taken in a public space, requiring the user to be orienting the tablet towards other people, this might make them feel self-conscious about what others are thinking about the activity [BDTO17].

After these two evaluations' results, the approach to narrative in 360° was refined, and the 360° VR touchpoint was reformulated through a gaming strategy, thereby enhancing the agency of the user. The next section details the new experience.

4.4.3.3 *The Pharmacy: A 360° Mixed Reality Touchpoint*¹⁴

The redesigned version of the 360° VR touchpoint was named The Pharmacy, to distinguish it for the previous prototype. The premise of the task remained the same: to prepare the medicinal drink called “*Poncha*.” However, in this version, in order to increase agency, participants embody the character of Laura to prepare the drink. This change led the experience to move away from a 360° immersive VR narrative, which was non-reactive to the participants' input and presence in the scene, into a Mixed Reality (MR) experience by creating a direct mapping between sensory–motor actions in both the real and virtual worlds. The synthetic content, Laura's pharmacy, and the participant's real-world actions are now able to react to each other in real-time forging a new hybrid/mixed reality [SpHN19].

The participant needs to search through the virtual pharmacy environment to find the right ingredients/objects that make up the “*Poncha*” recipe. Accomplishing this task encourages the participants to navigate and explore the virtual environment by moving around the mobile phone. In The Pharmacy, there are 15 objects/ingredients that are interactable, Figure 4:8 – Left Bottom. These were selected as representative of several traditional products or representative of traditions, in this way allowing for the inclusion of more information regarding local products and herbs.

When the participant is within reaching distance of one an object, the object is highlighted visually with a glow effect, and the participant can select it with an on-screen tap, Figure 4:8 – Right Bottom. After the selection, she/he is informed about the qualities and benefits of such products through the conversation between the character (Laura) and the neighbour, Figure 4:8 – Left Top. When an object that is part of the set of ingredients needed

¹⁴ Conspicuous parts of the text below has appeared in the published co-authored article:

Dionísio M., Bala P., Nisi V., Oakley I., Nunes N. (2018) Step by Step: Evaluating Navigation Styles in Mixed Reality Entertainment Experience. In: Cheok A., Inami M., Romão T. (eds) *Advances in Computer Entertainment Technology*. ACE 2017. Lecture Notes in Computer Science, vol 10714. Springer, Cham DOI:https://doi.org/10.1007/978-3-319-76270-8_3

to make the drink is selected, the user receives encouraging on-screen and auditory feedback. In this way, participants can explore the 3D virtual environment freely and can “*learn by doing*,” since they will embody the role of Laura while preparing the medicinal drink.



Figure 4:8 – Left Top: Participant holding Project Tango¹⁵ device running The Pharmacy; Left Bottom: Screenshots from The Pharmacy showcasing the 3D environment, an example of a correct ingredient (green glow); Right Top: The 3D character of Laura’s neighbour with the “Poncha” bottle; Right Bottom: The Pharmacy room layout (orange dots are selectable objects, and green dots are selectable objects that need to be collected in order to make the medicinal drink “Poncha”).

¹⁵ <https://www.intermodalics.eu/project-tango>

4.4.3.4 Evaluation of The Pharmacy

As the development of The Pharmacy progressed, it was challenging to conceptualize the navigation style that would provide the best user experience while exploring the virtual environment. To overcome this, an evaluation of The Pharmacy was conducted which yielded contributions outside the research goal of this thesis, with regard to how Navigational Styles (NS) impact Mixed Reality (MR) entertainment experiences (see Figure 4:9 for a summary of the study details and illustrates the three different conditions that were tested regarding the NS). The green represents navigation actions, and red represents looking actions. Objects are selectable by touching the screen. The *Hybrid* interaction technique revealed to be the most balanced NS to be used in The Pharmacy. Further details regarding the motivation, methodology, and resulting outcomes were published in the research paper mentioned in footnote 14 and can be consulted Appendix C.

One of the outcomes of The Pharmacy MR touchpoint evaluation was how it was seen as a positive experience, with participants reporting feeling involved and immersed in it (despite the NS). Furthermore, this study contributed to making informed decisions regarding the NS of the VR environment, to ensure participants had a pleasurable experience with it. The study pointed out that the Hybrid interaction was the best NS approach. In this interaction technique, the participant rotates both the device and themselves (physically) to look around in the virtual environment and uses the virtual joystick to move around back and forward. The mobile device's gyroscope and accelerometer control the participant's orientation and a virtual joystick enables navigation to different locations. This NS is particularly relevant given safety concerns and to the fact that it will be used in a public context. Finally, some participants expressed through informal feedback how they wished to be able to consult the "*Poncha*" recipe, as they would often forget what the ingredients were that they were searching for inside The Pharmacy.

The Pharmacy Evaluation
Overall experience and Navigation Style

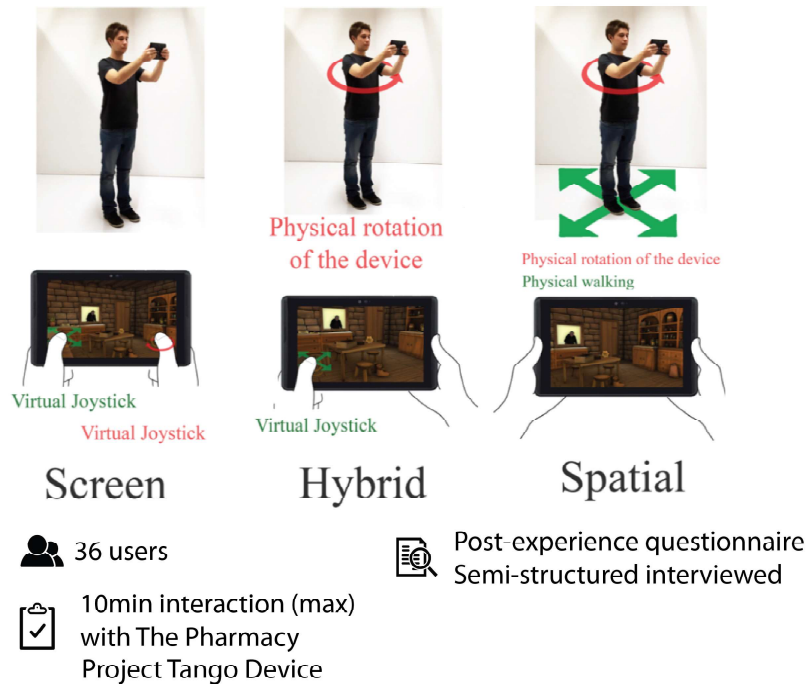


Figure 4:9 – Summary of the details of The Pharmacy evaluation.

4.4.4 Evaluation of the First Prototype of Fragments of Laura, a Location Aware Multimedia Story¹⁶

Once the FoL Location Aware Multimedia Stories (LAMS) prototype was completed, it was important to evaluate the experience in order to understand the story flow, its usability, and its overall user experience. As the different multimedia assets and mobile application were being developed it, it was crucial to identify if there were potential usability problems, low engagement or immersion with the narrative, and how well would the 3D interactive MR touchpoint integrates with the FoL LAMS. Furthermore, an opportunity was found, in section 3.2, to explore if Mobile VR (MVR) can be used to enhance the

¹⁶ Conspicuous parts of the text below have appeared in the published co-authored article: Dionisio M., Bala P., Nisi V., Nunes N. (2017). Fragments of laura: incorporating mobile virtual reality in location aware mobile storytelling experiences. In Proceedings of the 16th International Conference on Mobile and Ubiquitous Multimedia (MUM '17). Association for Computing Machinery, New York, NY, USA, 165–176. DOI:<https://doi.org/10.1145/3152832.3152868>

cultural heritage sites within the specific context of LAMS. As a result, this section describes a study designed with two clear objectives:

To understand the overall user experience of FoL LAMS experience.

To understand how successful the pairing of immersive MVR with LAMS would be, and, in particular, to study the best medium (and its implications) to deliver The Pharmacy interactive MR touchpoint.

Further details regarding the motivation, methodology and resulting outcomes were published in the research paper mentioned in footnote 16 and can be consulted in Appendix C.

4.4.4.1 FoL LAMS Prototype Implementation

The refined FoL LAMS concept was delivered through a mobile application in which the main interface is composed of a custom-made map containing clickable buttons representing meaningful locations (see Figure 4:10). It was programmed using the Unity game engine [Unit00]. When the first working prototype of the mobile application was ready, four out of seven of the multimedia touchpoints were completed. Touchpoints one, two, and four, correspond to 2D multimedia videos, while touchpoint three is the interactive MR touchpoint - The Pharmacy.

In touchpoint one, the audience gets to know the protagonist, Laura, and learn how she ended up as an orphan being raised by nuns. Touchpoint two reveals her growing interest in botanical science and how she desires to pursue it despite the nuns' disapproval. In touchpoint three, the audience moves around Laura's establishment and sees how she is trying to help the local community and preserve the forest. In the final touchpoint, the audience views how Laura has to escape the Island because of rumours circulating against her. These touchpoints already deliver an experience overview of the overall narrative, and for this reason the prototype was tested (although incomplete) to understand participants' engagement with the narrative theme, and to test the interface usability.

Participants, supported by the map interface, must find the desired touchpoints by walking to specific locations. Once at the desired location, they must find a physical marker; the presence of a physical marker indicates the story location (see Figure 4:11). The participant approaches the marker, the content is unblocked, and he/she can press the

corresponding button to view the multimedia associated. For the purpose of this evaluation, upon arriving at The Pharmacy touchpoint (see Figure 4:10, touchpoint 3), participants have to discover a hidden clue (see Figure 4:11, the first image showcases the marker and instructions for the hidden clue). This clue was a tangible piece of paper containing the recipe (ingredients and procedure) to make the “*Poncha*” drink (see Figure 4:11 - middle section for a photograph of the clue).

This clue was added for two reasons: firstly, to strengthen the connection of digital content with the location and reinforce the sense of agency of the players, and, secondly, to understand if a “*Poncha*” recipe would help the participants accomplish the task of making “*Poncha*” in the virtual world. This was because, in the previous evaluation of The Pharmacy, participants expressed that they would forget the ingredients.

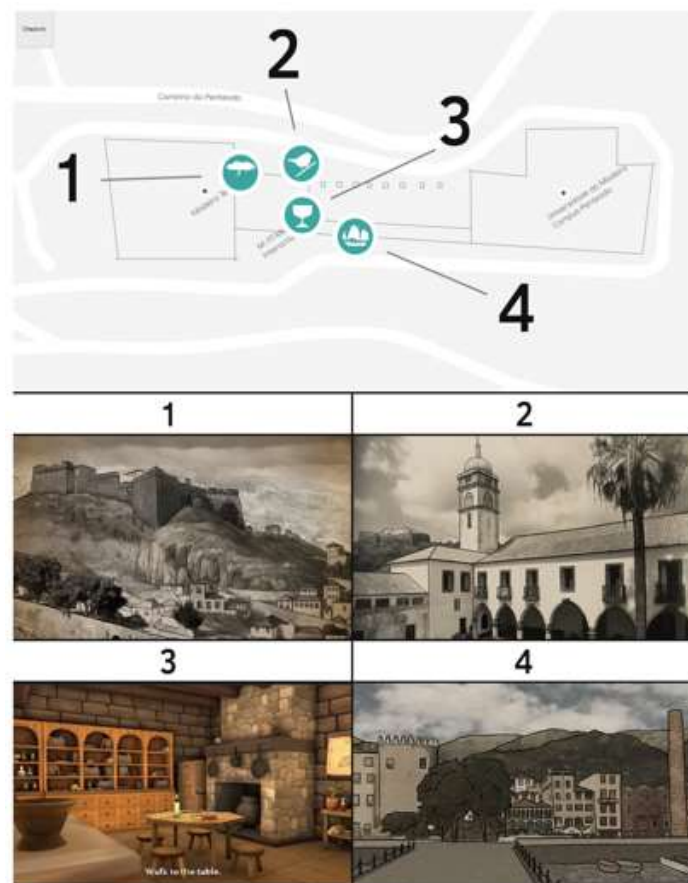


Figure 4:10 – Top: Screenshot of mobile application map interface; Bottom: Screenshots of the motion comic (Touchpoints: 1,2 and 4) and Screenshot of the interactive MVR touchpoint 3.

4.4.4.2 Summary of Study Design and Data Collected

Connecting to our motivation, Section 4.4.4, one further evaluation was designed, which had two main objectives:

To understand the overall user experience with FoL LAMS.

To understand how successful the pairing of immersive MVR with LAMS would be.

To achieve these goals the study was designed with two conditions (*Condition 1 Mixed Reality - CIMR* and *Condition 2 Head Mounted Display – C2HMD*). Each condition delivers a very similar experience in terms of the locations, story, mobile application interface, and goals, but the main difference between the two lies in the medium that supports The Pharmacy touchpoint, and the subsequent use of head-mounted displays (HMD). This approach allows us to understand what the impact of MVR technology in the FoL LAMS would be, since a comparison can be made between pairing of immersive MVR with LAMS (*C2HMD*) and not using HMD (*CIMR*). At the same time, and since the narrative and overall mobile application interface does not change between the two conditions, it is possible to understand how well the FoL LAMS experience works in terms of participants' engagement with the narrative, and to test the interface usability.

The study procedure was the following:

1. Upon their arrival at the researcher's office, the experiment protocol was explained to the participants, who were given a consent form by the experimenters and asked to fill out a small questionnaire to gather some demographic data; this first part of the procedure took no longer than five minutes. Participants were randomly assigned to one of the conditions. Participants in the first condition, *CIMR*, interacted in touchpoint three, The Pharmacy, using only the mobile phone screen display; essentially, the MR version described in 4.4.3.4 with a Hybrid navigation style. Participants in the second condition, *C2HMD*, would interact with The Pharmacy using an HMD; essentially, the mobile phone display inside a Google Cardboard. Table 4-1 summarizes the differences between the conditions, and Figure 4:11 illustrates them.
2. Participants were then led to the start point of the experience - an outdoor public location within the University campus. Participants were handed a smartphone (Samsung S5), equipped with headphones and with the FoL mobile application installed and running.

3. Participants had to discover the four touchpoints (see Figure 4:10) by interacting with the mobile application and looking around them to discover the physical markers. Upon the arrival to the third touchpoint, participants interacted in The Pharmacy according to the assigned condition (Table 4-1). As the participants experienced the FoL LAMS, the experimenter observed from a distance of around 4-5 meters (shadowing). The experimenter had previously explained to the participant that his presence should be completely ignored.
4. The tour lasted around 20 minutes and, once the participant had finished, the experimenter led him back to an office in order for the participant to fill out a self-reported questionnaire, taking around 10 minutes. This questionnaire was composed of pre-defined and validated scales: Flow Short Scale [EnRh08], User Experience Questionnaire – UXQ [User00a], Game Experience Questionnaire (GEQ) [IjKP08].
5. Finally, the experimenter conducted a semi-structured interview with a set of 5 pre-determined questions, approaching, in general, how they felt about the experience, and, some questions that arose from the shadowing. This section of the procedure took no longer than 10 minutes. The overall experimental procedure lasted around 40 to 45 minutes, and participants were compensated with a chocolate bar at the end.

Table 4-1 - Summary of differences between conditions C1MR and C2HMD

	Medium	Interaction required	Clue
<i>C1MR</i>	Mobile Phone Screen	Walk: Continuous touch in “Walk button” Object Selection: Touch input on virtual object	Recipe
<i>C2HMD</i>	Mobile Phone Screen + Google Cardboard HMD	Walk: Continuous Pressing in Cardboard Button Object Selection: Target virtual object and press the Cardboard Button	Recipe+Google Cardboard

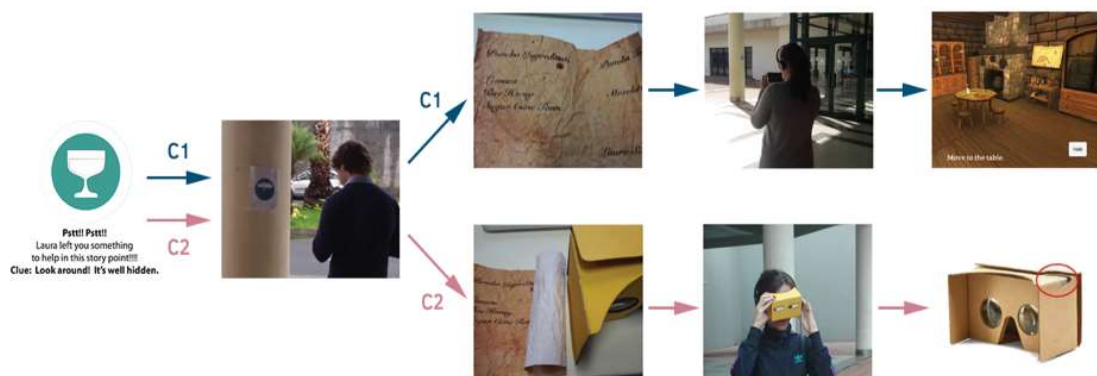


Figure 4:11 – Differences between C1MR and C2HMD in terms of the user experience.

4.4.4.3 Participants

A total of 24 users participated in the study (14 male and 10 female). The 24 participants were randomly assigned between two conditions (independent measures), with 13 participants in condition C1MR and 11 participants in condition C2HMD (for further details refer to Table 4-2). Participants were recruited using a snowball sampling methodology. It was more appropriate to have different users in the two conditions (independent measures) to remove the carry-over effect that would result from the user going through the experience more than once, as this would most likely result in a decrease of engagement and motivation, as a result of already knowing the story.

Table 4-2 – Participants’ gender and age range frequency data per condition

Condition	Gender	Freq.	Percent	Age Range	Freq .	Percent	Total
C1MR	Male	9	69.2%	18-24	3	23.1%	13
	Female	4	30.8%	25-24	8	61.5%	
				35-44	2	15.4%	
C2HMD	Male	5	45.5%	18-24	6	54.5%	11
	Female	6	54.5%	25-24	4	36.4%	
				45-54	1	9.1%	

4.4.4.4 Summary and Discussion of the Results

The FoL LAMS experience was, in general, well received and enjoyed by the participants since high score values were reported in dimensions of the UX questionnaire such as *Attractiveness*, *Novelty*, and *Stimulation* for both of the conditions (see Figure 4:12). The feedback received was very positive with most of the participants highlighting how much they enjoyed the overall experience of a LAMS coupled with The Pharmacy touchpoint. The feedback was divided into three main takeaways:

1. Finding the balance between multimedia an immersive multimedia content
2. Challenges in embracing Mobile VR
3. Provide “onboarding” time for an MVR experience

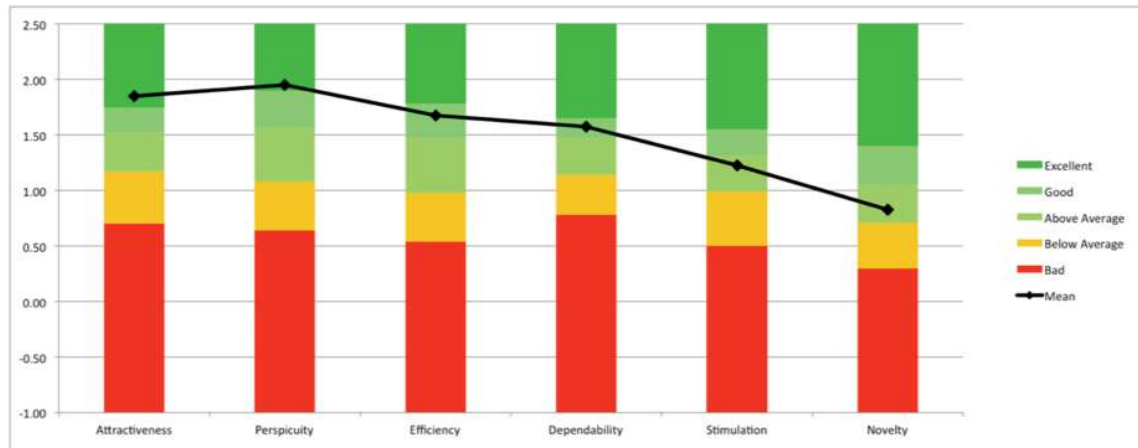


Figure 4:12 – Results for the FoL LAMS User Experience Questionnaire showcasing 2 dimensions with excellent results (Attractiveness, Perspicuity), 2 dimensions with good results (Efficiency and Dependability) and 2 dimensions with above average results (Stimulation and Novelty)

Finding the balance between multimedia an immersive multimedia content: Participants enjoyed the combination of media between the videos and the interactive scene. Participants felt that the experience was balanced in terms of the amount of 2D and 3D content. However, this is a factor that needs to be pondered in future iterations as the interaction with The Pharmacy was something that absorbed much attention from the participants and it should not become something mentally draining or tiring. Furthermore, the incorporation of media such as audio, which does not require the participants to actively focus on the screen, is beneficial as it maintains the variety of media (which is enjoyed by the participants) while allowing them to consider the locations they are in.

In general, participants scored high values in Competence, Immersion, Flow and Positive Affect, and low values in Negative Affect, Tension and Annoyance and Challenge (all components of game experience questionnaire), indicating that participants had a pleasant game experience independent of the condition in which they were. In time, the task could be pushed to be even a bit more challenging (see Figure 4:13).

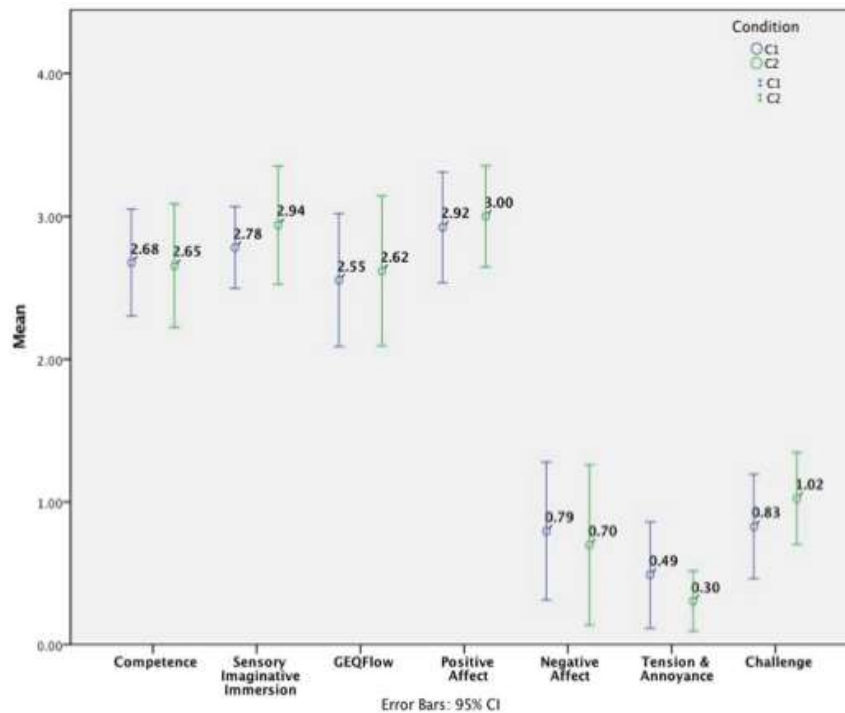


Figure 4:13 – FoL LAMS Median Scores in the Game Questionnaire dimensions in each of the conditions.

Challenges in embracing Mobile VR: Despite the encouraging feedback from the participants, it is essential to acknowledge that mobile VR is still not widely accepted socially. Some participants mentioned being uncomfortable during certain moments of public use. A suggestion received was that the interactive scene should be done in a reserved location. Moreover, we observed users physically walking while interacting in The Pharmacy, in both conditions. This behaviour was not foreseen when The Pharmacy was designed. Most likely, the nature of the interaction required in the virtual environment (walking and exploring) promoted this behaviour in the real world and, in fact, it was quite worrying, as we feared for participants' safety in the physical environment. This exploration task is not ideal for a busy location (with people passing by, obstacles, or vehicles), or tight spaces (where users could bump into walls). Suggestions as to how to overcome this problem propose to have passive story visualization, where the action is happening virtually around the participant, and no user interaction or exploration within the VR environment is required.

One of the goals of this study was to understand the users' experience while interacting with MVR in a public context, and it was not surprising to discover that participants found *C1MR* more familiar and easier to adapt to, compared to *C2HMD*. *C1* condition seems to have a broader reach and acceptance by the audience since it relies on more common interactions present in current mobile computing interaction (e.g. touch to select objects and press buttons to move), while the interaction in *C2* using HMD's is still less common and harder to adapt to.

Provide “onboarding” time for a MVR experience: It is interesting to highlight that participants felt the need to have some “preparation” before the interactive scene. Participants need to be put in the right mind-set as, until that point, the device that they were using was taking a different interaction format. In a way, particularly for participants in the condition using the HMD, it seems that the use of the phone inside Google Cardboard disrupted their mental model of the mobile phone role in the context of the experience. Hence, future iterations of the experience should be designed in a way that gives the users “onboarding time” in the transition between different types of mediums (videos vs VR). Despite this, it is also interesting to see that participants felt more *Competence* and *Challenge* in condition using the HMD. One reason for this could be the fact that, since the task to use the cardboard revealed to be more challenging, participants also felt more empowered after being able to achieve the task and this, in the end, became more rewarding.

4.4.4.5 *Limitations of this FoL LAMS Evaluation*

The study was conducted on the university campus and not in the intended location of the city centre. This location was considered as a “safe setting” for the participants to engage in an interim evaluation of the partial prototype, focusing in particular on the integration of LAMS with MVR.

4.4.4.6 Implications for the Final Iteration of FoL LAMS

The quantitative and qualitative data analysis presents encouraging results in terms of the overall experience. The media presented was praised by participants and they have enjoyed the overall concept of finding the FoL narrative by the format of a LAMS. However, generally speaking, the audience reported uneasiness in embarking on MVR experiences utilizing HMD's in public spaces, just yet. This study was just a first attempt in understanding the use of MVR coupled with LAMS and it opens promising avenues for future research in order to understand how such experiences should be designed to be more comfortable for the users, and hence easily adopted. The future iteration of this work will include a redesign of specific usability issues and bugs found in the mobile application. The hidden clue about the "Poncha" recipe was interpreted as useful and an interesting feature to be included in an improved version of The Pharmacy. In terms of the user experience, it was fundamental to reconsider how to improve the transition between the different types of media and provide an "on-boarding" time before the participants interact with The Pharmacy touchpoint.

4.5 Há-Vita, the Hypermedia Platform design and evaluations¹⁷

The development of Há-Vita, a hypermedia component of the FoL TEE experience, intended to build a connection and empathy with the local community, evolved along two main stages. Phase 1 concerns the conception and content design of the platform based on the gathered literature, informal interactions with local scientists, local artisans, with details in subsection 4.5.1. Phase 2, subsection 4.5.3, concerns the design of the web platform and how it took inspiration from the relevant literature on community-based tourism, and the video interview topics, to allow visitors to engage in activities around the Island that enable deeper contact with the locals and their way of life.

4.5.1 Phase 1: Há-Vita 1.0

Content Creation: The format of video interviews was chosen to give visitors the sense to “get to know” the community members and hear from them directly. Interviewees were carefully chosen based on their expertise and knowledge on local heritage, crafts, and biodiversity, and their availability to be interviewed. The interviewees represented two different sources:

1. Scientific knowledge holders
2. Local folk knowledge holders

All interviewees were informed of the general project goal to stimulate and instil in tourists an interest in the natural heritage and folk knowledge of Madeira. Open-ended questions were asked to scientists regarding technical distinctions of terms such as “native” and “endemic” plants, or the causes of wildfires or floods on the Island. Local residents were posed general questions about their knowledge and experience with the flora, fauna,

¹⁷ Conspicuous parts of the text below have appeared in the following published co-authored articles:

1. Dionísio M., Silva C., Nisi V. (2019) Fostering Interaction Between Locals and Visitors by Designing a Community-Based Tourism Platform on a Touristic Island. In: Lamas D., Loizides F., Nacke L., Petrie H., Winckler M., Zaphiris P. (eds) Human-Computer Interaction – INTERACT 2019. INTERACT 2019. Lecture Notes in Computer Science, vol 11747. Springer, Cham DOI:https://doi.org/10.1007/978-3-030-29384-0_46
2. Nisi V., Dionísio M., Silva C., Nunes N. (2019). A participatory platform supporting awareness and empathy building between tourists and locals: the Há-Vita case study. In Proceedings of the 13th Biannual Conference of the Italian SIGCHI Chapter: Designing the next interaction (CHIItaly '19). Association for Computing Machinery, New York, NY, USA, Article 16, 1–10.

and traditional products of Madeira. The content and thematic areas addressed in the platform were directly mapped to themes of the fictional story content.

After three months of work collecting interviews, 18 interviews of various length were gathered. The content and themes were analysed and matched to the fictional story themes, and finalized into seven categories: Laurisilva, Madeira's Fauna, Traditional Products, Hydrological Balance, Macaronesian Forests, Invasive Species, and Natural Disasters (represented in Figure 4:15 – 7 Themes Page).

Conceptualization of the Interface: The Há-Vita hypermedia platform homepage presents a promotional video introducing the platform's main goal (see Figure 4:14 – Top). The graphical design highlights the connection to Madeira's nature and traditions; for example the main logo represents one of the indigenous trees (see Figure 4:14 – Bottom) and the third icon in from main categories depicts "*Poncha*" - one of the traditional beverages of Madeira (see Figure 4:15).

The top of the homepage contains a drop-down menu, where clicking on the word *Episodes* leads to the identification of the seven themes, as drawn from the interviews and extensive interactions with the locals. The icons in the drop-down menu expand and, by clicking inside the expansion, the visitors are forwarded to the page where the locals express their knowledge regarding the chosen topic (Figure 4:15 – Specifics of the Madeiran Fauna's video page). The interface was deployed using a customized WordPress template.

Há-Vita
A transmedia dialogue

About

Episodes ▾ Search ...

Explore the Seven Themes

All

Há-vita - Promotional video

Watch later Share

Hydrological **ala**

Há-Vita means "there is life" in a mixture of Portuguese (Há) and Latin (Vita).

Há-Vita is a web-based interactive multilinear repository of video interviews covering many aspects of Madeiran **nature and culture**.

Há-Vita explores the **interaction** between residents and visitors by giving voice to locals to talk about the richness of Madeira Island's natural capital and local culture. It is a repository of anecdotes shared by local people as well as of educational information and scientific knowledge explained by biologists, engineers, and historians.

Há-Vita is also a **transmedia** project, which means that it provides a story experience across multiple platforms and formats. Thus, the project unravels through two different interdependent media channels: Há-Vita itself and the location aware mobile fiction story Fragments of Laura (FoL).

Há-Vita was designed to complement **Fragments of Laura** mobile story, as our goal is to connect the overall audience of the app – Portuguese and foreign visitors – with local scientists, traditions, and day-to-day events.

Há-Vita is also a space of **dialogue**, in which we want to invite locals and visitors to contribute with questions, comments, or by sending photos, videos, or posts.

Há-Vita is part of an ongoing research project that started several years ago under the Future Fabulators EU project, and continuing under **BeansTalk** regional project centered around the field of tourism and marketing sponsored by **MADRIPA 14-20 FEDER** funded project with the

Homepage



Figure 4:14 – Top: Há-Vita Homepage; Bottom: Close up detail of logo

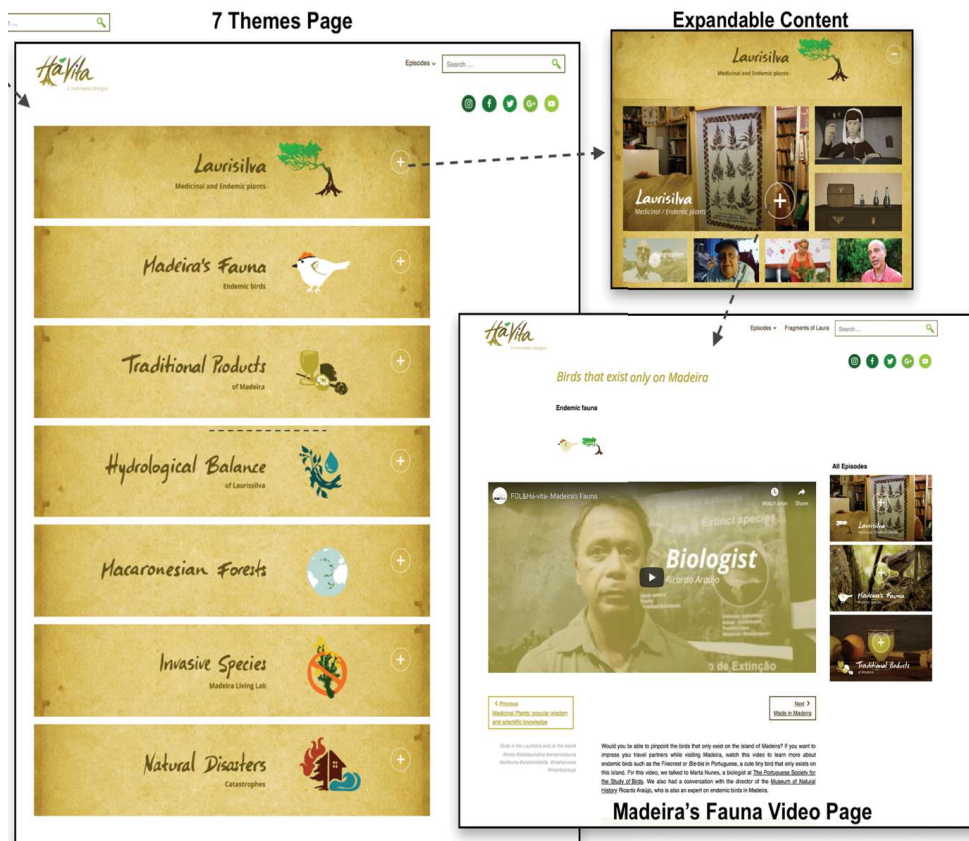


Figure 4:15 – Montage of the interaction sequence from the 7 Themes page to the Madeira Fauna webpage.

The content was available in the platform in a non-linear, modular fashion. At an early stage of the prototype, the communication between the visitors and the locals was still quite restricted, being only granted through allowing comments on the videos. In order to enable a sense of empowerment of locals through the interaction with visitors, the platform needed to be more interactive.

4.5.2 Pilot study of Há-Vita 1.0

A pilot study aimed at gathering tourists' first insights on the web platform concept, content produced, graphic interface, and user interaction, was conducted in the lobby of a five-star hotel, in the touristic district of Funchal. This section summarizes the procedure

and overall results of the study. The study¹⁸ was published as a full paper (see the second reference in footnote 17). For the complete description, including details on methodology, sample and results, see Appendix E.

To evaluate the Há-Vita platform, a table was set up in a hotel lobby with a computer and tablets

(Figure 4:18 – Pilot study setting). Researchers invited the guests to interact with the platform. A semi-structured interview was designed to probe into three main areas: A) Content; B) Interface; C) Connection with locals. The whole protocol lasted 15/20 minutes. Twelve European guests, ranging in age from 14 to 65, participated in the pilot and were rewarded with a locally produced vegetal sponge. Interviews were recorded and later transcribed into NVivo software.

The pilot study gave insights across three main themes:

1. The platform content
2. Improvements
3. Interaction between visitors and locals

The platform was well received in terms of its design and interaction, but especially in terms of its content featuring local residents. Its content was seen as a valuable source of authentic information about the Island. However, the platform goal should be clarified, with clear connections with location around the city and advices/recommendations. Finally, the interaction between locals and visitors was considered positively, although some concerns were raised. Details of the study findings are captured in the table below (see Table 4-3).

¹⁸ This study involved 4 researchers (One digital media researcher with a journalism background, one designer, one tourism researcher and myself). The researcher with the journalism background was the main responsible for the designing and conducting the pilot study in the hotel lobbies. The tourism and designer researchers were responsible for helping out in several logistical aspects related with conducting the interviews. My role was to analyze the data from the interviews and distill insights.

Table 4-3 – Results of the pilot study, grouped by Nvivo nodes and illustrative quotes

<p>Platform Content: 1) Design and interaction were simple; 2) Participants enjoyed and found the content shared by the locals relevant; 3) Scientific content was valued to confirm knowledge obtained during their explorations; 4) Videos featuring the locals sharing folk content was perceived as being authentic; 5) Há-Vita had enabled them to gather new knowledge about Madeira and its ecosystem; 6) Added motivation to explore the island more; 7) Participants imagined accessing Há-Vita, before and during the travel.</p> <p><i>PSU1- “she is really authentic, (...) I could meet her out in the street, and she would just talk to me like this...”</i></p> <p><i>PB1- “I haven’t realized it been so many natural disasters! (...) deforestation, so that’s what I discovered, and I also feel... sympathy for the people who were caught in the natural disasters...”</i></p> <p><i>PJ11- “I was unaware of all this unique nature, there is more than you realize, different birds, plants, different species”</i></p> <p><i>PSU4- “I think the combination of being out there and then catching up with background is very good...”</i></p>
<p>Improvements: 1) Include advice on what to do, or not do, in order to preserve local nature, biodiversity, and traditions; 2) Videos should be tied with locations around the island (e.g., That bird can be found in X location/city); 3) Add a clear message about the website goal; 4) Add a short textual description before the video summarizing the subject.</p> <p><i>PSU6- “It is simple to navigate and go around it... (says spontaneously before the question)”</i></p> <p><i>PGH1- “(...) interesting videos, but it doesn’t become clear... what you want to tell me..”.</i></p> <p><i>PSIT1- “just tell us want we can do ... people don’t like to think...”</i></p>
<p>Visitors and locals’ interaction: 1) the videos triggered curiosity about the locals; 2) Some participants felt prompted to interact with the interviewee while locals or others foresee difficulties in the communication and logistics.</p> <p><i>PS2- “ (...) I would ask the best places to go, about to finding about locals, what they are doing, maybe there are traditional festival going on if there is something very special happening...”</i></p> <p><i>PSU- “The Poncha lady, I think that is really authentic. I would ask for recipes, how to find the herbs out in the trails.”</i></p> <p><i>PA1- “(...)not really, only between a group of friends, but not me, myself”</i></p> <p><i>PSH2- “That is very difficult because they obviously speak a different language (...)”</i></p>

Implications of the findings for the Há-Vita design and follow-up study: While the platform was generally well-received, visitors are transient individuals and do not usually have time to divert from their holiday plans. As a result, most of them engaged in the study in a rushed and reluctant way, echoing [MoWC10] findings. Therefore, it was decided that, in order to have participants committed to discussing the platform for longer and to probe more in-depth opinions, a focus group was a more suitable approach to evaluate phase two of the hypermedia platform.

4.5.3 Phase 2: FoL Web Platform 2.0

Section 2.3 of this thesis, *Understanding the Tourism Experience*, highlights how the direct involvement of local communities in touristic activities could benefit both visitors and locals [MoWC10]. From the visitors' perspective, it would provide the opportunity for an authentic experience, and for the locals it would provide empowerment. Hence, this design phase of Há-Vita focuses on detailing the Hypermedia features designed to bring tourists and visitors closer together. Consequently, the Há-Vita hypermedia platform was extended so that locals could be contributors to the platform, beyond the content for the main themes videos. These contributions can take the form of activities and workshops advertised on the platform itself.

For the locals who contributed to the video content, their picture appears on the right side of each video. Below the picture, there is a highlight pointing out to the visitor viewers of the platform if the local offers an activity. By clicking on that section, visitors will be able to see which activity is proposed (see Figure 4:16). Visitors can also have an overview of all locals participating in the platform, while locals have access to a backend allowing them to manage their connection with the visitors (see Figure 4:17).

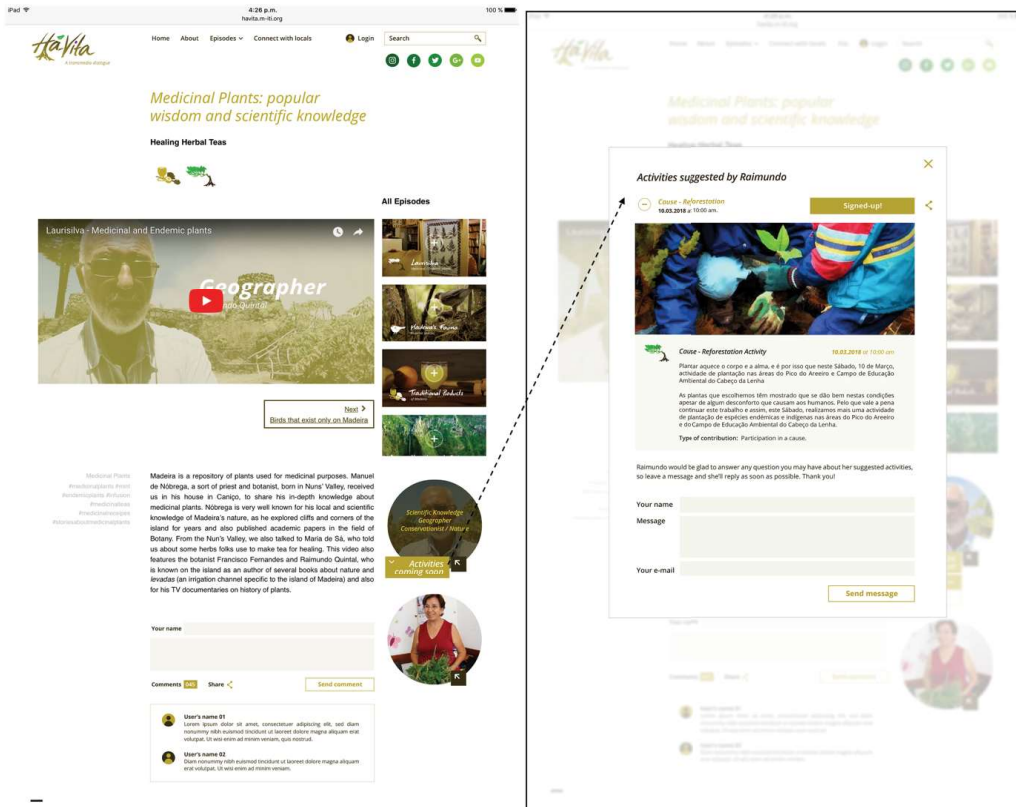


Figure 4:16 – Features enabling visitors to connect with locals. Left: Hovering on the locals’ photographs keywords showcases a summary of who the local is. Right: Activities showcase a description, date, type contribution, explanation, on how to sign up and a contact form in case doubts arise.

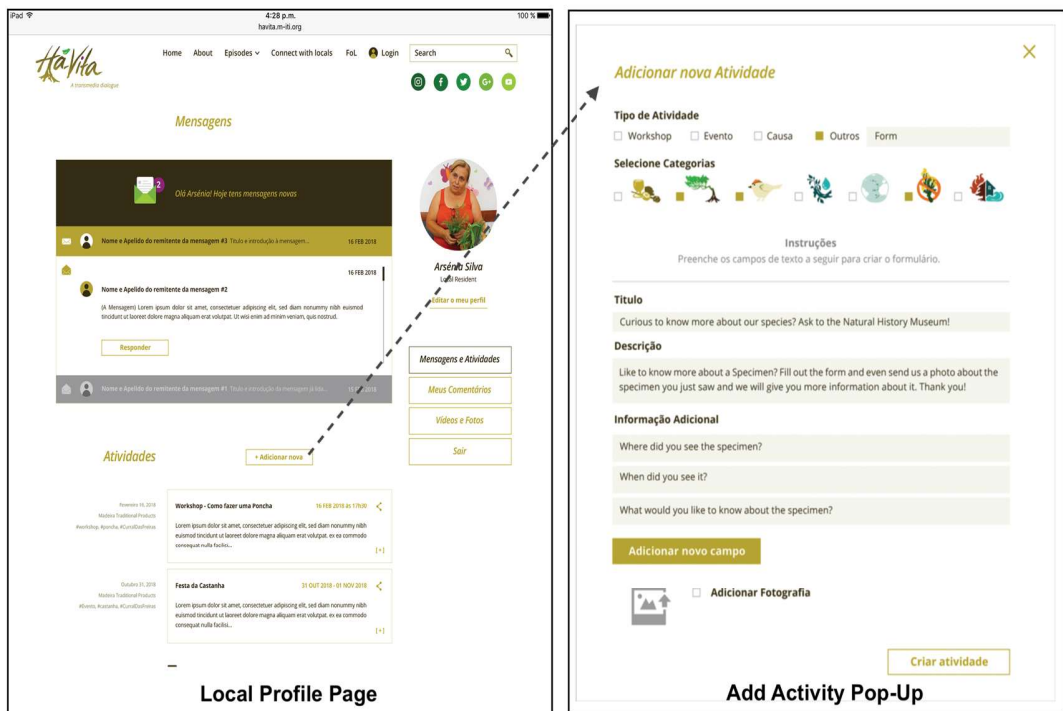
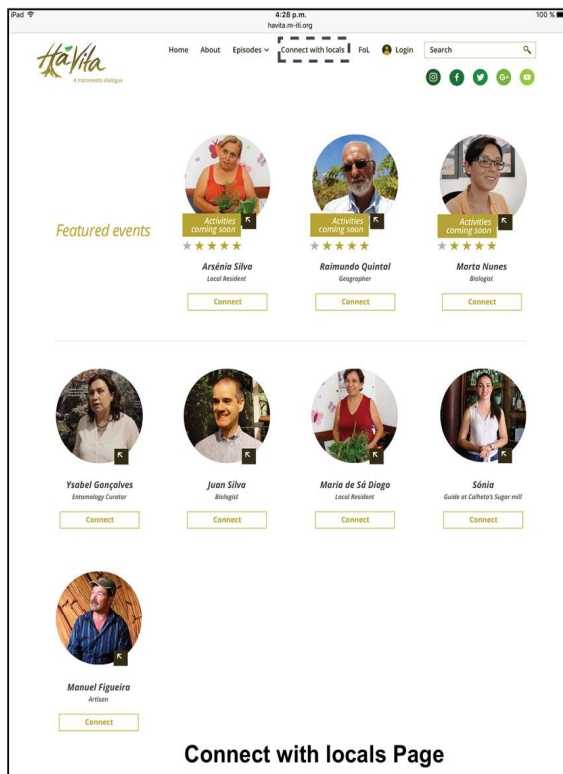


Figure 4:17 – Top: Complete list of all the locals participating in the platform with whom visitors can connect, and instructions on how to connect. Types of possible connections: Sending messages or enrolling in activities. Bottom Left: Locals profile page featuring the contacts from the visitors and activities they are currently organizing; Bottom Right: Form for Locals add a new activity.

4.5.4 Evaluation of Ha-vita 2.0: Focus Groups Study

A specific study was designed to understand how different stakeholders would respond to the concept of the FoL Hypermedia platform, involving local community members who held “popular/folk knowledge” (e.g., popular wisdom about medicinal plants), local “experts” (e.g., local scientists and tourists operators), and visitors to Madeira Island (Figure 4:18). The sessions were moderated by two facilitators and two assistants who helped in the setting up and documentation of the sessions (always the same across sessions). Sessions were recorded both in audio and on video; observations and non-verbal interactions were noted¹⁹.



Figure 4:18 – Images from the conducted evaluation sessions

¹⁹ Similarly, to the pilot study, the focus group also involved the 4 researchers (the same team: One digital media researcher with a journalism background, one designer, one tourism researcher and myself). I was the main responsible for designing and conducting the focus group study. The journalism researcher was also co-moderator of the focus groups. Both of us were responsible for recruiting the participants and the performing the thematic analysis to the data from the focus group sessions.

The designer was responsible for recording the session in video and audio while the tourism researcher was responsible for transcribing the data resulting from the videos.

4.5.4.1 Design of the Focus Group Session

The facilitator presented the general purpose of the focus group (FG), introduced the research team, and gathered consent forms. An icebreaker activity followed, and then the Há-Vita platform was showcased, projected onto a large screen followed by a discussion designed to elicit comments and feedback on the platform. Throughout the text, we have replaced the participants' names with identity codes (IC) referring to each FG and the ID of the participant (e.g., FVC: Focus Visitors Letterfakename).

Table 4-4 – Characterization of the participants and focus group sessions

Sessions / Participants General Characterization	Duration/N° Participants
Local Community: Age ranging from mid-thirties to late sixty, residents in Nun's Valley locality; Elderly handcrafters, farmers and stay-at-home women, or retired people, but all were active members of the community center; IC's: FLC; FLL; FLA; FLM; FLJ; FLMR	80min / 6
Experts Community: Participants with different expertise: 1 environmental researcher/geographer (FERQ), 1 Biologist (FECG); 4 participants with background in tourism (one travel agent (FERP), one guest relations manager (FESC), the head of the government touristic projects (FECN) and a tourism Professor from the local university (FELM);	120min / 6
Visitors: 6 females and one male with ages ranging from 24 to 44; All participants had a higher education degree; 2 participants were Portuguese (from mainland Portugal), 1 Romanian, 1 Italian, 1 German, 1 Turkish and 1 Spanish; IC's: FVMM, FVMF, FVIA	60min / 7

4.5.4.2 Results

The main results from the focus group (FG) are presented in this section and were published (see the first reference in Footnote 17). All FG were recorded and audio files transcribed. Two researchers, using a thematic analysis approach supported by Nvivo software, analysed the resulting data.

Firstly, open coding was used to create high-level categories individually, then these were reviewed and their separate efforts merged into new common categories. Secondly, the information was grouped into affinity diagrams used to explain the relationships between categories. Thirdly, the most frequent concepts and insights were organized for each focus group, followed by the description of each one with illustrative quotes given by users

in the interviews. First, the results from each focus group are presented separately, and then the overall findings and discussion are presented in Section 4.5.5.

Table 4-5 – Summary of the Local Community Focus Group

Positive reactions of the community to the multimedia content of Há-Vita platform: 1) Participants enjoyed watching its content and felt proud of viewing the local community members featured in the video interviews (FLC2); 2) Most enjoyed videos: The Laurisilva Video (featuring a priest-scientist), the Traditional Products explained by locals themselves, and the Exotic Species video; 3) The community members expressed a desire to collaborate in producing further content and suggested several topics they would like to contribute (FLC1, FLC1) .

FLC1: “This is a great initiative... will you continue making more videos?”

FLC2: “We have great things (...)why not showcase them to others...”

FLC1: “More wickerwork, it’s a local handcraft and a thing they might like. Here are also women who know how to embroider, by showing the embroidery of Madeira.

Há-Vita a catalyst for interaction between the local community and visitors: 1) Participants were very open to, and happy with, the idea of having a deeper and more authentic connection with the tourists (FLC4); 2) Participants recognized in the Há-Vita platform an opportunity to share the local culture, eventually leading to attracting people to the small village and retaining them (FLC3). Apart from festivals/parties, tourists visit the location just for sightseeing purposes, spending little time in the village itself (5-10 min); 3) Participants were excited about the idea of organizing workshops for tourists and immediately started brainstorming types of workshops (FLA4, FLL1). The workshops would be very valuable, not only for economic reasons but also to keep traditions alive (see FLM2). They mentioned that some of the customs/traditions are being lost since younger generations are not interested in them. However, if there is (business) potential in the workshops, they might change their minds (FLM1). 4) The local community also expressed interest in learning something from the visitors (referring to a cultural exchange).

FLC4: “We want to welcome them all, as long as they’re good people.”

FLC3: “(...) promoting the products would be a great help. It’s very important. It’s good for the local business, to expose the parish itself. FLM [complementing]: Because we don’t want tourists who arrive here to stay only for 5min, have a coffee and leave.

FLM2: “it’s not just about selling [the baskets] there must be teaching and learning.”

FLM1: “the workshops could be also a way to attract youngsters to learn these crafts... at first could be just for fun but then they might enjoy it.”

FLA4: “This godmother of mine would love to make some chestnut soup, to dry and tread the chestnuts.; FLL1 (complementing): More wicker work, it’s a local handcraft and a thing they might like. There are also women who know the embroidery of Madeira.”

Concerns: 1) Participants were worried that such a platform could not be developed in time within their lifespan that would be something more for their children or grandchildren to take advantage of; 2) Participants expressed that they would not be able to interact with the digital platform to add information, videos, or propose workshops, and they would need help from their children or grandchildren (FLA6).

FLA6: “It’s too much work for us, it would have to be my daughter or Mr Manuel’s daughter it’s difficult for us.”

Table 4-6 – Summary of the Local Experts Focus Group

<p>Há-Vita general impressions: 1) Local experts enjoyed Há-Vita and considered it a good start to be further expanded. They found the content interesting and dynamic, except for the “Natural Disasters” which was labelled as too sensitive to be disclosed to the visitors in this open way; 2) Participants valued the initiatives that promoted the connection between tourists and locals through organized workshops as it would help support locals’ small business initiatives as well as farming and agriculture (FERQ1, FERP2, FERP3). Participants mentioned that these types of “connecting” activities would make visitors care about the location and revisit Madeira (FECG1).; 3) Participants found the idea of a network of “Contacts, Activities, and people” novel and worth pursuing (FERP1).</p> <p><i>FERQ</i>: “(...) it should be either a monetary offer or a fixed price. If we have something to offer, there are costs involved. <i>FECG1</i>: Otherwise people don’t show up.” (complementing)</p> <p><i>FER</i>1: “There is a platform... Be local, where people can sell a product. In September, if I have the grape harvest, and people can sign up for my activity. Tourists do look for these things...”</p> <p><i>FECG1</i>: “These types of connections are what makes visitors feel well, come back and pass on the good word about Madeira.</p> <p><i>FERP</i>”: “Some tourists go to some typical houses that are not on a known route. They already know there is this man who offers a liquor (...) and most of the times the tourist leaves a monetary gratification and that man already won his day. (.”.)”</p> <p><i>FERQ</i>”: “We have a collaboration with some hotels (...) Their guests sign up and participate in the tree planting/reforestation activities. Some become members (of the association”).”</p>
<p>Concerns and future suggestions: 1) Some of the local knowledge holders may present a lack of familiarity with technology and foreign languages and this should be taken into account in future iterations; 2) Several political issues were mentioned, such as more government intervention and support to preserve the local natural heritage (FERP7, FERP6). Há-Vita could work as a place where locals could publicly emphasize threats to the environment in order to draw the attention of the government; 3) Experts worried about the popularity of Madeira as a tourist destination and how that is affecting the resources of the island (in particular the natural trails and Laurisilva forest) (FERP6); 4) Participants suggested that Há-Vita could have a role as an educational tool regarding local values (FERP8, FECN2); 5) Participants suggested to highlight the features that support direct communication and interaction between locals and visitors. Furthermore, a calendar showcasing activities would facilitate planning and participation before reaching the destination.</p> <p><i>FERP7</i>: “Everyone wants to “gain” from the tourism but they don’t want to protect the “product of madeira” – it’s Nature, locals don’t participate in the volunteering activities.”</p> <p><i>FERP8</i>: “Tourism need to be educated – eg. Not to pick plants, feed birds and not to go on trails who are closed – “they need to learn the household rules.”</p> <p><i>FECN2</i>: “Even though I work for the government... it needs to be educated as well.”</p> <p><i>FERP6</i>: “Similar to other cities, limits must be imposed ... if we don’t preserve and limit ... everything will be destroyed (referring to Laurisilva forest, and limits in the trails).”</p>

Table 4-7 – Summary of the Visitors Focus Group

Appreciation for the authenticity and dynamic content: 1) Participants appreciated how the information was presented in an informative and timely way and how the short and dynamic videos help to keep the focus on the content (FVIA2, FVMF2). In particular, they enjoyed the authenticity of the local people featuring on videos, and the mix between popular and scientific knowledge; in particular, the experts’ reasoning as opposed to an emotional perspective (FVIA1); 2) Participants mentioned that the platform can become a powerful database of knowledge and they mentioned, Padre Nóbrega (a community cherished priest and botanist) who passed away soon after releasing the interview with the Há-Vita production team; 3) Participants also shared that they learned new things about Madeira from the video content. Several users highlighted the richness of information and authenticity value of the video about the exotic plants (luffas), the medicinal plants, and the video explaining the origins of “*Poncha*”.

FVIA: “I also like that idea that you put “normal” people in the videos, that is really cool. It is nice to have experts but also just the locals... it gives a sense of authenticity.”

FVMF2: “The graphic elements helped to retain the information of what the people were saying.

FVIA2: “it’s like dynamic, this moderation between the videos.”

FVMF3: “(...) that database, that recorded knowledge. Because, that priest already died, right? His way of presenting information is really interesting. You see, he really feels passionate about it.”

Suggestions to strengthen the Há-Vita platform and stimulate the connection between visitors and locals:

1) The activities proposed by the locals should be laid out clearly so that people know exactly what to do and what to expect (FVGA1). When volunteering activities, clearly state why they are important and what benefits they can have for the local community. Explain what is unique about the workshops/activities promoted through Há-Vita (FVIA5, FVMF3). Echoing the “Experts” group, participants suggested a more efficient way to present the activities, for example in a calendar or a map, so that visitors could plan the activities according to their stay (FVMF4, FVSG1); 2) Expand and add more content and topics; there could be a crowdsourcing component where people could submit their videos about specific topics; 3) Use infographics to summarize the information from specific videos. Finally, they expressed the desire to have more videos inside each of the main categories and express the interest in having fun facts or curiosities that could be added as text or images in the webpage of each main topic; 4) In terms of the design and videos of the website, participants pointed out small improvements, such as the quality of sound in specific videos, keeping the consistency between videos in the flow and pace of the content (e.g. some videos were more balanced than others in terms of pace and some videos had more infographics than others).

FVIA5: “For community spirit, sometimes don’t need the same language, I feel like if you really want to do something you do”; FVMF3 (complementing):” put there, like lady don’t speak English but it’s a fun activity, or you’re gonna meet the locals, it’s a very interesting experience.”

FVGA1: “You could write as a traveler what is the benefit/contribution? Is it the time? the place? It takes one hour or tell me that you will bring me to this place where I have never been before.”

FVSG1:” (...) little more information about the people who speak and maybe a little bit of summary of the content... in the beginning or after.” FVMF4 (complementing):”: “(...) if we could see the map of Madeira activities, and everything that they are talking about. We can know where about.”

4.5.5 Discussion of the Há-Vita Evaluation

The following section presents a detailed discussion of the results from the Há-Vita study. The discussion is divided into two sub-sections:

1. **Enabling Local Empowerment:** a discussion of the potential for Há-Vita to provide social-cultural well-being at the local destination
2. **Authenticity and Visitor Experience:** a discussion about to what extent tourists found the content and experience that the platform offers authentic

Enabling Local Empowerment: In the FGs, locals, especially the residents from the Nun's Valley location, expressed a striking enthusiasm and willingness to organize activities for visitors such as workshops, tours, and visits to specific local areas. Although participants did not stress economic benefits per se, they were open to engaging with visitors through Há-Vita and receiving a financial reward for the activities they could eventually organize. However, they were also open to other forms of rewards; visitors could, for instance, engage with locals from less urbanized areas in a fair exchange, such as helping out in the winemaking and then receiving a traditional lunch. A platform like Há-Vita could add value to the community and location by proclaiming new and authentic activities for tourists to engage in (FERP2). It could also lead to “indirect” economic benefit that would come from the spread of the destination's positive image (FECG1).

During the FG in the Nun's Valley, locals showed pride while watching their community represented on Há-Vita, through their comments and facial expressions (FLC2). They voiced that the platform was a powerful means to showcase local traditions to visitors. For this reason, several participants said aloud that they wanted to further contribute to the novel content. They also proposed activities in which they could share their culture and crafts (FLC1). This suggestion to keep adding content was later on reinforced in the FG with visitors, in which they recognized how the multimedia part of the platform could become a “powerful database of knowledge” (FVMF3). Based on these results, Há-Vita could function as a self-esteem empowering tool for the community members, because it highlights values of the local culture, natural resources, and traditional knowledge.

In the FGs, Há-Vita emerged as a potential tool for social empowerment by improving individuals' and families' cohesion, while working together towards the ecotourism goals and activities. Locals in the Nun's Valley mentioned how such a platform could be used

to trigger youth interest and instil pride in learning old customs and traditions (FLM1). Elderly participants manifested a need for assistance from their children or grandchildren to use Há-Vita and communicating in foreign languages (FLA6). On the one hand, this lack of digital literacy and foreign languages can be seen as an issue, but it can also provide the local community with bonding opportunities across generations as they work together, leading to an improvement of digital literacy for those elderly locals.

The FG with locals (providing scientific knowledge), revealed a certain level of disempowerment of the locals. From the words of the locals, companies are the only entities that profit from the tourism but do not take action to protect the main “product of Madeira,” which is nature and culture (FERP7). In the FG with scientific knowledge holders, participants spent significant time discussing how Há-Vita might support community political empowerment. FG participants discussed how the platform could provide the local community with a forum in which people could speak out about pressing issues, allowing them to address the regional government, and to raise questions and suggestions. These participants were very concerned with tourism policies and pointed out the need to raise the regional government’s awareness of nature and traditions (FECN2). These findings led us to further envision Há-Vita as a potential channel of social and political change. This would address the concerns of Di Salvo et al. [DiSB10] and Manyara et al. [MaJo07] and could generate collective action by influencing policy and regulations regarding tourism and environmental preservation and awareness.

Authenticity and Visitor Experience: In general, results suggest that visitors perceived the video content to be authentic and engaging. Participants appreciated Há-Vita as a medium that offers insights via video content into the cultural background of the local community and nature. In this way, findings reinforce the design rationale of providing starting grounds for interactions with locals. Such interaction could even begin before arriving at the destination, as suggested not only by several participants but also by Moyle et al. [MoWC10]. Likewise, Há-Vita could allow alternative touristic experiences benefiting those visitors wanting to enter “back regions” of the locale [Sebe10] but also promoting alternative routes and situations, eventually taking pressure off some of the most visited places. Indeed, our findings showed that most of the visitors that we engaged with were surprised to learn about the island’s difficulties (PB1). Tourism Board’s webpages

often promote destinations as immaculate places while what visitors learned from Há-Vita contrasted with the “paradise” image of the destination they held before the interaction with the Há-Vita platform. At the same time, however, the experience of browsing Há-Vita brought the visitors closer to the authentic reality of the Island (PSU1, PSU7, FVIA). Findings suggest that Há-Vita shone a light on the Island’s values (biodiversity, folk knowledge and traditions), not only for visitors but also for the rest of the stakeholders (PJI1).

Locals and visitors both manifested an interest in extending and regularly updating the Há-Vita content, which resonates with what Novacek [Nova08] suggested; that by utilizing multimedia content we were able to engage the public not only in the biodiversity of the island but also with its traditions and folk knowledge (FVMF2, FVIA2). Moreover, visitors found the content interesting because it added to their touristic experience and local field trips. While local experts praised the website for its ecological and local values message, it is encouraged to be more assertive and more precise when posting these messages (such as “house rules”) making clear calendars, communication channels, and information more easily available (FVGA1, PSIT1).

Establishing connections between visitors and locals does not come without challenges, something that has been previously approached in the CBT literature [MaJo07]. Locals may have unique expertise but may not know how to share it with visitors. As seen previously, this could be related to digital literacy issues and/or due to language barriers. The latter was also a concern shared by visitors. However, they were open and willing to make efforts to overcome this (FVIA5).

Lastly, it is important to mention that some informal feedback from colleagues and users highlighted that some confusion was generated by the experience having two distinct names - one for each of its components.

4.5.6 Implications for the Final Iteration of the Hypermedia Platform

These evaluations were an important step in improving and refining the Há-Vita platform, before performing an integrated evaluation together with the FoL LAMS in a unified TEE experience. These studies not only allowed us to understand the necessary adjustments to be made in the design of the platform, but also to understand the challenges of performing user evaluation with visitors. Moreover, it was enlightening to understand the logical challenges of maintaining the connection between tourists and locals through on-site activities.

Based on the collected feedback, the hypermedia platform was refined promoting balance in the delivery of folk and scientific knowledge, as well as scientific and emotional content; complementary media such as infographics, animations, and visual summaries are used to help viewers retain information. Following the feedback given, the hypermedia content contains more assertive and clear messages, explaining to visitors certain “rules” and some of the boundaries that should be respected while visiting the Island, and giving some advice on how to behave and how to preserve the natural sites.

Furthermore, for the last iteration of the prototype, bearing in mind the logical challenges of organizing activities that bring together tourists and locals, the content of the web platform is adapted to facilitate this task. The site will allow locals to advertise activities and suggestions that visitors can then carry out at their own initiative.

Last, but not least, regarding the confusion generated by the experience having two distinct names for each of its components, the name of Há-Vita for the hypermedia platform was dropped to strengthen the experience cohesion of FoL, and both channels were named “Fragments of Laura” (FoL), differentiating them by the media channel on which they are encountered by the public: FoL LAMS experience and the FoL Hypermedia experience.

4.6 Mapping the FoL Experience Components to the TEE Framework

This section describes how the FoL TEE experience matches the novel framework, in particular how the different components and features can be mapped into the different elements of the TEE Framework (See Figure 4:19).

At the centre of the framework is the FoL experience, composed of two distinct media channel components; the FoL LAMS experience and the FoL Hypermedia experience. The combination of both components incorporates elements from the four central elements of the framework (**Storytelling, Real-World, Ubiquitous Media and Participatory Experience**).

In the FoL LAMS, the **Storytelling** component is present in a fictional story with a strong historical fidelity. It is centred around one of Madeira's most precious resources: its natural heritage, the Laurisilva forest and how it shaped and has been shaping the local context. The story progression of the FoL LAMS experience enables the exploration of **Real-World** settings; this is directly motivated by the desire tourists have of living an adventure while getting to know new locations. The interactive A 360° MR touchpoint, The Pharmacy, is designed to incorporate storytelling elements in a reconstruction of what used to be a real-world location, in this way blending fiction and reality. Furthermore, The Pharmacy brings in participatory elements as it instils the visitors' actions within the story world.

The FoL experience offers an interconnected **Ubiquitous Media** experience; it connects a mobile experience with a blend of fictional, historical, and real-world elements (the FoL LAMS) to an online platform populated with interviews with local scientists and residents addressing contemporary issues within the destination (FoL Hypermedia).

The FoL Hypermedia content was envisaged to match the **Tourist's Motivations** of connecting with the local community. Furthermore, the FoL Hypermedia is designed to call for the **Participation** of locals in providing activities and moments of exchange and encounters with tourists. Conversely, tourists can participate in local community activities and establish new points of dialogue between themselves and the locals.

The touchpoints between the FoL TEE experience and the audience have been designed with attention with the specific goal to **Raise Awareness** about the Island's heritage, giving the audience knowledge regarding the destination's local heritage and values. The

FoL Hypermedia goal of establishing a dialogue between locals and visitors aims to keep **Social-Cultural Well-Being** at the local destination by allowing locals to share their culture and engendering pride in their old customs and traditions. Eventually, this makes visitors more aware of the local way of living and to be more connected to them during their stay.

Some of the FoL components and features are deeply interlinked among several of the TEE framework elements, making it hard to illustrate a straightforward mapping. See Figure 4:19 for an illustration of these interlinks.

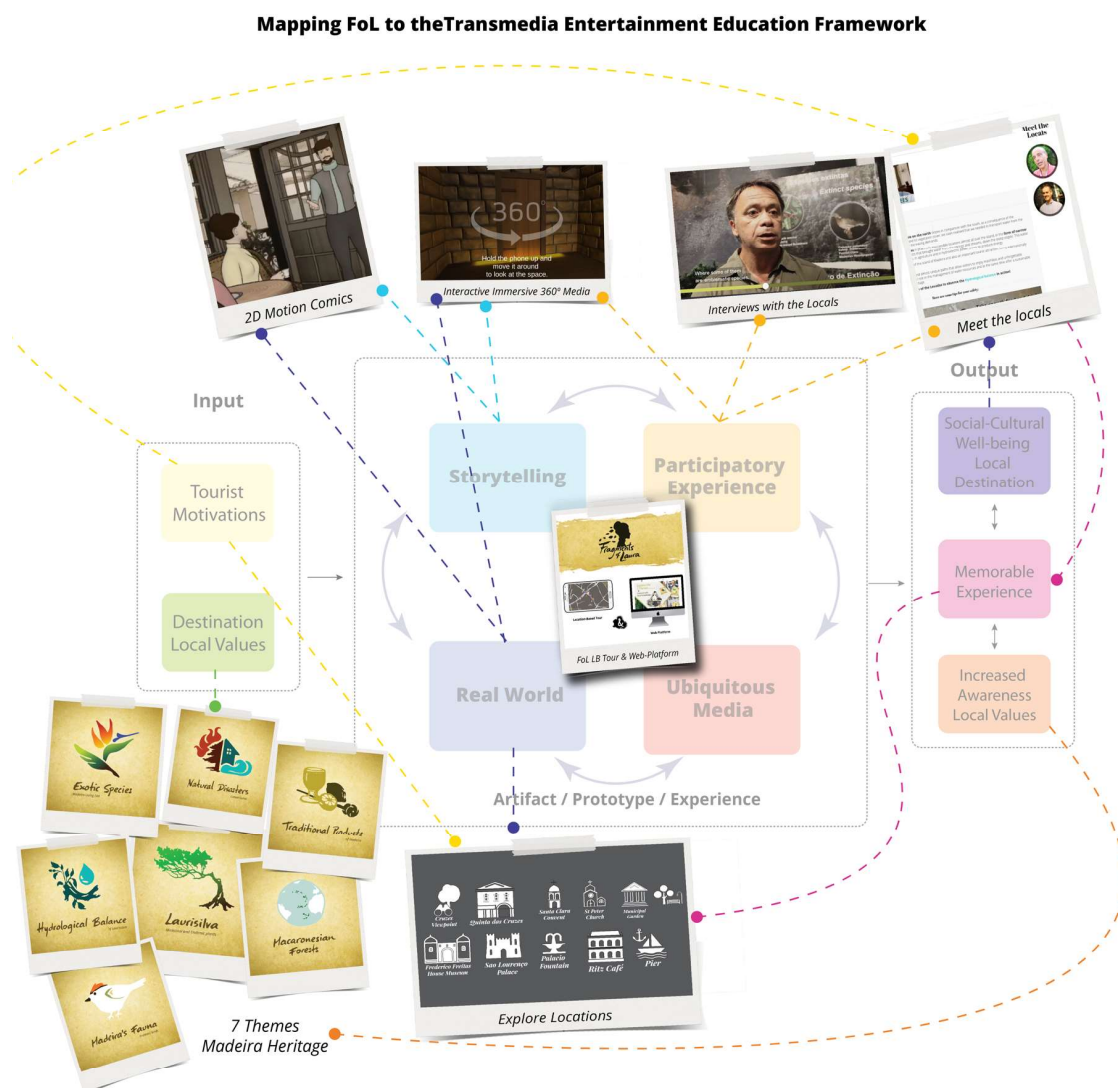


Figure 4:19 – TEE Experience Components mapped against the different components of the Fragments of Laura case study.

4.7 Chapter Conclusion

This chapter details the various prototypes stages, artefacts, interfaces, media produced and refinements of the TEE experience aimed at tourists. The novel TEE framework requires a complex ecosystem of media artefacts in which many different components need to work together, but also individually. By prototyping and testing different components, and stages of the prototypes, it was possible to refine and improve the different working components of the experience. The initial FoL experience prototype allowed for testing a very early stage of the experience and to gather feedback on how well the FoL story and overall concept could be received. It provided essential feedback for new design features, such as the integration of the hypermedia component and the usage of new media by incorporating mixed reality features. However, the novelty of such new media and features brought new challenges in terms of experience, interface, and media design, which led to a set of further studies.

This set of very focused studies regarding the interactive 3D reconstruction of Laura's pharmacy, the FoL LAMS and the Há-Vita Hypermedia platform allowed for making informed decisions regarding the coordination of the interaction and user experience design of the different components of the FoL TEE experience. All of this process led to the redesign and development of a second, fully functional, prototype of the FoL TEE experience. The next chapter, reports on the refined final version of FoL TEE experience.



5 The Final Iteration of Fragments of Laura: A Transmedia Entertainment Education Experience

This chapter contains the description of the redesign of the final prototype of Fragments of Laura (FoL). It begins by explaining the redesigned experience, how the different components connect, and how it embodies the elements of the novel TEE framework and the refinements from the previous stages. Following this, it explores in detail the user experience interaction for each of the two FoL TEE components. Finally, it presents an overview of how the 13 design insights informed the design of FoL as a TEE experience.

Fragments of Laura TEE Experience Main Touchpoints Overview



Figure 5:1 – Main touchpoints (TP) of the FoL TEE experience (A to F). Each TP is described and referred to throughout the chapter by its corresponding letter; for example, TP-B (referring to Facebook page).

5.1 Experience Scenario and Touchpoints of the Last Iteration of the FoL TEE Experience

Ideally, visitors to Madeira Island can mainly encounter the FoL TEE experience in two different stages. The first, when they are searching online for activities to do on the Island (this can be before their arrival or when they are already on the island), or, secondly, when the visitors are already on-site, exploring a destination. In the first case, visitors can encounter FoL Hypermedia channel or the FoL Facebook Page. In Figure 5:1, these are represented by touchpoint (TP) A and B, respectively. Furthermore, flyers and posters advertising the TEE experience can be found distributed in hotels, coffee shops, or tourist point offices, represented by TP-C in Figure 5:1 (high-resolution images of these the posters and flyers can be seen Appendix F. Flyers and posters have QR-Code directing users to the FoL website and also contain a contact e-mail address.

The FoL Facebook Page was a new addition to the last iteration of the TEE experience. The page contains general information about the experience, such as some promotional videos and pictures. The audience is also redirected to the website for further information. Figure 5:1 – TP-B and Figure 5:2 show screenshots of the FoL TEE Facebook page.

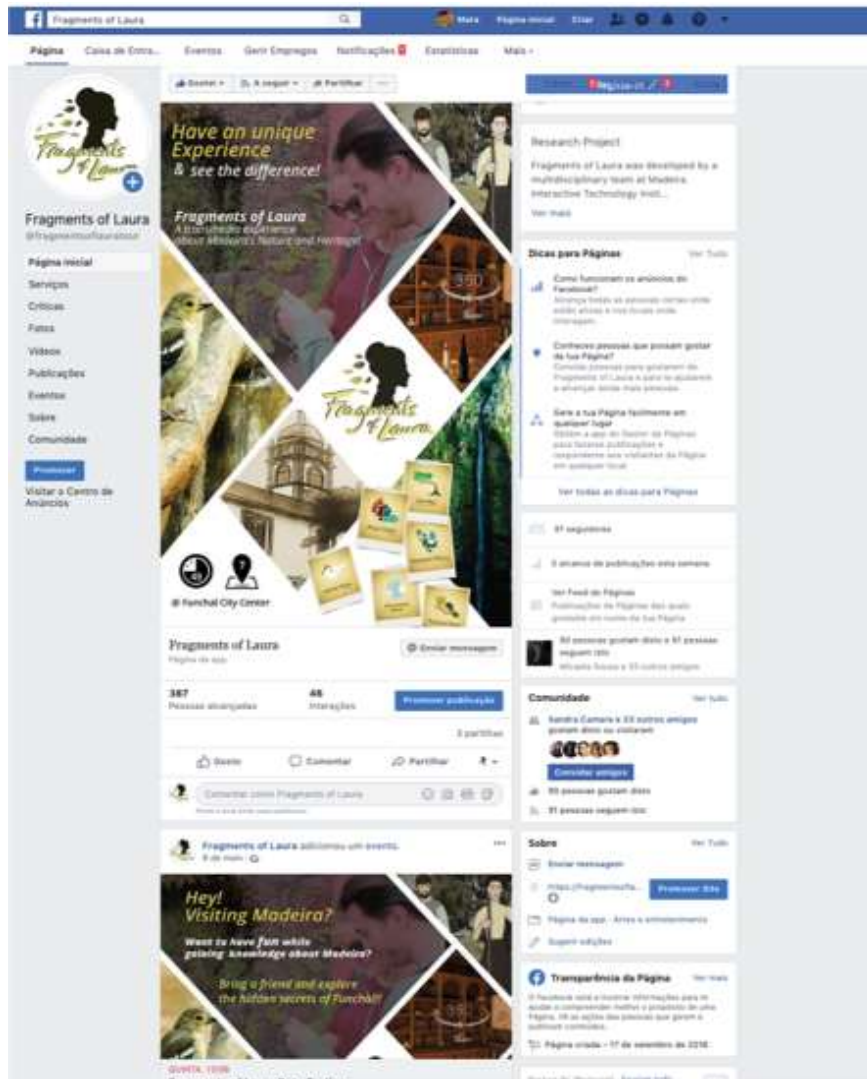


Figure 5:2 – Screenshot of FoL TEE Facebook page, showcasing promotional images of the experience (TP-B).

On reaching the FoL Hypermedia main page²⁰ (Figure 5:1– TP-A), visitors can view a promotional video that gives an overview of the FoL TEE experience. Afterwards, visitors can either look up the *Location-Based Tour* (Figure 5:1, TP-D) or click on the *Explore the 7 Themes* tab (Figure 5:1, TP-H). The details for these interactions will be explained further, in sections 5.2 and 5.3 respectively.

Ideally (but not as yet implemented), participants who decide to enrol in the FoL LAMS, will be able to download the mobile application and can do the experience at their own convenience. For the time being, and for the research purposes of this thesis, potential

²⁰ FoL Web Platform: <https://fol.m-iti.org/>

users can schedule a place and time to meet a FoL team member who will meet with them in order to lend them a mobile phone and kick-off the tour (Figure 5:1, TP-E). After completing the FoL LAMS, they will receive a follow-up e-mail inviting them to reconnect with the FoL Hypermedia, giving them a password code to access exclusive content regarding the story (Figure 5:1, TP-G) and encouraging further connection with the local community by exploring the *7 Themes* page (Figure 5:1, TP-H and TP-I). For visitors who want to discover Laura's fictional story without engaging in the physical LAMS experience (e.g. those who may have mobility problems or might be staying in a different part of the Island) a different option to engage with the fictional narrative is proposed. In this case, access to the FoL linear Movie version can be provided (Figure 5:1, TP-G).

5.2 FoL Location-Aware Multimedia Story Experience

The next sub-sections explain in detail the interaction and user experience with the final prototype of the FoL LAMS component, highlighting those aspects that were redesigned and improved for this last version of FoL LAMS, after incorporating feedback obtained from the previous evaluation (see Section 4.4.4).

5.2.1 FoL Fictional Narrative²¹

After the shift from the peripheral village of Ponta do Sol to the main city of Funchal, the FoL fictional story was adapted to the new location, as described in Section 4.4.1. Some further refinements aimed at incorporating authentic historical details, architectural landmarks, and scientific facts that would connect with the seven main themes of the hypermedia platform. Figure 5:3 illustrates how the fictional story points connect with the web platform themes, incorporating a summary of FoL fictional story plot points and the knowledge acquired from the interviews with the locals. Inspired by Greek tragedy, and the function and model of the Greek Chorus, some of the initial storyline details were

²¹ To view the final version of the FoL Narrative in movie format visit: <https://fol.m-iti.org/index.php/story/> and in the text box at the end insert the following password: fol

moved from the Motion Comic episodes and incorporated as Audio Clips, which will be explained further on.

The Greek Chorus is a group of performers who comment and provide background information on actions and events taking place in the story. This dramatic-literary device helps the audience follow the performance and the writer to control the atmosphere and expectations of the audience [Kitt68]. By making this adjustment, the visuals of the Motion Comic episodes could be made shorter, accommodating the participants' attention span without compromising the storyline. At the same time, the Greek Chorus technique creates a deeper connection between the characters and the audience.

Story Media	Story Point Synopsis	Theme
	<p>The two nuns find Laura, a young orphan whose parents have died in the “Aluvião”. Laura is about to die, severely ill - nuns take her to heal her, using the power of plants.</p>	<p>Natural Disasters Catastrophes</p>
	<p>Laura observes the Nuns using plants infusions and Laurel oil from the Laurisilva to heal. Laura tries to replicate the process in a wounded puppy. As a consequence she might be punished.</p>	<p>Laurisilva Medicinal / endemic plants</p>
	<p>As Laura grows up in the convent, raises a lively interest in the power of medicinal plants, taught by the nuns. After successfully being able cure a Bis-Bis, she starts to encrypt all recipes and keep everything in a secret diary. Laura confides to Maria Clementina, her closest friend, the will of leaving the convent.</p>	<p>Madeira's Fauna</p>
	<p>After being abroad, Laura comes back to visit Lady Malory to tell her about the establishment of her pharmacy. During their conversation, Laura shows how reluctant she feels about the impact of bringing exotic species for the construction of a Botanical Garden in Madeira.</p>	<p>Exotic Species Madeira Living Lab</p>
	<p>By exploring Laura's pharmacy, not only it is possible to learn how to make Poncha, a drink with medicinal purposes but also about several local ingredients, plants and tools about Madeira's folk culture.</p>	<p>Traditional Products</p>
	<p>Laura and Adam, a british naturalist, trek to Fanal to collect samples for Laurisilva Trees. While in the forest they got surprised by encountering some carvoeiros who are taking down some trees. Laura quickly takes action.</p>	<p>Hydrological Balance of Laurisilva</p>
	<p>At the pier Laura and Adam say goodbye, he is embarking to an expedition. Laura is attacked. Her book gets lost. Adam saves her and both leave Madeira. Later it's discovered that this was just the start point of her journey to become a world-renowned naturalist.</p>	<p>Macaronesian Forests</p>

Figure 5:3 – Summary of the seven episodes in which the FoL fictional narrative is divided. The middle section presents a short synopsis of the episode, on the left a screenshot, and on the right the overall theme that the story episode touches upon.

5.2.2 The FoL LAMS Final Experience Design²²

The final design of FoL LAMS is composed of seven touchpoints, with six being 2D Motion Comics and one a 360° MR scene reconstructing Laura's pharmacy from the 19th century. Moreover, two new media artefacts were incorporated; Multimedia Pop-up Windows, and Audio Gossips. Twelve Multimedia Pop-up Windows, appearing at the beginning and the end of each story touchpoint, were designed to integrate the story with real facts and information about the local architecture, and propose short snippets of the FoL Hypermedia interviews with the local community. Finally, six Audio Gossips, inspired by the Greek Chorus narrative device, are distributed along the main story path, informing the audience about the community opinion of Laura and her actions.

The rest of this section describes in detail each FoL LAMS touchpoint and its redesigned features. Figure 5:4 illustrates the touchpoints that comprise the final experience design.

²² For this iteration of FoL LAMS my contribution to the prototype was in refining the user experience by incorporating the DI and user feedback and also by redesigning the graphical interface. New 2D assets (icon design, tutorial screens, buttons, pop-up screens etc...) were produced by me re-incorporating the illustrations of the seven themes developed by the graphical artist who worked in Há-Vita web platform.

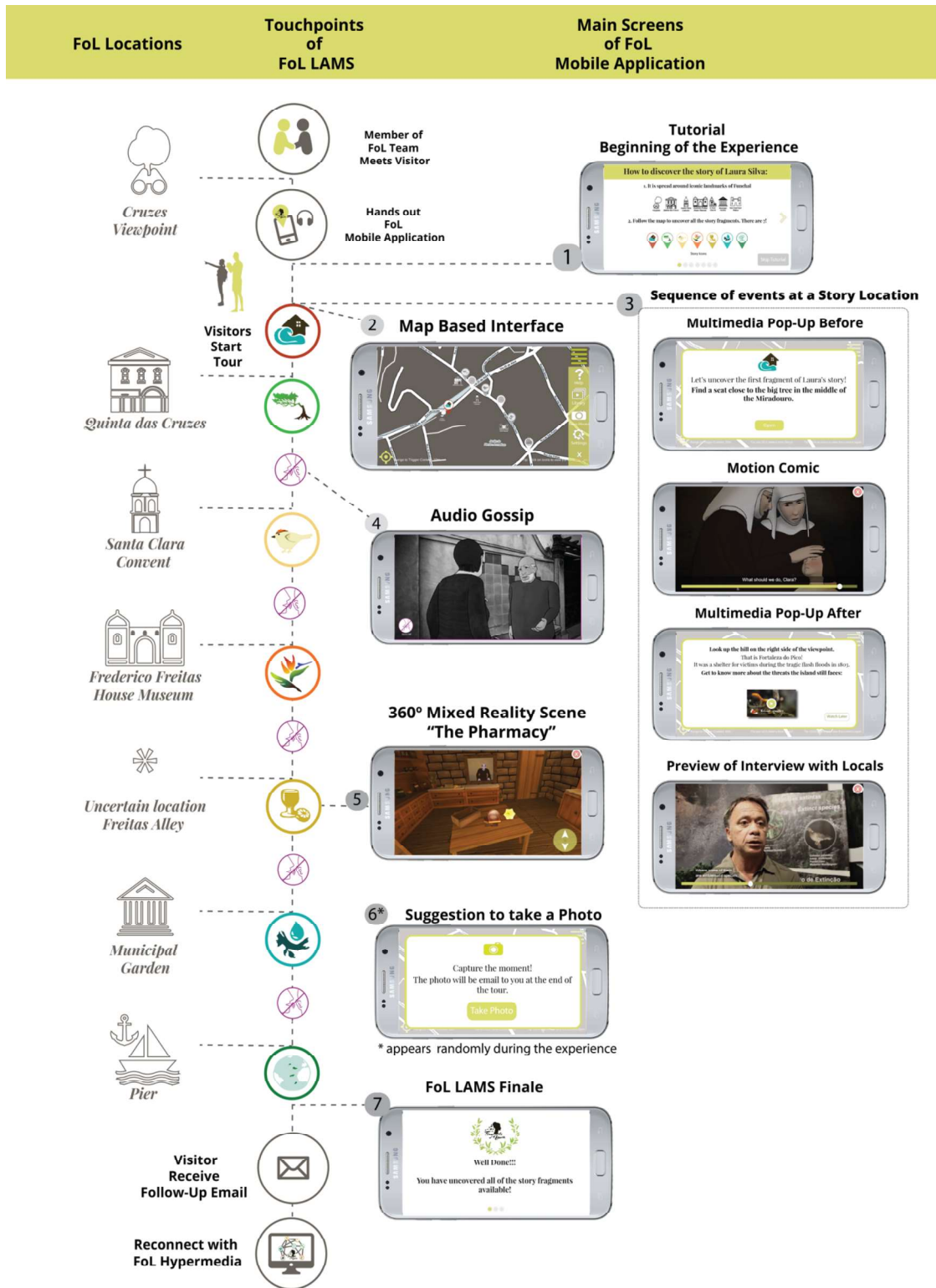


Figure 5:4 – Overview of the main FoL LAMS touchpoints with the corresponding historical landmarks in the city (icons on the left side) and screenshots of the FoL LAMS mobile application showcasing key moments of the interaction.

FoL LAMS Tutorial: previous feedback highlighted how much participants felt they needed time to become familiar with the concept and flow of the FoL LAMS experience. Providing visitors with this “on-boarding” opportunity is crucial. If participants do not understand the experience they will not engage with it. As a result, a tutorial was designed to explain how the FoL LAMS mobile application works and the overall flow of the story; furthermore, it calls to the attention of the visitors some details and precautions - for example, how users should look for shade on sunny days, how they should be aware of cars, and traffic in general, and how headphones are recommended to listen to the media. See Figure 5:5 for details on the tutorial screens.

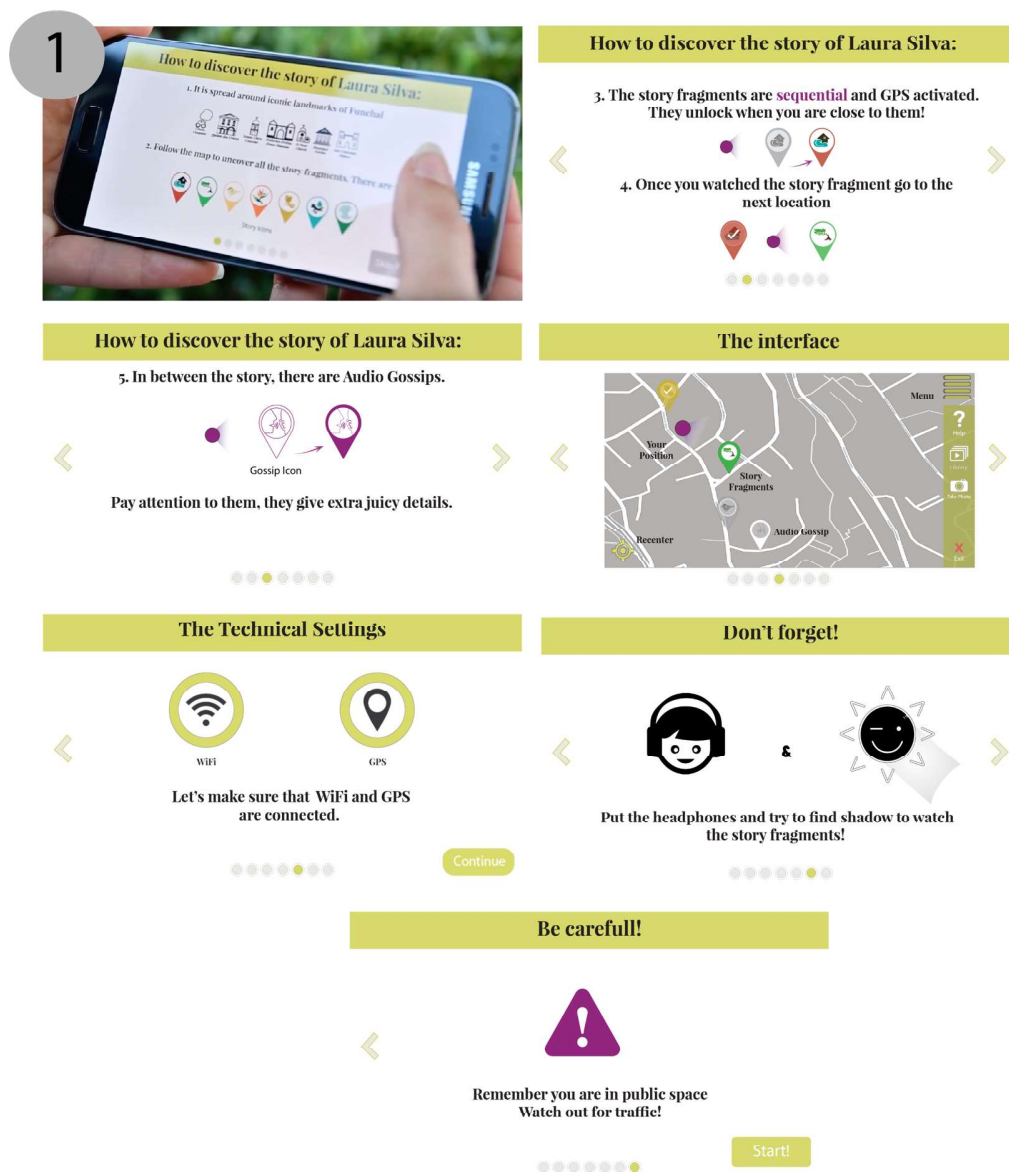


Figure 5:5 – Screenshots of the tutorial featured at the beginning of the FoL LAMS mobile application in which details are given on the best way to experience the FoL LAMS.

FoL LAMS Map Interface Design: The mobile application graphical interface was completely redesigned for this final version of the prototype. As mentioned before, visitors find the desired story locations by walking. They are supported by a GPS driven map with icons representing the meaningful locations where they can unlock story content. Each location is associated with a story episode and its icon is representative of this association. A purple dot represents participants' GPS position and orientation. In Figure 5:4, left side, can be seen the representation of these locations, and Figure 5:6, shows the map interface and the seven story icons.

The interface provides participants with information regarding how far they are from the goal. Since episodes are sequential, it was essential to give the participants feedback regarding what they have already seen, and what to see next. Therefore, the icons representing the stories have three different states: *Blocked*, *Unblocked*, and *Done* (see Figure 5:6). At the start, all story points except for the first one, are blocked. While the participant is walking to reach the desired position, the icon pulsates and once they are close to the desired location, the mobile phone will vibrate, indicating that they are in the correct story location and a Multimedia then Pop-up appears.

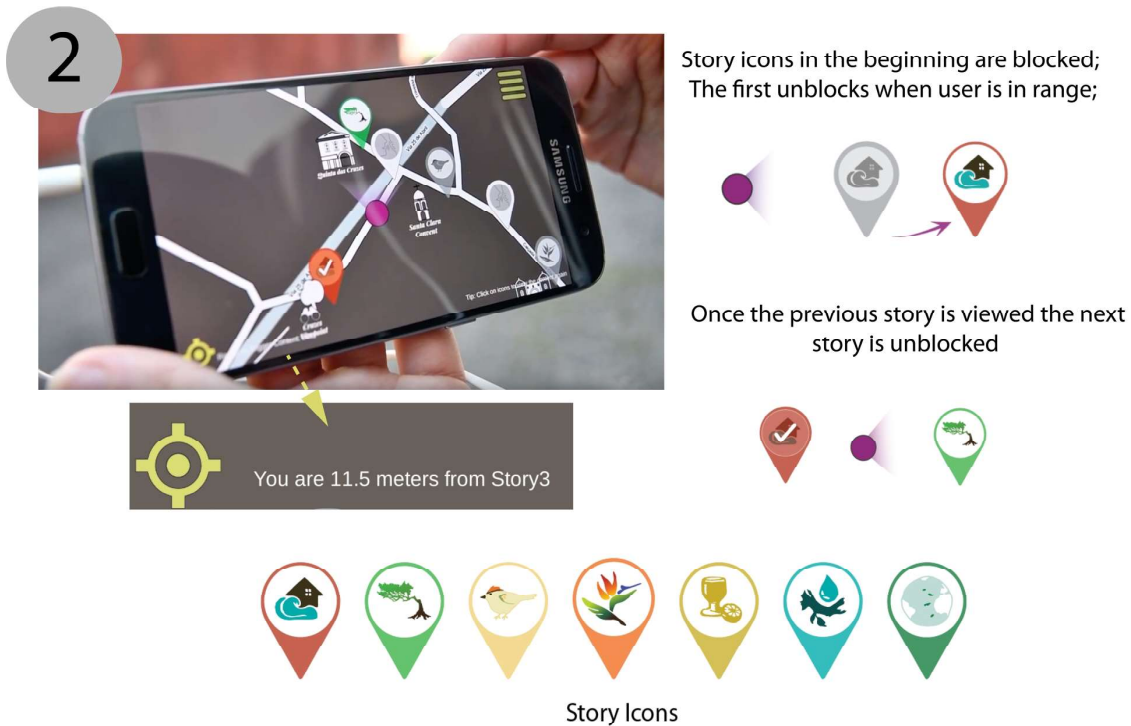


Figure 5:6 – Top Left: FoL LAMS Map Interface; Top Right: Showcases the three different states that the story icons can have: Blocked, Unblocked, and Done; Middle Left: Detail of the interface indication of the distance in meters from reaching a story location; Bottom: The seven icons representing the story locations and respective story theme.

Multimedia Pop-up Window: This new textual feature integrates the fictional story with facts and points of interest about the context in which it is seen. There are two different kinds of Multimedia Pop-ups:

1. Before Story: Composed of an icon representative of the story theme and a small text. Highlighting interesting elements of the location surrounding the audience; When the participant is ready, they can then press the *Open* button to visualize the story. The story plays through a video player, enabling the user to pause, play, and close the story. See Figure 5:7 – Left side for an example where the Multimedia Pop-up Window before the story episode is reinforcing to the participant that they are in the correct location and where to find a seat to watch the story.

2. After the Story:_Composed of text and a thumbnail of a video that presents short previews of the video interviews with locals, synthesized from the FoL Hypermedia. The participant can choose to watch now, or save it for later viewing. See Figure 5:7- Right side for an example of Multimedia Pop-up after the story episode bringing the participants' awareness to the Fortress, up in the hill, that is featured in the story clip and suggesting they watch the video interview.

Furthermore, the full version of the interviews can be followed in the FoL Hypermedia.

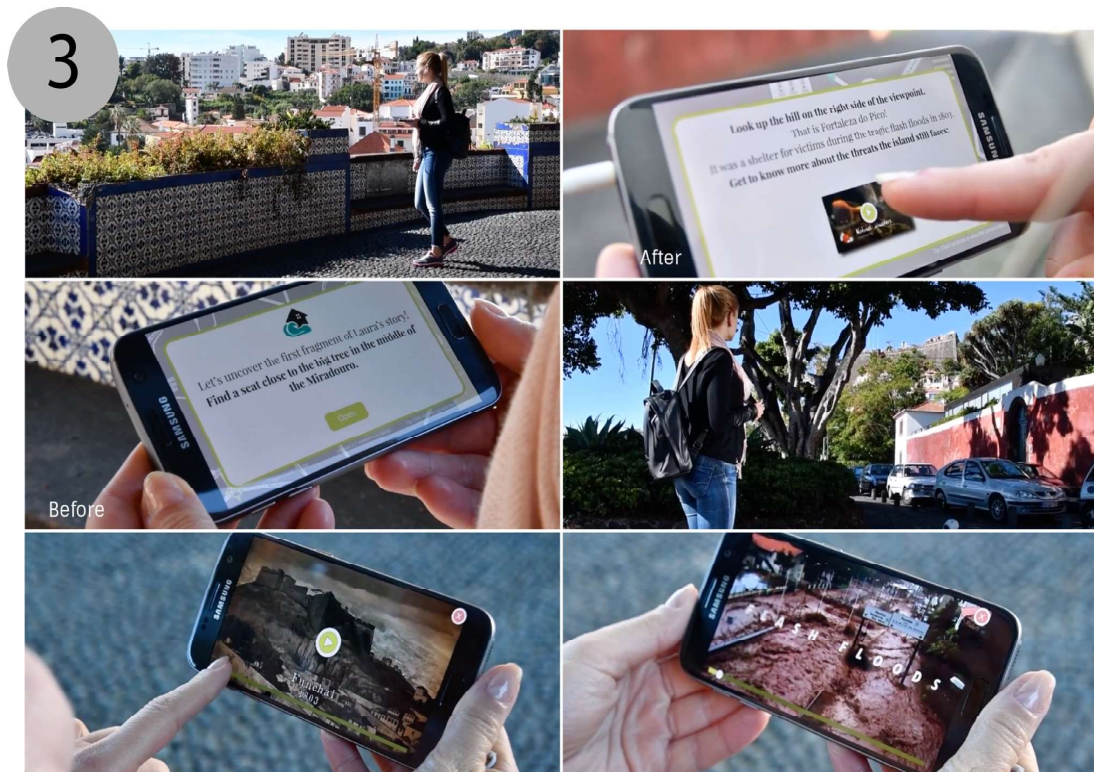


Figure 5:7 – Examples of the Multimedia Pop-up Window; Left: Multimedia Pop-up Window before the story episode. Right: Multimedia Pop-up after the story episode.

2D Motion Comics: This media format delivers most of the fictional story, in which the protagonist, Laura, undergoes several challenges in order to defend her values. This part of the FoL LAMS was kept unchanged from the previous description. However, it is important to highlight the effort made to incorporate local authenticity into the visual graphics of the FoL episodes. The motion comics visuals showcase the 19th century atmosphere through costumes and the sepia colouring, and the locations where the participants view the story content incorporate elements of the locations where the story takes place. For example, the last touchpoint of FoL LAMS is Funchal harbour. In the story episode presented at this point the audience watch Laura departing the Island from that same harbour in a Portuguese Caravel. As participants stand in the harbour, they can see a replica of a Portuguese Caravel that is now used for sightseeing tours. This effort to incorporate local authenticity in the visual graphics was made to increase the FoL fictional story credibility and to increase the connection with the locations where the episodes were visualized.

The 2D motion comics (story plot and characters' emotional journey), in combination with the real-world elements, is designed to enhance narrative transportation, win over the audience, make them care about Laura and her cause, transport them into the story world, and bring them close to local values and history.

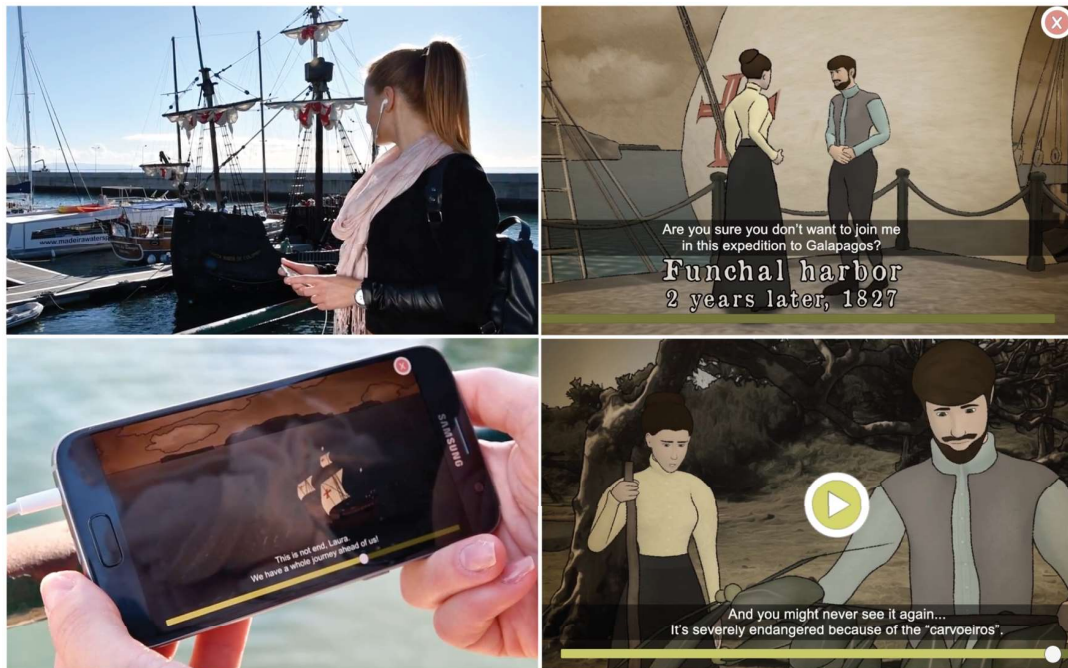


Figure 5:8 – Upper Left: Participant in the last location of FoL LAMS, the Funchal harbour; Upper Right: Screenshot from the 2D Motion Comic that is presented in the last touchpoint where Laura departs the Island from the same harbour in a Portuguese Caravel; Lower Left: Close-up of a participant visualizing the 2D Motion Comic; Lower Right: Screenshots of the 2D Motion Comic, showcasing the protagonist and the supporting character Adam, a naturalist visiting the Island.

Audio Gossips: Six audio clips were designed and distributed across the physical path to fill in background details of the story. This media feature was added to help recreate the experience of eavesdropping on community gossip. The Audio Gossips are placed near public fountains, where local community used to habitually meet when fetching water or recovering from the heat. Here, visitors can also rest, admire the architecture, or take a sip of fresh water along the journey, as the local community used to do (see Figure 5:9). Its narrative goal is to fill in background details for the action, the characters' back-story and foreshadow events.

The Audio Gossips features audio, over a static, black-and-white image, of two local characters talking to each other. The static image enables the participants to look around and take in the location's architectural layout and monuments, rather than always looking at the screen. The Audio Gossips are not essential to understanding the story; instead, they enhance and complete narrative and character transportation, and give perspective to the story, but can be easily skipped by pressing a button.

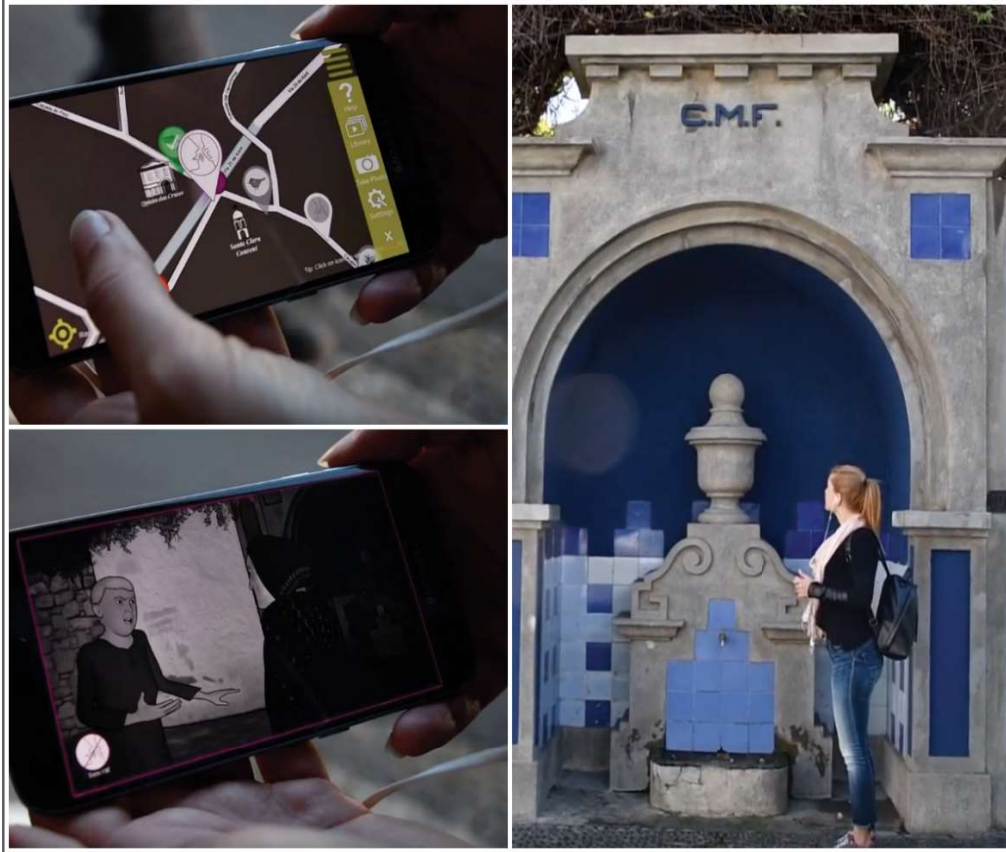


Figure 5:9 – Participant interacting with one Audio Gossip touchpoint. Left Top: Screenshot showcasing the Audio Gossip icon highlighted; Left Bottom: Showcases the screenshot of the Audio Gossip image. Right side: Participant observing the public fountain while listening to the Audio Gossip.

360° Mixed Reality Touchpoint - The Pharmacy: This media was the one that underwent most changes along the refinement process for FoL TEE. It started as a 360° VR scene where the two main characters of the story were having a conversation, telling part of the story and preparing a medicinal drink. After the studies described in section 4.4.3.2, the dialogues between characters were dropped, and participants were cast in Laura's role, impersonating a pharmacist for a few minutes. In this way, the audience takes an active role in exploring and engaging in the 3D environment of the pharmacy, thereby translating into a mixed reality experience.

Once participants arrive at the right location, a Multimedia Pop-up Window appears to tell them that they are right on the spot where Laura's secret pharmacy used to be (see Figure 5:10 – 1). This strategy was used to affect the user experience positively, since previous studies (section 4.4.3.2) indicate participants accessing the story in the exact location where the character once was affects the user experience positively in terms of *Flow*, *Narrative Transportation*, and *Presence*.

On opening The Pharmacy, an “onboarding” screen introduces the participants to the scene (Figure 5:10 – 2). This is followed by a small tutorial in which participants learn the required interactions in order to explore The Pharmacy (Figure 5:10 – 3,4). The scene makes use of *Hybrid* interaction (see Figure 5:11). The top of Figure 5:11 shows the participant interaction with the 3D MR scene in the story location, while the bottom of Figure 5:11 showcases a close up of the Hybrid interaction method; to move within the 3D environment participant presses the green button (with the front and back arrows), and to look around the participant rotates the device around. The participants enter the 3D room of The Pharmacy and start their quest for the ingredients of the “*Poncha*” medicinal drink (Figure 5:10 – 5). Adjustments to this version of the 360° MR scene included adding a textual recipe of the “*Poncha*” that can be consulted by users at any time by pressing the book icon on the top left side of the screen. It presents all the ingredients that participants need to collect and keeps track of the participant's progress. As participants find the right ingredients, the ingredients in the recipe become coloured and show a check on top (see Figure 5:10 – 6). If participants are successful in finding the ingredients, they are presented with an animation of the “*Poncha*” making process and success screen (see

Figure 5:10 – 8,9) but if they choose to exit the pharmacy before finding all the ingredients, they are presented with the encouragement screen.

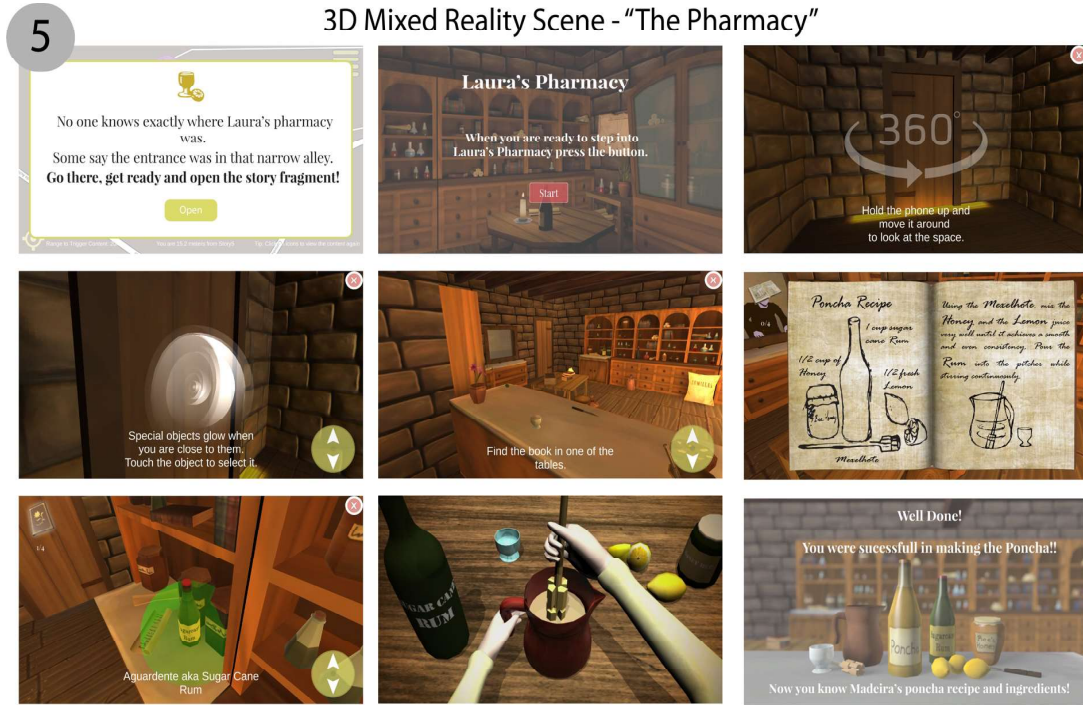


Figure 5:10 – Sequence of nine screenshots from the 360° MR touchpoint. From top left to bottom: 1- Multimedia Pop-up Window presented upon arriving at the right location; 2- 360° MR scene onboarding screen; 3 and 4- Tutorial for the interaction before entering Laura's pharmacy; 5- Virtual environment of the pharmacy; 6- The recipe of the "Poncha" drink that can be accessed/closed by clicking the book icon (on the top left of this screenshot). 7- Ingredient highlighted by a green glow indicating that is part of the "Poncha" recipe; 8- Animation of the "Poncha" making process; 9- Success screen for accomplishing the task

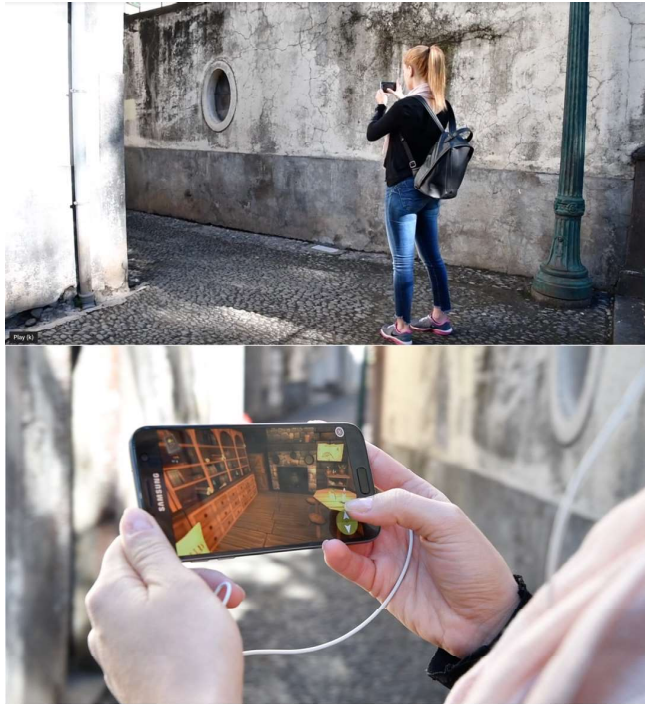


Figure 5:11 – Participant interaction with the 360° MR touchpoint in the story location showcasing the Hybrid interaction method

FoL LAMS Mobile Application Menu: At any stage of the FoL LAMS experience participants can click on the main menu of the application. Here, they will find the *Library* and the *Take a photo* feature. The *Library* holds the collection of all the story and interviews clips, and the clips already viewed will be unblocked. Figure 5:12 – Bottom shows the screenshots from the FoL Library, showcasing two separators, one for the fictional story videos and one for the locals' interview previews. In this example, two videos are unblocked while the other videos are still blocked (thumbnail with a higher opacity level).

By clicking the *Take a photo* button, participants can take a selfie augmented with FoL themed frames that they will receive later via e-mail. In Figure 5:12 - Top Right Column it is possible to see the screenshots from the *Take Photo* feature, showcasing the four FoL themed frames available to choose from. Participants are also encouraged to do this during the tour through a surprise Pop-up Window that appears randomly during the FoL LAMS experience (see Figure 5:12 – Top Left Column).

Take a Photo Feature

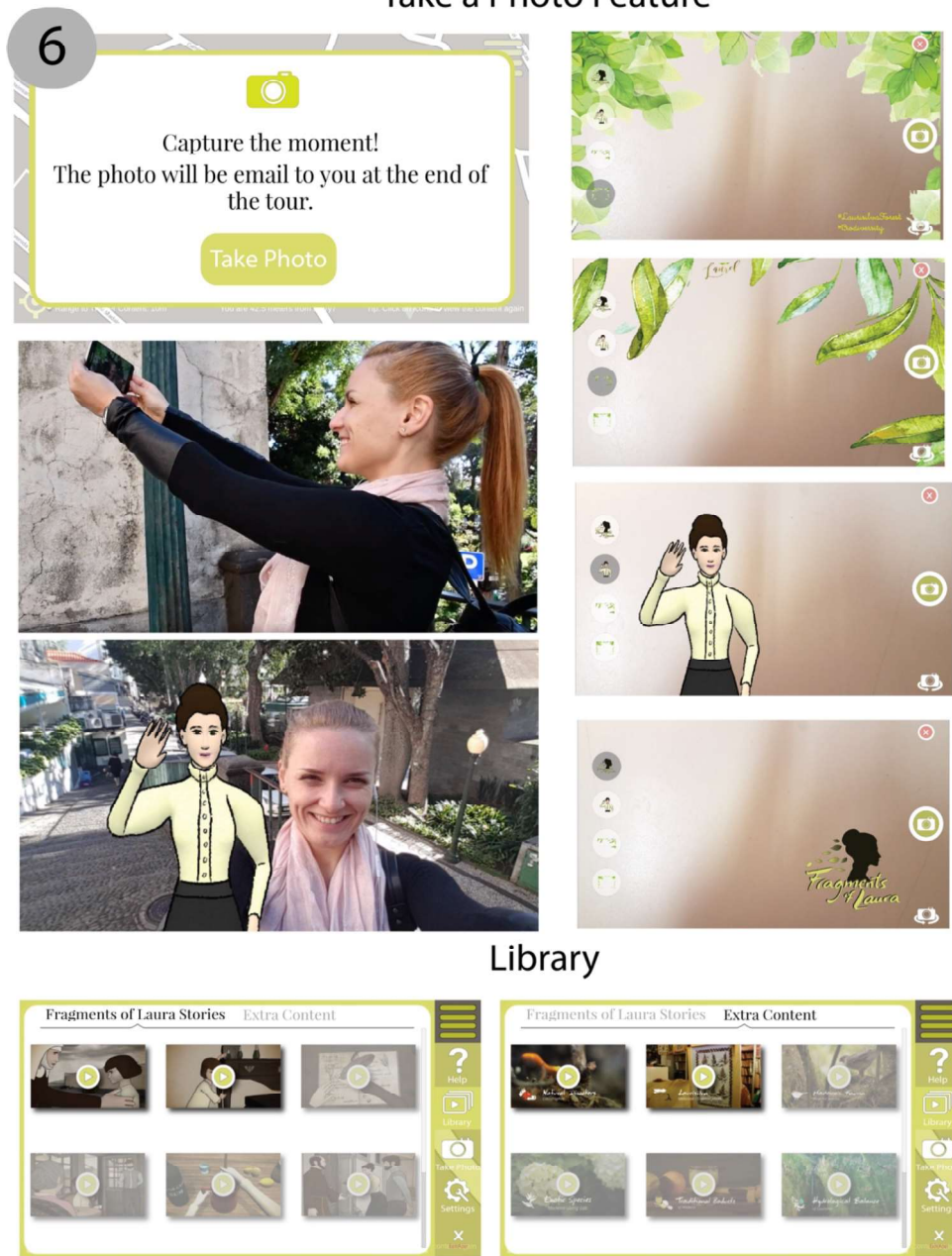


Figure 5:12 – Top Left Column: Pop-up Window suggesting Take a Photo. Selfie taken by the participant with Laura, the fictional character. Top Right Column: Screenshots from the Take a Photo feature, showcasing the four FoL themed frames; Bottom: Screenshots from the FoL Library

FoL LAMS Finale: After watching the last story episode, participants are presented with the conclusion of the story and an opportunity to provide their e-mail. Via e-mail they will receive an invitation to browse the rest of the online interviews with the local community members (on the FoL Hypermedia platform channel), and the Augmented Reality selfies that they might have taken with the story characters (see Figure 5:13).



Figure 5:13 – Sequence of screenshots that finalize the interaction with the mobile application that supports the FoL LAMS experience

FoL LAMS Technical Adjustments: In the first version of FoL LAMS, Bluetooth beacons were coupled with GPS. The GPS was mostly used to help participants go from location to location, and the Bluetooth beacons were used to trigger the story content due to their higher precision and reliability when compared to GPS. However, the Bluetooth features, coupled with GPS and the rich media (2D Motion Comics and 3D MR scene), were consuming too many resources from the mobile phone resulting in a battery drain before the experience was completed. Furthermore, it was hard to make sure that the beacons would not be stolen from the public locations, hence the decision to rely only on the GPS to trigger the FoL LAMS content.

5.3 Refinements of the Fragments of Laura Hypermedia Platform²³

The FoL Hypermedia platform was initially designed as a stand-alone, independent channel, with its own identity (as described in section 4.5), while thematically and technologically connected to the FoL LAMS fictional component. In this way, tourists were not required to experience the FoL LAMS in order to enjoy the community interviews web platform, and vice versa. However, after several pilot evaluations and participatory sessions with local community members and visitors to the island, it became apparent that, for the sake of experience cohesion, the name for the LAMS and the Hypermedia platform should be the same. This resulted in a redesign of the hypermedia portal, providing a more closely unified experience between the fictional story and local interviews, under the same visual language, name, and across the seven themes. The connection between the seven themes and the fictional episodes are detailed below (see also Figure 5:14).

Natural Disasters: This theme describes how wildfires and floods are the two main elements that can cause natural harm to Madeira’s environment. The local scientists explain the connection between flash floods and wildfires, and how to “fight them.” This links back to the narrative’s first episode, when Laura is orphaned in 1801 by one of the most significant floods in the Island’s history.

Laurisilva (Medicinal and Endemic Plants): Aromatic and medicinal plants are found in the indigenous vegetation of the Island. Under this theme, locals share their in-depth knowledge about medicinal plants and how they can be used to make various traditional healing teas. This thematic is reflected in the second episode of the narrative when Laura witnesses the local nuns treating a neighbour with medicinal plants, and eventually puts this knowledge into action herself.

²³ For this iteration of FoL Hypermedia my contribution to the prototype was in refining and unifying the user experience and redesigning the graphical interface. New 2D assets for the web platform were designed to match the visual style of the FoL LAMS again incorporating the illustrations of the seven themes previously developed by the graphical artist. The researcher with tourism background contributed to gather and summarize all the content for the new section regarding curiosities and activities and worked closely with the graphical designer in refining the interview videos and adding infographics. Finally, the platform was deploying using WordPress and with the help a programmer research intern.

Exotic Species: This theme presents the problem of invasive exotic species. In the fictional narrative, Laura, after studying abroad, is bothered and concerned by the construction of a local botanical garden that would bring exotic species to the Island.

Traditional Products: One of the most important activities in the 19th century was the transformation of sugar cane into sugar and alcoholic beverages. Residents explain the different uses of the sugar cane plants, including the original “*Poncha*” drink recipe. In the fiction, the audience, while in the MR touchpoint, learns about several local ingredients and folk traditions, including the “*Poncha*” local drink and remedy.

Hydrological Balance: This theme is concerned with the importance of the local forest for the Island’s delicate hydrological balance. The fictional episode narrates how Laura and her naturalist friend walk along in the forest and talk about the trees that are responsible for capturing water from the mists.

Macaronesian Forests: This theme highlights how the Macaronesia islands, of which Madeira is a part, are considered one of the most important biodiversity centres worldwide. In the last episode of the narrative, Laura is forced to embark on a journey to different Macaronesia islands, which hold similar characteristics to Madeira.

Story Media	Theme	Video Interview Synopsis	Video Interview Screenshot
	 Natural Disasters Catastrophes	Madeira island is a example of fast human-driven and also natural causes of ecosystem destruction. The locals Raimundo Quintal, Rui Carita, and Miguel Sequeira explain what are these so-called "aluviões", their significance, the connection between the flash floods and wildfires, and how to "fight them".	 Biologist Miguel Sequeira
	 Laurisilva Medicinal / endemic plants	The video features local botanists and Manuel de Nóbrega, a priest and botanist, who shares his in-depth knowledge about medicinal plants. From the Nun's Valley, we also talked to Maria de Sá, who shared some herbs folks use to make tea for healing.	 Local Resident Manuela de Sá Discover the power of Laurisilva
	 Madeira's Fauna	In this video, you can get to know more about the endemic birds with Marta Nunes, a biologist at The Portuguese Society for the Study of Birds and ex-director of the Museum of Natural History, Ricardo Araújo, who are both experts on endemic birds that can be found in Madeira.	 Biologist Ricardo Araújo
	 Exotic Species Madeira Living Lab	The island over the years has been used as an "acclimation garden"; Plants and animals that have been introduced to a new ecosystem are known as exotic species. In this video Local experts call for citizen participation and raise awareness about the risks of growing non-endemic plants in the Madeira soil.	 Exotic Species Madeira Living Lab
	 Traditional Products	Madeira Island is very rich in culture and is becoming increasingly diversified, with flower, wickerwork embroidery and sugarcane industries playing important roles in the economy. Local residents explain the several processes of the sugarcane and its different uses, in particular the original Poncha drink recipe.	 Local Resident
	 Hydrological Balance of Laurisilva	Learn how in Laurisilva forest, water is a constant presence and it is even known as a "water-producing forest", the conjugation of its multiple components contributes to the hydrological balance essential to life and to the collective future of the ecosystem, of the island of Madeira and of Mankind itself.	 FROM THE MIST The interview
	 Macaronesian Forests	Madeira and Azores Islands, in Portugal; Canary Islands, in Spain, and Cape Verde Islands, in Africa. Do you know what they have in common? Discover what makes Madeira special from a nature standpoint and why the Laurisilva forest became a World Heritage Site by UNESCO.	 Macaronesian Forests

Figure 5:14 – Connection between the FoL Hypermedia interviews and the FoL LAMS narrative fiction

The changes and features of the FoL Hypermedia webpages are described below:

FoL Hypermedia Homepage: This page introduces tourists to the concept of the FoL TEE experience by showcasing a promotional video of the FoL LAMS and FoL Hypermedia populated with factual interviews harvested from local community members (see Figure 5:15 – 2). The top of the page contains a navigation menu with five items: Home, Location-based Tour, 7 Themes, Events, About. The Location-based Tour and the 7 Themes each have a drop-down menu (see Figure 5:15 -1).

FoL Hypermedia 7 Themes Web Page: In this page, participants can choose to browse the themes by clicking one of the seven polaroid-shaped icons (see Figure 5:15 -4).



Figure 5:15 – Left: FoL Hypermedia landing page; Right: 7 Themes web page

FoL Hypermedia Thematic Web Pages: These pages are the heart and soul of the FoL Hypermedia, as they contain the videos interviews with the local community. The main

goal is to make participants explore and discover more about the community's local values and traditions, as well as some of the challenges that the Laurisilva's natural heritage face today. The outline is identical for each 7 themes web page; Figure 5:17- Left, shows as an example of the Laurisilva theme web page. The text summary of the video clip is now featured at the top, then the video clip interview itself, followed by a section with a list of videos related to the topic. Similar to the previous version of the left side of the page, there is a menu to navigate to the other six themes and a section featuring the locals that feature in the video interview (Figure 5:17– Right: 9).

The videos with the local community interviews were enriched with infographics, and animations summarizing the content that locals were sharing to improve and maximize content absorption (see Figure 5:14 for a summary of each video). For example, in certain videos key concepts and words were highlighted by using kinetic typography overlaid on the interview video. In other cases, infographics were added. For example, in the video about the *Macaronesia*, the locations and percentage of preserved Laurisilva forest were showcased in an infographic illustrating the Island map while having the local scientist as a voice-over (see Figure 5:16- Middle and Left).

In Figure 5:17– Right Side: 9, can be seen a screenshot of the *Meet the Locals* page, featuring a photo of all the locals who contributed in the interviews, and a short biography of each.



Figure 5:16 – Left: Screenshot of Macaronesia video with an infographic, summarizing information. Middle and Right: Screenshots of kinetic typography overlaid to the interview video of Madeira Fauna and Hydrological Balance respectively

A new section was added with further information about the theme (see Figure 5:17– Right Side: 7). This section is composed of items of interest in a mixed-media format

(images, text, maps, photo galleries, schemes and infographics). This section was added to provide visitors with access to specific on-site information/advice from the local community and to share practical information on respectful behaviours towards the local destination.

The content and media of this final section are tailored depending on the theme that is selected. Its goal is to either propose on-site activities, locations, or products that visitors can find on the Island. For example, in Figure 5:17– Right Side: 7, the new section seeks to engage visitors with Medicinal plants by suggesting a visit to a local herbarium. Figure 5:18 contains several illustrative screenshots of this section where each screenshot belongs to a different theme (Exotic Species, Hydrological Balance, Madeira’s Fauna and Natural Disasters). In the example featured in Figure 5:18 - Top Left, can be seen a map featuring gardens around Madeira Island in which exotic plants can be found.

Figure 5:17 – Left: Laurisilva Thematic Page (5: Summary of the content featured the video interview; 6: Section that features videos related with this topic; 7: New section composed of curiosities in a mixed-media format. Right: Meet the Locals page

Furthermore, in this section containing items of interest in a mixed-media format, some characters from the fictional story are featured to bring the fictional story closer to the real-world facts. In Figure 5:18 - Top Right, can be seen an illustration of Laura Silva advising how to plan for a “Levada” hike. “Levadas” are streams of water along the mountain, hence something particularly relevant to the topic of the Hydrological Balance. Figure 5:18 - Bottom Left holds a screenshot of the section containing images and with Laura sharing practical information on recommended behaviours for bird watching. Finally, Figure 5:18 - Bottom Right, illustrates the section belonging to the Natural Disaster theme and advises visitors on what they can do in order to prevent natural disasters.

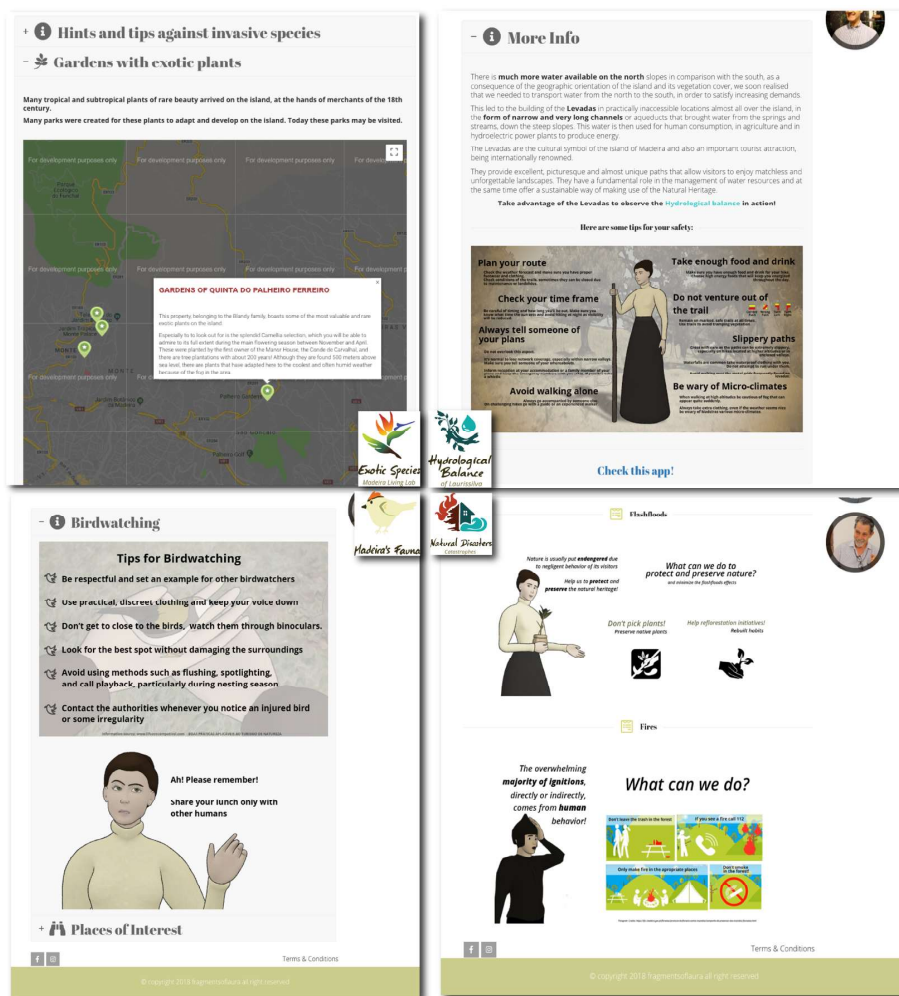


Figure 5:18 – Screenshots showcasing four different examples of mixed-media used in the new section of the Hypermedia portal. Top Left: Map of exotic plants on Madeira Island; Top Right: Laura Silva advising on how to plan for a “Levada” hike. Bottom Left: Recommended behaviours for bird watching. Bottom Right: Illustrations of what visitors can do in order to prevent natural disasters

FoL Hypermedia Web Pages related with the FoL Fictional Story: The FoL Hypermedia contains two pages dedicated to the connection with the FoL Hypermedia content and the FoL LAMS. These pages also function for participants who are curious to engage with more details about the FoL fictional story.

1. **Location-Based Tour Web Page:** The Location-Based Tour web page includes details about the FoL LAMS experience in a graphical, clear, and detailed way to encourage tourists to enroll in the experience. In Figure 5:19 – Left Side, can be seen a screenshot from the Location-Based Tour web page (1- contains details about the FoL LAMS, 2- contains the form to contact the FoL team to book the experience). Clicking under the Location-Based Tour menu item, on the submenu item Story, leads to a reserved area for participants who have already tried the FoL LAMS experience (see Figure 5:19 – Middle Top). This section is unlocked through a password that is provided in the follow-up email participants receive when they finish the FoL LAMS. As explained previously, in section 5.1, participants who do not want/cannot attend the FoL LAMS can also unlock this page by sending an e-mail to the email address provided on the webpage. In Figure 5:19 – Middle Top – 3 can be seen the password field to input the password provided via e-mail. Unlocking the page then features the FoL Movie; an adaptation of the seven episodes and gossips stitched into a linear movie. Figure 5:19 - Right Side Top showcases a screenshot of the FoL movie webpage, containing the embedded video player.
2. **Locations and Characters Web Page:** The Locations and Characters web pages include further information in the format of text and images regarding the fictional characters' profile and historical relevance of the FoL LAMS landmarks. In Figure 5:19 – Middle Bottom section can be seen a screenshot of the characters' web page featuring extra details about each of the characters from FoL fiction. In Figure 5:19 – Right Side Bottom is a screenshot of the location's web page featuring extra details about the relevance of each of the landmarks along the path of FoL LAMS.

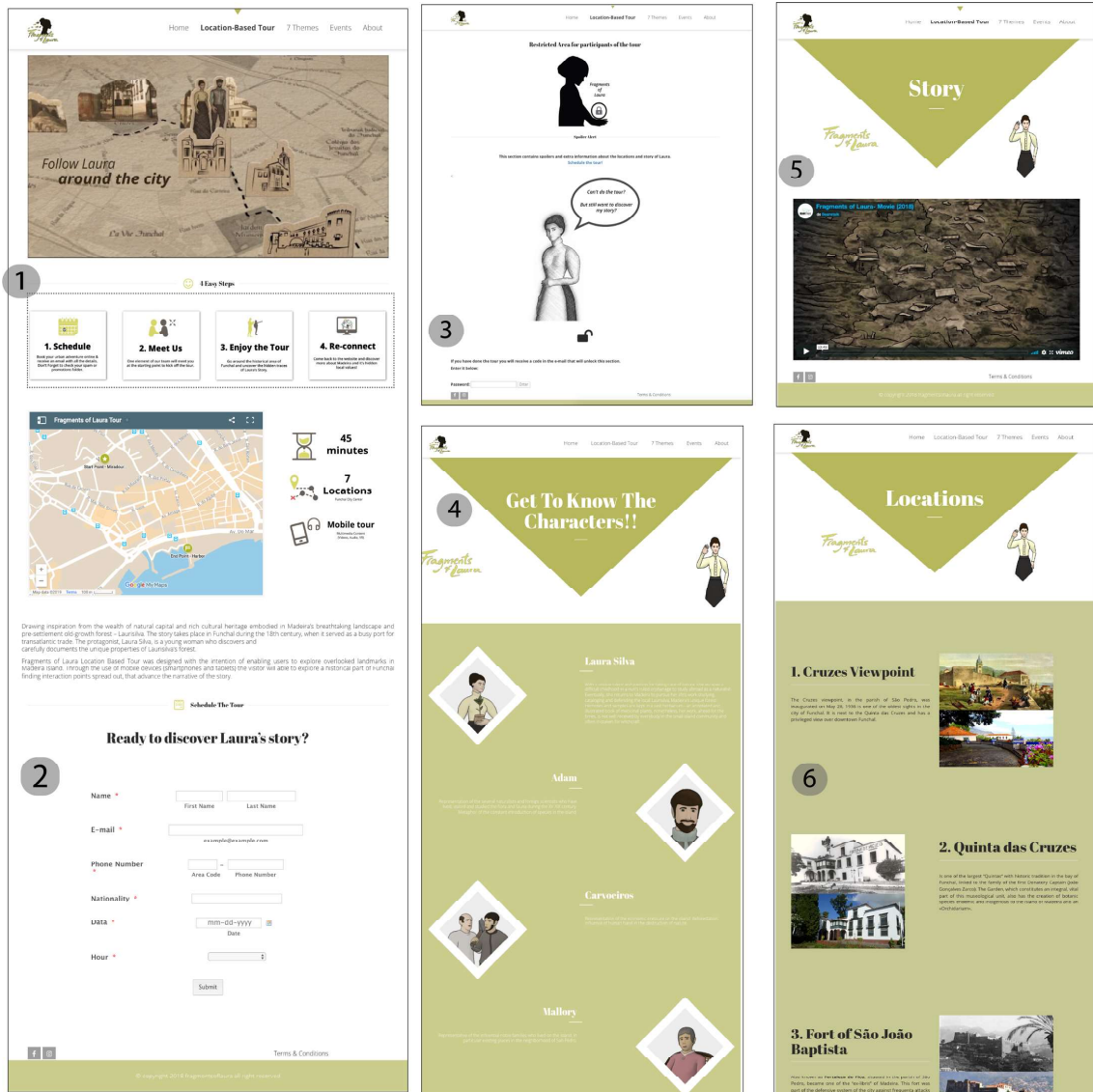


Figure 5:19 – Left: Screenshot from the Location-Based Tour web page; Middle Top: Screenshot of the Restricted web page to access exclusive content about the FoL fictional story; Middle Bottom: Screenshot of the characters web page; Right Top: Screenshot of the FoL movie web page; Right Bottom: Screenshot of the location's web page.

5.4 The Design Insights Influence in the FoL TEE Final Design

This section describes how each one of the 13 DIs was operationalized into different design features in each FoL TEE component (FoL LAMS, FoL Hypermedia). Towards the end of this section the overall FoL TEE is discussed in the light of the DI, (see Table 5-1).

5.4.1 Design Insights Applied to the FoL Location-Aware Multimedia Story

In an effort to provide *authentic storytelling (DI 1)*, the final version of the FoL fictional narrative incorporates historical events that occurred during the 19th century, as well as some additional information gathered during the interviews with the local community. In this way, the narrative interweaves science, local traditions, and folklore of the Island, into the fiction. The visual aesthetics of the Motion Comics incorporated several factual and spatio-temporal cues (use of dates, and reproduction of real-world locations in the Motion Comics) to increase the authenticity of the content (Figure 5:8). In addition to this, the Multimedia Pop-Ups Windows explain the connection of the narrative to real locations and facts, reinforcing the cues given in the Motion Comics (Figure 5:7).

The role of the Multimedia Pop-ups Windows and the Motion Comics is tightly linked with the attention paid to designing the *transition between physical locations and digital content (DI 2)*. Some of The Multimedia Pop-ups Windows propose interactions with the physical space and landmarks, while the Motion Comics promote a visual blend of a location and the digital content by portraying the characters' adventures in the setting where the participant is located. On the other hand, the mobile device vibration alerts help to guide the audience through the transition from the real world into the digital world, by letting them know that new content is available.

In order to take into account the *points of interest (POI) of the experience (DI 3)*, all landmarks and locations that trigger episodes from the FoL narrative were carefully selected. First, most POI in the FoL LAMS are buildings (museums, churches, or gardens) of high historical value, and that play a role within the fictional story. Secondly, the locations that trigger the content are off the usual tourist routes and are positioned where

locals usually pass by. Moreover, the Multimedia Pop-ups Windows assumed an essential role in minimizing the poor GPS accuracy of some locations by directing participants to more comfortable/safer locations to be able to watch the FoL LAMS episodes.

In order to provide *content engagement through Mixed Reality technologies (DI 4)* the 360° MR scene, The Pharmacy, was designed to add an extra layer of interaction and engagement, having the participants assuming a more active role in the experience. In particular, its goal is to allow the audience to explore a 19th century pharmacy and learn about the remedies that were used at the time (Figure 5:11). Furthermore, this media is included halfway through the FoL LAMS as a technique to provide a *rewarding experience (DI 7)*. It introduces not only a novelty factor to the FoL LAMS interaction, but also a challenge that the audience needs to overcome (making the “*Poncha*” drink), leading to an opportunity to build up skills and self-esteem for having accomplished it.

The FoL narrative and characters were developed to emotionally involve the audience in Laura’s journey in protecting the natural heritage of Madeira Island. The FoL narrative is distributed in seven story clips, presented as Motion Comics, and six Audio Gossips. In order to comply with the care needed in providing *multimedia content that can be easily assimilated (DI 5)* and *limiting cognitive overload (DI 8)*, the Motion Comics are each a maximum duration of two minutes and are enhanced with captions to make the narrative more understandable. The Motion Comic episodes are linear and follow a specific order, while it is suggested not to skip episodes so as to increase the involvement with the narrative; dropping or skipping one or more episodes does not compromise the story, as long as they are viewed and in the correct order. Furthermore, the Audio Gossips were designed to limit cognitive overload with narrative details. Designed to deliver story material as audio-only media, it limits visual overload and renders participants free to look away from the screen and enjoy the physical surroundings. The Audio Gossips are not vital for the story and can be skipped if participants so choose.

The Multimedia Pop-up Window also plays a role in **limiting the cognitive overload (DI 8)** by facilitating the urban environment intake, and pointing out features in the physical environment before it is referenced by the visual story clip. Moreover, they offer time for

the audience to prepare themselves to view the story content. Furthermore, after each story clip, a Multimedia Pop-up Window presents the suggestion to view a summary of an interview with a local, based on the FoL Hypermedia content. The interview summary follows **DI 8** guideline, as it works as an enticement to discover part the FoL Hypermedia content without providing too much information.

The two FoL LAMS features, Taking Photo and Follow up e-mail, set up a *reward (DI7)* and different *levels of participation* for the viewers (**DI 9**). On the one hand, the selfie taken during the tour is sent to the user via e-mail, as a way to *reward tourists* with a memento from the experience (**DI 7**). At the same time, the Take a Photo feature functions as a mechanism to maintain contact with the participants after the FoL LAMS is terminated. This e-mail contact is intended to remind the user to participate in exploring the FoL TEE experience through its online component (**DI 9**) (Taking Photo Feature: Figure 5:12, Follow up e-mail: Figure 5:13).

Finally, the FoL LAMS is designed to accommodate different *levels of participation (DI 9)* according to the different needs, desires, and abilities, of the participants. For example, the Audio Gossips and the 360° MR scene can be skipped if participants feel like the experience is requiring too much effort from them.

5.4.2 Design Insights Applied to the FoL Hypermedia Platform

The whole Hypermedia platform, but in particular the “7 Themes pages” and all of its content, were designed in order to *provide authentic storytelling (DI 1)*, to the audience. The Hypermedia platform provides content through a different approach (when comparing to FoL LAMS). Local stories and information about the destination are outsourced through journalistic-style interviews, allowing participants to gain access to authentic information. The journalistic-style content allows *accommodating for different Audiences (DI 6)*, attracting those who enjoy fiction or VR game-like experiences, but also those who seek more fact-based knowledge. Furthermore, the items of interest section of each Theme web page, seeks to provide a higher degree of participation making sure to provide the audience with different *levels of participation (DI 9)*, such as getting in touch with

the local community, so providing opportunities and information to visit several locations based on what is proposed by the locals (Figure 5:18). The several hours of video interviews collected were divided by themes and edited dynamically into short videos (approximately 2 minutes long) so as to limit *cognitive load (DI 8)*. Furthermore, the video interviews and items of interest section of the platform were enriched with infographics and kinetic typography to render the *Multimedia content* easily *assimilated (DI 5)* (Figure 5:16).

The FoL movie, made available through the FoL Hypermedia platform, is an effort to *accommodate for different Audiences (DI 6)* opening the experience up to audiences suffering limitations, such as those who cannot walk the street of the city or have accessibility issues. The decision to have a movie version of the FoL narrative also allows for participants to review the whole story in a movie format (Figure 5:19 - Right Top), and is an opportunity to *maximize multimedia content assimilation (DI 5)*.

Extra content about the FoL fictional narrative was added to the FoL Hypermedia to stimulate the curiosity of tourists who seek engagement with the fictional world and extensions of the story applying the *media distribution channels (DI 11)*.

5.4.3 Design Insights Applied to FoL Transmedia Entertainment Education Experience

The FoL TEE breaks down into two main interconnected components: the FoL LAMS, and the FoL Hypermedia. Taking into consideration *DI 9* and *DI 11*, different audiences with different preferences can engage differently in the FoL TEE Experience. For example, a more adventurous and tech-savvy audience can engage in the FoL LAMS and extend all the experience with all the FoL Hypermedia video content items of interest and proposed activities. On the other hand, an audience that is seeking something more restful, or fact-based content, can choose to interact only with the FoL Hypermedia and engage with the interviews from the local community.

The two components of FoL TEE went through several iterations, as described over this document, to ensure that *the experience is as good as its weakest part (DI 13)*. Over

several user studies, it was clear that further clarifications and improvements had to be incorporated to make sure that all the different media components and interactions were clear for the participants. For example, the adjustment of interaction methods in the 360° MR scene, the addition of tutorial screens at the beginning to the FoL LAMS, or even the several iteration steps that FoL Hypermedia component went through.

The FoL TEE development followed an RtD methodology [ZiFE07] with the input of a multidisciplinary team of programmers and designers with backgrounds ranging from entertainment technologies to the tourism industry, thereby bringing together **DI 10: Production team and Methods** and **DI 12: Local community involvement**. During the development of the fictional story the team consulted with a local History expert to verify the facts incorporated into the story and to keep historical coherence. In addition to how **DI 12** was incorporated, the involvement of the local community through the interviews done with locals, and the focus groups conducted with local experts, all helped to shape the final concept of the FoL TEE experience, bringing together the fictional story and the local interviews.

Table 5-1 – Summary of the design insights influence on the several aspects and features of the final prototype of the FoL TEE experience

Guideline	Feature/Media	Component
DI 1: Authentic story-telling	FoL Fictional Story FoL Motion Comics	FoL LAMS
	FoL Video interviews	FoL Hypermedia
DI 2: Transition between physical locations and digital content	FoL Pharmacy Multimedia Pop-Ups Windows FoL Motion Comics	FoL LAMS
DI 3: Points of interest (POI) of the experience	Multimedia Pop-Ups Windows FoL Landmarks FoL Vibration Alerts	FoL LAMS
DI 4: Content engagement through Mixed Reality technologies	FoL Pharmacy	FoL LAMS
DI 5: Multimedia content assimilation	Distribution of the FoL fictional story into: Seven Story Clips and Six Audio Clips Use of Subtitles in Seven Story Clips	FoL LAMS
	FoL Movie	FoL Hypermedia
	Infographics and Kinetic typography in FoL Video interviews	
DI 6: Accommodate different audiences	FoL LAMS +FoL Hypermedia	FoL TEE
DI 7: Rewarding experience	Taking a Photo FoL Pharmacy Follow up e-mail with FoL Photos	FoL LAMS
DI 8: Cognitive load	Audio Gossips Multimedia Pop-Up Window	FoL LAMS
	Short Dynamic Video Interviews	FoL Hypermedia
DI 9: Levels of participation.	FoL LAMS +FoL Hypermedia	FoL TEE
	Audio Gossips and 360° MR skip feature	FoL LAMS
	Curiosities and extra information section of 7 Themes pages	FoL Hypermedia
DI 10: Production team and Methods	Multidisciplinary Team Historian Consultant Research Through Design Method	FoL TEE
	FoL LAMS +FoL Hypermedia	FoL TEE
DI 11: Media distribution channels	FoL Movie	FoL Hypermedia
	Web pages with extra content about FoL Narrative	
D12: Local community involvement	Focus Groups with Locals Local Interviews Contextual research	FoL TEE
DI 13: The experience is as good as its weakest part	FoL Tutorial Screen 360° MR Pharmacy Tutorial	FoL TEE

5.5 Chapter Conclusion

This chapter described in detail the design decisions and features of the final prototype of FoL TEE experience. Moreover, the chapter describes the overall user experience with the two distinct, yet interconnected, components; FoL LAMS and FoL Hypermedia. The FoL TEE improvements are reported in detail by highlighting the incorporation of the different feedback gathered following the RtD methodology, and the design insights gathered from the related work.



6 Evaluation of Fragments of Laura as a Transmedia Entertainment Education Experience

This chapter contains the methodology and results of the evaluation of FoL as a TEE experience. The first section details the evaluation methodology. The second and third sections explain how the data analysis was performed for each type of data. The fourth section describes the participants' sample and characterization. Finally, sections fifth and six present the results obtained.

6.1 FoL TEE Evaluation Methodology

The last prototype of the FoL TEE experience was designed in particular to answer the second RQ of this thesis and explore how the novel TEE framework can support the design of entertainment artefacts to engage visitors with the local destination, bring awareness, and create connections between them and the local community and its values. To that end, the evaluation of FoL TEE was designed as mostly guided by *RQ2: How to design a TEE experience that delivers a memorable tourist experience while raising awareness towards local values present in the destination's context?* This multi-layered question was unpacked into three further, and specific, research questions:

- **RQ2.1:** Can FoL TEE provide a fulfilling and memorable touristic experience?
- **RQ2.2:** To what extent did both distinct yet interconnect components, FoL LAMS and FoL Hypermedia of the FoL TEE experience, support tourists to connect with the Island's local values and community?
- **RQ2.3:** Did FoL TEE enrich the knowledge of the local destination's cultural and natural heritage in a significant way? If so, what role did the two FoL TEE components, and its respective features, play in this?

The methodology used, and how it addresses the above questions, is detailed in the next subsections. However, it is important to highlight that, while the main target users of this evaluation were visitors to the Island, the component of the research that dealt with empowering the local community could only be evaluated with engaging the local community in testing the application. For this reason, part of the user's sample is composed of local inhabitants of the island. This allowed us to gather data to understand if one of the output components of the TEE framework was fulfilled, namely the *Socio-cultural Wellbeing at Local Destination*.

6.1.1 Measures Used in the FoL Evaluation

In order to answer the 3 further research questions, the evaluation of the experience was designed to collect information during 3 stages (before FoL LAMS, after FoL LAMS, after FoL Hypermedia) through three questionnaires (Q1_Demographics, Q2_LAMS, Q3_Hypermedia). Each of these questionnaires had a section regarding Madeiran heritage: Madeira Questions Scale (MQS). The MQS is composed of a set of 16 true or false questions, developed by two researchers²⁴ in order to touch upon different topics related to Madeira's natural heritage and culture.

The first questionnaire (Q1_Demographics) was composed of 2 sections. One was designed to collect the participants' demographic data, their experience with mobile phones and location-based tours, and contained questions regarding their profile as tourists (e.g.

²⁴ This questionnaire was developed by myself in close collaboration with the tourism researcher that was part of the Beanstalk research team at the time.

duration of stay on the Island). The other section of the Q1 worked in synergy with the MQS to provide a baseline on participants' previous knowledge about Madeiran values and cultural heritage before engaging with the FoL TEE. Furthermore, MQS was applied at the end of the FoL LAMS and then after the interaction with the FoL Hypermedia, to assess if participants acquired knowledge as they went through the FoL TEE components, thereby addressing **RQ2.3**.

It was important to collect data about the participants' experience after they had experienced each of the FoL TEE components (FoL LAMS and FoL Hypermedia) separately, in order to assess how effective each of the components was. Hence, the second questionnaire (Q2_LAMS) was designed to understand how involved in the fictional narrative visitors felt, and what they retained from the local values by engaging only with the fictional narrative, before the visitor's exposure to the Hypermedia channel (part of RQ2.2). The Q2_LAMS was composed of Narrative Transportation scale (NTS) which assess participants' ability to be transported into the FoL fictional narrative [GrBr00].

The User Engagement Short Scale (UESS) [ObCH18] comprised of 12 items that measure 4 dimensions of engagement with the FoL LAMS: Focused Attention (FA); Perceived Usability (PU); Aesthetics Appeal (AE); Reward Factor (RW). 4 single Likert items were included measuring the difficulty and demands of the experience, the awareness of the real world, and how the experience allowed them to learn about local values. Furthermore, to assess "Presence," a single item was included in the questionnaire: "In the video narrative, I had a "sense of being there." "Presence" is defined as "a psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways" [Lee04]. In particular, "Presence can intensify existing media effects such as enjoyment" [WHBV07]. The final section of Q2_LAMS was the MQS.

Finally, the third questionnaire (Q3_Hypermedia) was administrated to access the experience with the FoL Hypermedia and participants' overall perception of the FoL TEE experience. For this reason, it was divided into 3 sections. One focused on evaluating the experience with the FoL Hypermedia to answer part of **RQ2.2**. It included 7 items adapted from the User Engagement Long Scale [ObTo13] that probed how rewarding and pleasing the experience with the web platform was (items: RW9, RW4, RW10, AE5, RW1, AE2, RW6).

The second section was tailored to investigate the participants' perception of the FoL TEE experience and answer **RQ2.1**. To assess the memorability of the overall transmedia experience as tourism experience we applied the Memorable Tourist Experience (MTE) Scale [ChVa15] with 13 items and looking at six dimensions related with the travel experience (Affective Emotions/Hedonism, Authentic Local Experiences, Refreshment, Fulfilment/Personal Travel Interest, Meaningfulness, Knowledge). Moreover, 4 single Likert items were included in this section: one to understand the difficulty, and one to understand demands of the FoL TEE experience; 1 to understand how much participants learned from the FoL TEE experience; 1 item asking if participants would recommend FoL TEE to others. Finally, to measure the FoL TEE user experience, we returned to the short version of the User Experience Questionnaire (UEQ) [User00b] with 8 items in the form of word pairs. The final section was comprised of the MQS. A copy of each of the questionnaires is included Appendix G.

The last step in the evaluation was a semi-structured interview conducted to assess the overall experience of the FoL TEE. It was guided by 6 open questions to allow participants to share their thoughts:

1. What did you think about the experience?
2. Can you in a quick way retell FoL fictional story?
3. What was your first impression of the website?
4. Did you enjoy the videos from the website? How useful was the information?
5. Overall, what was confusing about FoL experience?
6. In general, what could be improved?

The methods and measures used for the local residents' sample were identical except that some questions were removed from two of the questionnaires. Namely, in Q1_Demographics any questions regarding tourism behaviours were removed (e.g. duration of stay on the Island) and in Q3_Hypermedia the section about the Memorable Tourist Experience (MTE) Scale was also removed.

6.1.2 Protocol

Participants were made aware of FoL TEE and recruited for the study through events on social media, posters and flyers distributed in hotels, Airbnb lettings, hostels, and some tourist points around the city of Funchal. The goal was to evaluate the FoL TEE experience in the closest way to a real tourism experience. Therefore, participants had the freedom to choose what would be the most convenient way for them to experience FoL. They could choose to try the experience individually, in pairs, or even in a group. It was mentioned in the sign-up form that the experience would be best done either individually (1 participant, one mobile phone) or in pairs (2 participants sharing a phone) but bigger groups were welcomed with the constraint of a maximum of 6 participants per session, due to available devices and experimenters.

The whole protocol, comprising 6 phases, lasted for around 1h 30m. The number of experimenters per session depended on the group size that would sign-up for the experience, with one experimenter per pair of participants. Figure 6:1 presents and summarizes the protocol phases divided into steps.

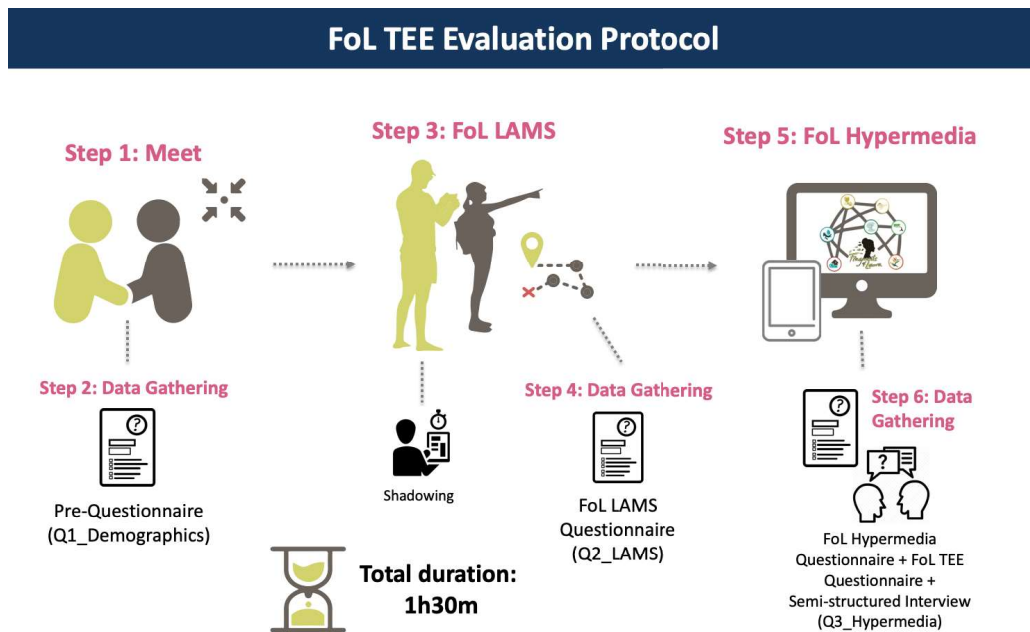


Figure 6:1 – Overview of the steps composing the FoL TEE evaluation protocol

Experimenters met the participants at the starting point of the FoL LAMS, explained the research procedure, asked them to sign the consent form and administered the first questionnaire (Q1_Demographics: questions regarding demographics and general knowledge about Madeira.). Experimenters provided the mobile phone and headphones to participants who sometimes shared the mobile device, with two pairs of headphones. The mobile phones used were Samsung S7 and S7 Edge. On average, the duration of the FoL LAMS lasted around 45 minutes, after which participants were asked to complete the second questionnaire (Q2_LAMS: questions about the experience with FoL LAMS and general knowledge about Madeira). Afterwards, participants were asked to browse the FoL Hypermedia for at least 10 minutes. A specific questionnaire was administered after this last step (Q3_Hypermedia: questions about the experience with the FoL Hypermedia, overall FoL TEE and general knowledge about Madeira.). Finally, a 5-10 minute semi-structured interview was conducted and audio-recorded. Participants were rewarded with a unique cotton bag printed with the FoL logo and some leaves from the local flora, Figure 6:2. Due to lack of time availability, some participants preferred to visualize the FoL Hypermedia component later on. These participants received a follow-up e-mail with a link to FoL Hypermedia and questionnaire Q3_Hypermedia.



Figure 6:2 – Top: Tourist in the third touchpoint of the FoL LAMS; Bottom: Group of tourists who participated in the FoL TEE evaluation holding their souvenir the FoL TEE cotton bag.

6.2 Quantitative Data Analysis

All statistical analyses described over the next section were performed by the author with SPSS version 25. The reliability of the scales and subdimensions were checked to ensure consistency of the measures in the context of this sample. For further details on the reliability of the different scales, see Table 6-1. The scoring guidelines for each of the scales (NTS, MTE, UESS) were followed, so as to reach the scores for measuring the overall user experience. For the Madeira Questions Scale (MQS), a score of 10 points was given to questions that participants responded correctly, and then a total score was obtained for each stage. The maximum score that a participant could obtain was 160. Since the MQS was applied 3 times, this resulted in 3 different scores, with 1 corresponding to each stage: before the start of the FoL LAMS; after FoL LAMS; after Hypermedia platform. These will be referred later on the document as MQS1_BeforeFoLAMS, MQS2_AfterFoLAMS, MQ3_AfterHyper, respectively. The normality of the data was analysed using the Shapiro-Wilk method, the data revealed to be non-normal. Therefore, only Median scores (Mdn) with respective Inter Quartile Ranges (IQR) were reported and non-parametrical statistical tests performed. Quantitative data from visitors and local residents were analysed and presented separately as they present distinct target participants.

Table 6-1 – Results of the reliability analysis of the applied scales for both Visitors and Local Residents Samples

Scale/Sub-dimensions	Visitors Reliability*	Notes	Locals Reliability	Notes
Narrative Transportation Scale	$\alpha = .758$	Removed 2 reversed scored items.	.713	After removing 3 reversed scored items
Memorable Tourism Experience	$\alpha = .957$.930	
Affective Emotions/Hedonism	$\alpha = .885$.932	
Authentic Local Experiences	$\alpha = .830$.877	
Refreshment	-----	Single item	----	
Fulfilment/Personal Travel Interest	$\alpha = .819$.642	
Meaningfulness	$\alpha = .880$.932	
Knowledge	$\alpha = .871$		-.143	
User Engagement Short Scale	$\alpha = .808$.804	After removing: "I lost myself"
Focused Attention (FA);	$\alpha = .521$	Low reliability	.514	Removed: "I lost myself"
Perceived Usability (PU);	$\alpha = .562$	Low reliability	.592	
Aesthetics Appeal (AE);	$\alpha = .829$.815	
Reward Factor (RW)	$\alpha = .883$.546	
Questions Madeira	$\alpha = .838$.536	
User Experience (word pairs)	$\alpha = .821$	After removing 1 item -UEQ1	.842	After removing UEQ1
User engagement long scale adaptation	$\alpha = .899$.893	

*A scale's reliability is considered high if its Cronbach's alpha Value $\alpha > 0.75$

6.3 Qualitative Data Analysis

The resulting data from the interviews was analysed using a Thematic Analysis [BrCl06] approach to collect users' impressions concerning the TEE experience, with the support of Nvivo software²⁵. Two researchers conducted a bottom-up data analysis review, resulting in a three stage iterative process. Firstly, researchers used open coding, in which each researcher selected quotes and created high-level categories, reviewed, and merged or divided, into new nodes. Secondly, affinity diagrams were used to explain the

²⁵ <https://www.qsrinternational.com/nvivo/what-is-nvivo>

relationships between categories. Thirdly, researchers organised the most frequent concepts and insights found, followed by the description and illustrative quotes given by users in the interviews. Figure 6:3 presents an overview of this process.

At the top of Figure 6:3, the first two screenshots represent the themes that emerged from each researcher after the analysis of visitors’ transcriptions (each blue dot is a Nvivo node that represents a theme) and the last screenshot represents the combination of the themes merged upon agreement of both researchers. The bottom of Figure 6:3 presents the same process carried out but for the Local residents’ interview transcripts.

Quantitative data from visitors and local residents were analysed and presented separately, as they represent distinct target participants.

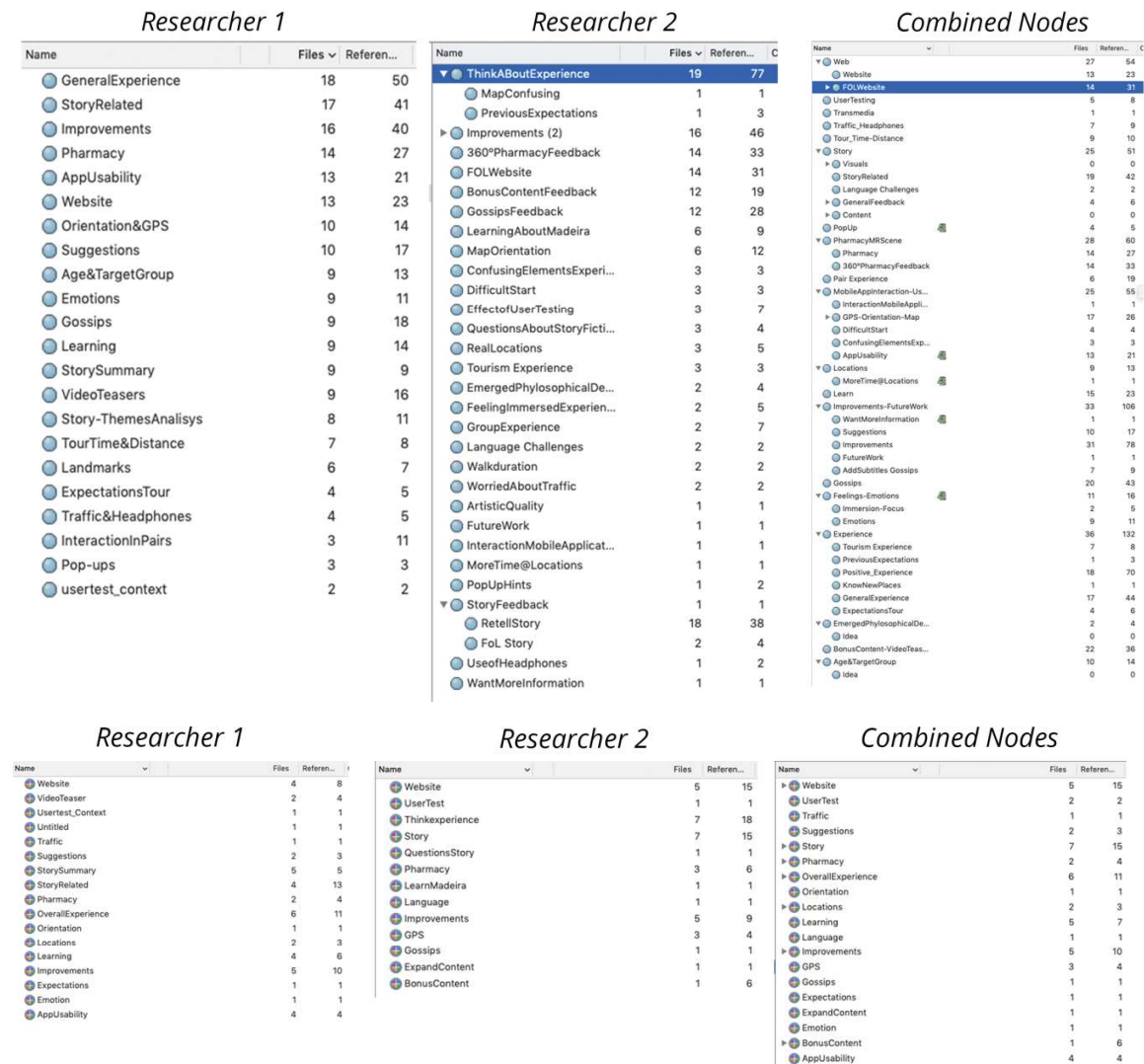


Figure 6:3 – Combination of screenshot of the Nvivo software, used to facilitate the Thematic Analysis. Top: Nodes from the Visitors’ Sample; Bottom: Nodes from the Local Residents’ Sample

6.4 Participants Sample and Demographics

A total of 62 people responded to the invitation to participate in the evaluation of FoL TEE experience. Of the 62 participants, 45 were visiting the Island while 17 were local residents of the Island. Of the 45 visitors, 10 completed only the FoL LAMS experience, while 35 completed the whole FoL TEE experience (FoL LAMS +FoL Hypermedia). Of the 17 local residents, 6 completed the first stage only (FoL LAMS) while 11 completed the whole FoL TEE experience. Fifty two participants did the FoL LAMS tour in pairs (26 pairs sharing one mobile device but with individual headphones) and 10 did the FoL LAMS tour by themselves. Of the 52 who experienced FoL in pairs, 40 were visitors and 12 locals. Of the 10 participants who experienced FoL by themselves, 5 were visitors and 5 were locals. For a summary of the study sample see Table 6-2.

Table 6-2 – Details of the participants samples for the FoL TEE Evaluation

	Visitors	Locals
FoL LAMS Only	10	6
Complete FoL TEE Experience	35	11
Pair Experience	40	12
Individual Experience	5	5
Sub-total by sample	45	17
Total Participants	62	

6.4.1 Visitors: Sample Characterization

Regarding the visitors' age ranges: 15 participants were aged between 18-24, 15 participants between 25-34, 7 participants between 35-44, 6 participants between 45-54, and 2 participants between 65-74.

Their native languages were: Spanish (17), English (4), Portuguese (3), Romanian (5), Polish (3), Italian (3), Finnish (2), German (2), Tagalog (1), Bulgarian (1), Georgian (1), Russian (1), French (1), Greek (1), and Thai (1).

Regarding their experience with smartphones: 7 participants had low experience, 17 average experience and 21 participants high experience. Concerning their experience with location-based tours: 25 participants had a low experience, 19 average experience and 1 participant high experience. Although most of our participants had a lot of experience with smartphones, they were not experienced in location-based tours (see Figure 6:4).

Regarding their travel profile: the majority of our participants (28) considered themselves as tourists who try to interact with locals in their travels (see Figure 6:4). 9 participants had only been in Madeira for less than 2 days, 11 for 2-3 days, 4 for 3-4 days, 4 for a week, 2 for 2-3 weeks, and 15 for more than a month. When asked about the full duration of their stay, 3 participants were staying for 2-3 days; 11 for 3-4 days; 12 for 1 week, and 19 for a longer period of more than 1 month.

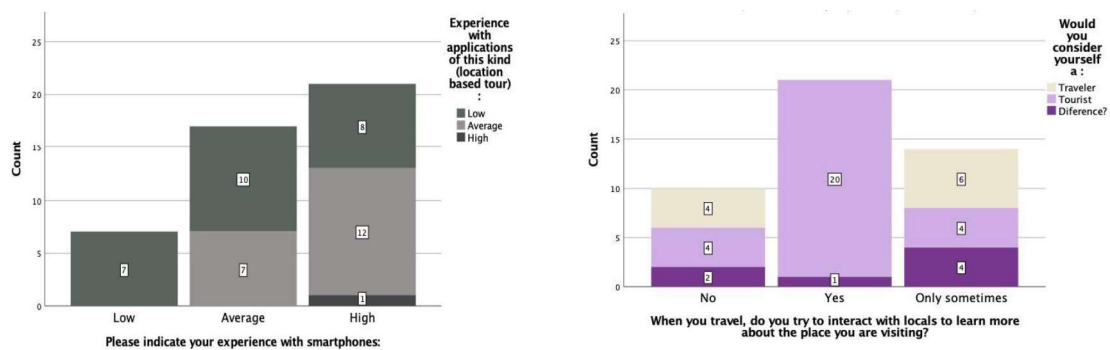


Figure 6:4 – Left: Participants’ experience with technology; Right: Participants’ travel behaviour

6.4.2 Local Residents: Sample Characterization

Of the 17 local residents who participated of our study, 4 were aged between 18-24, 6 were between 25-34, 5 between 35-44, 1 participant was between 45-54, and 1 was between 65-74.

Regarding their experience with smartphones: 7 average experience and 10 participants high experience.

Concerning their experience with location-based tours: 10 participants had a low experience, 7 average experience.

6.5 Results from the Visitor Participants

This section outlines the results obtained from the group of visitors who experienced the FoL TEE and is divided into four subsections. The first three sections report the quantitative results from the three different evaluation stages of the experience, after the FoL LAMS, after interacting with the FoL Hypermedia platform and then the results from whole FoL TEE experience. The last section presents the qualitative results from the thematic analysis of the interviews at the end of the FoL TEE experience.

As mentioned before (see Table 6-2), some visitors did the FoL LAMS experience in pairs and this was not analysed separately as it was not part of the goals for this evaluation. Hence, the results presented in Section 6.5.1 reflect the visitors total sample of 45 participants who experienced FoL LAMS and the results presented in Sections 6.5.2 and 6.5.3 reflect the visitors total sample of 35 participants who experienced the FoL Hypermedia and the FoL complete experience.

6.5.1 Visitors: FoL LAMS Quantitative Results

Visitors' overall engagement with the FoL LAMS was positive, with most participants agreeing that it was an engaging experience and reporting high median values for the total User Engagement Short Scale (UESS). Looking in detail at the different dimensions of

the UESS, most participants reported the FoL LAMS to be rewarding and enjoyed the aesthetics of its graphics (see Figure 6:5).

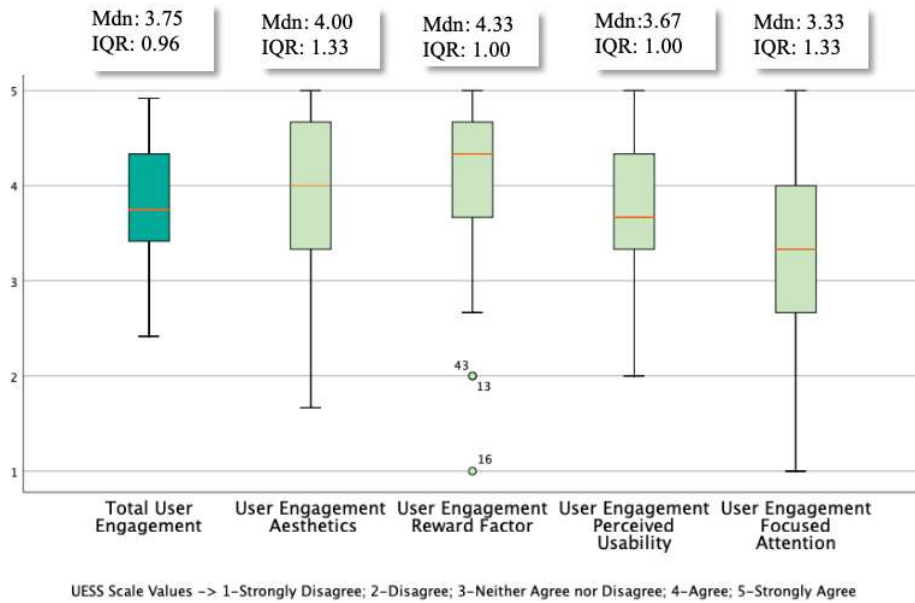


Figure 6:5 – Visitors’ Median Scores and IQR for Total UESS and the four dimensions of engagement: Aesthetics Appeal (AE), Reward Factor (RW), Perceived Usability (PU) and Focused Attention (FA) regarding the experience with FoL LAMS

Participants considered the duration of the FoL LAMS to be ideal (see Figure 6:6, *Duration of the experience* item). They did not feel like it was too demanding, or even difficult based on the average median score reported in the items *Demands of the experience* and *Difficulty experience* (see Figure 6:6).

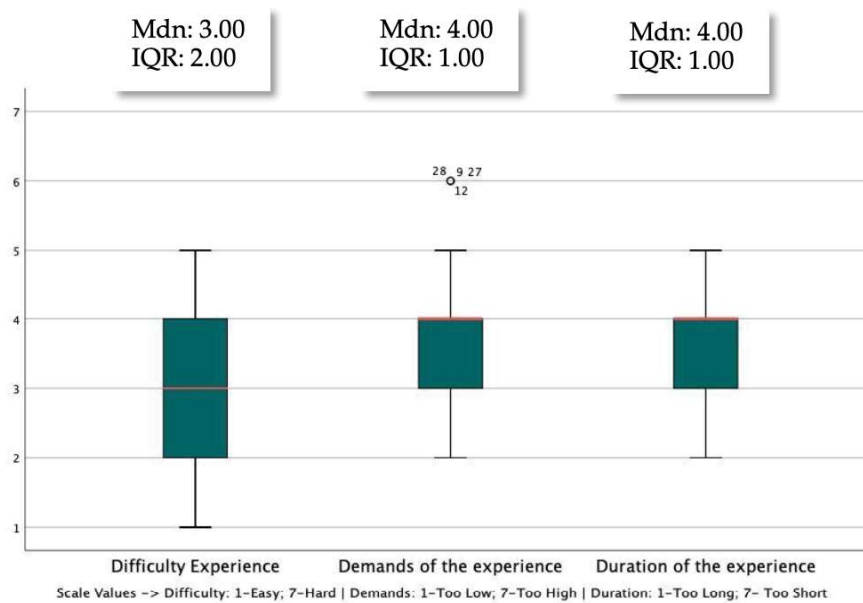


Figure 6:6 – Visitors’ Median Scores and IQR for the single Likert items regarding the Difficulty, Demands, and Duration of the FoL LAMS

Most visitors felt quite involved in the fictional narrative, according to the median score for the Narrative Transportation Scale, Mdn: 5.00; IQR: 1.44 (on a 1 to 7 scale). Furthermore, most participants reported high levels of Presence in the narrative, as measured by the item *Sense of “Being There”* and reinforced by the low median values in real-world awareness. The FoL LAMS enriched the participants’ knowledge of Madeiran culture, as participants reported high median scores in the item *Learn about the Madeira Heritage* (see Figure 6:7).

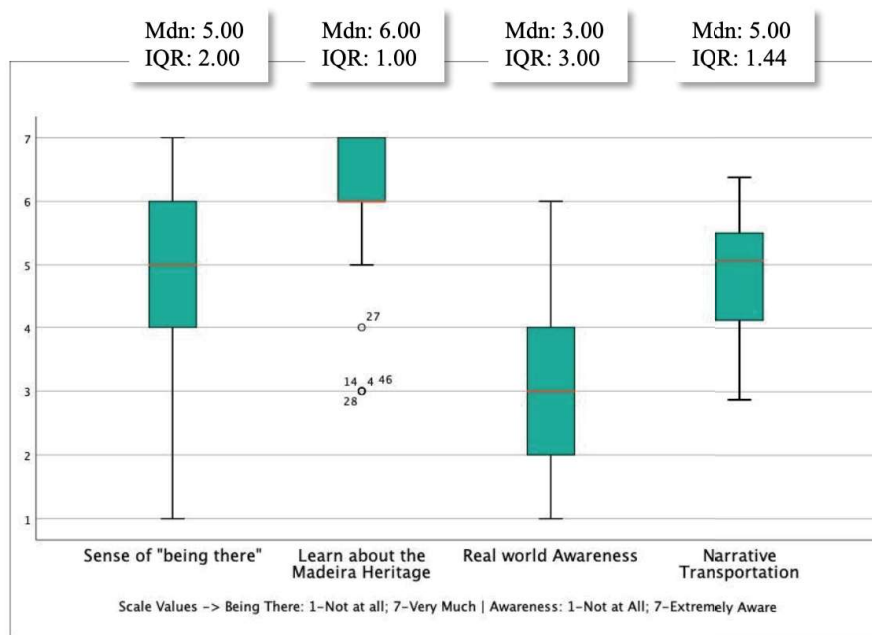


Figure 6:7 – Visitors’ Median Scores and IQR, Narrative Transportation (NTS) with the FoL fictional narrative and Median Scores and IQR for the single Likert items regarding Presence, Learning and Real-World Awareness in the FoL LAMS

6.5.2 Visitors: FoL Hypermedia Quantitative Results

Most participants found the FoL Hypermedia rewarding, fun, and worthwhile, reported as high median scores in the single Likert items: *It was rewarding*, *This was fun*, and, *The visualization of the platform was worthwhile*. The FoL Hypermedia was also perceived as aesthetically and visually appealing, considering the high median scores reported in the single Likert items: *The web platform was aesthetically appealing* and *The web platform was visually appealing*. Furthermore, most visitors mentioned that the FoL Hypermedia content served as an enticement to continue exploring the Islands’ local values (see Figure 6:8).

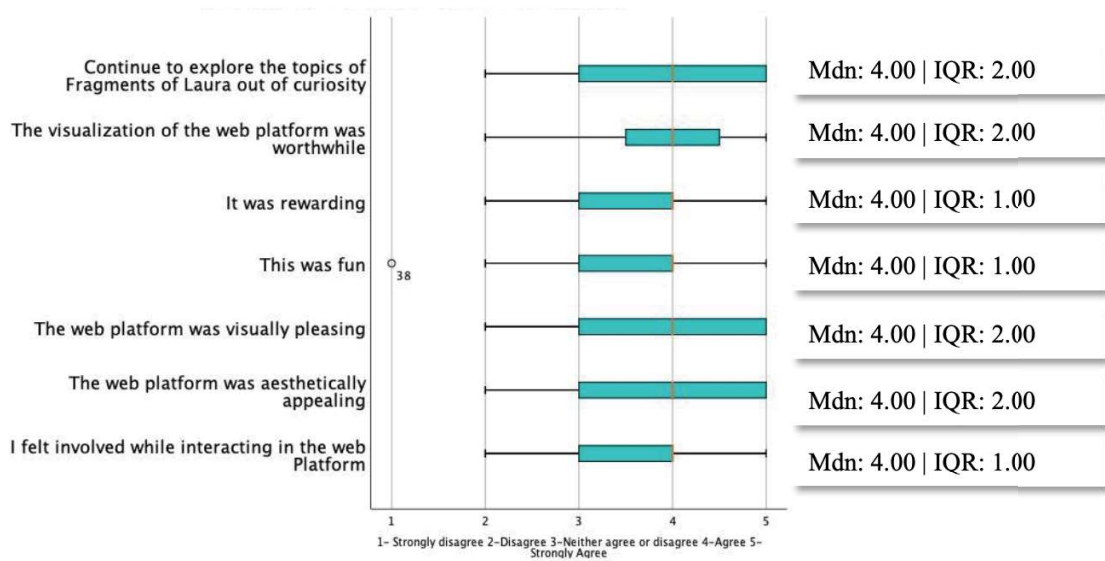


Figure 6:8 – Visitor's Median Scores and IQR for single Likert items regarding *Curiosity, Reward, Fun, Visually and Aesthetically pleasing and Involvement* with the FoL Hypermedia²⁶

6.5.3 Visitors: FoL TEE Experience Quantitative Results (FoL LAMS and FoL Hypermedia)

The FoL TEE experience was considered by participants to be a memorable tourist experience, based on the high median scores for the total score of the MTE scale (Mdn:5.46 IQR:2.00). Participants reported high values in the median scores across the six dimensions related to the travel experience. From the different dimensions, it is important to highlight how the FoL TEE experience was considered refreshing, authentic, and resulted in knowledge acquisition (see Figure 6:9).

²⁶ In this figure the visual representation of the IQR for the item “The visualization of the web platform was worthwhile” is misleading when compared to other items with the same IQR of 2.00, like for example “Continue to explore the topics of Fragments of Laura out of Curiosity” this is due to Mendenhall & Sincich statistical method adjustments. Where $Q1 = L$ th element in the entire set $Q3 = U$ th element in the entire set. $L = (\frac{1}{4})(n+1)$, is rounded to the nearest integer value, however if L falls exactly halfway between to integers, round up; $U = (\frac{3}{4})(n+1)$ is rounded to the nearest integer value, however if U falls exactly halfway between to integers it is round down.

Sources: <https://www.lexjansen.com/phuse/2012/pp/PP16.pdf> and <https://www.ibm.com/support/pages/boxplots-hinges-and-quartiles>

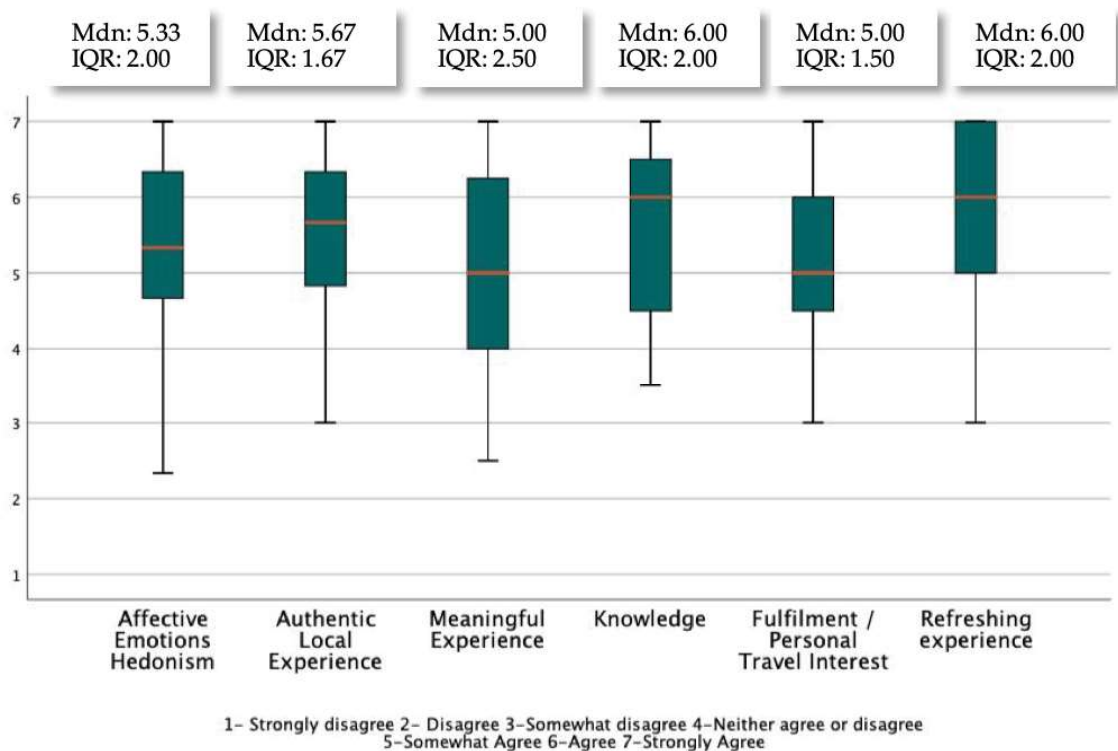


Figure 6:9 – Visitors’ results on the six dimensions that compose the Memorable Tourism Experience (MTE) Scale

To understand to what extent the two distinct yet interconnected components affected the visitors’ experience, Spearman’s rank-order correlations were performed and revealed a strong, positive correlation between MTE scale scores and: 1) FoL LAMS NTS scores (statistically significant [$r = 0.504$, $N=35$ $p = 0.002$]); and 2) User engagement (UEQ) during the FoL LAMS (statistically significant [$r = 0.751$, $N=35$ $p = 0.000$]). This indicates that, the more the involvement in the FoL fictional narrative and the engagement in the FoL LAMS, the more memorable the touristic experience.

Regarding how the Hypermedia component affected the visitors’ experience, the Spearman's rank-order correlations revealed a strong positive correlation between the reward resulting from browsing the web platform and how authentic the experience felt, which was statistically significant [$r = 0.507$, $N=35$ $p = 0.002$]. This indicates that the more the visitors browsed the Hypermedia content, the more authentic and rewarding the FoL TEE experience felt. No other correlations were found.

In general, visitors had a pleasing user experience with the whole FoL TEE experience, reporting high median scores for the pragmatic and hedonic dimensions of the UEQ scale (Figure 6:10 –Top).

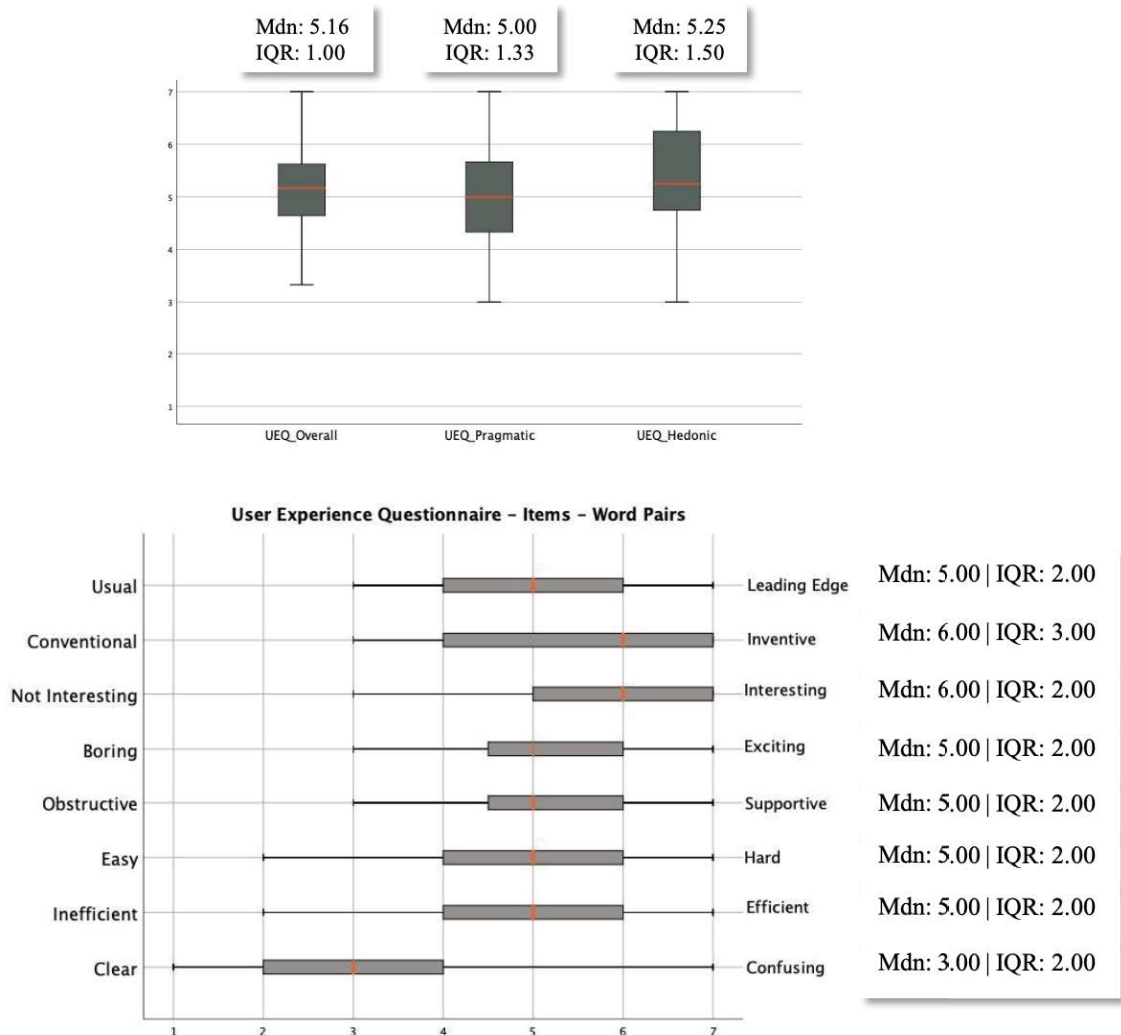


Figure 6:10 – Visitors’ median scores for the UEQ overall scale, Pragmatic, and Hedonic quality (Top); Median score results for each word pair items that compose UEQ

When considering the FoL TEE experience as a whole, low median scores in the items: *Difficulty of Experience* and *Demands of this experience*, demonstrate that participants considered that the level of difficulty and demands experienced were low. Most participants were neutral about recommending the experience to others, as indicated by the average median scores for the single item related to recommending the experience. The majority of the participants reported that they learned about Madeira values through the FoL TEE experience as indicated by the high median scores in the item, “*The experience*

enabled me to learn about Madeira Local Values” (see Figure 6:11). This data is also consistent with high median values in the *Knowledge* item from the previously mentioned MTE scale (see Figure 6:9).

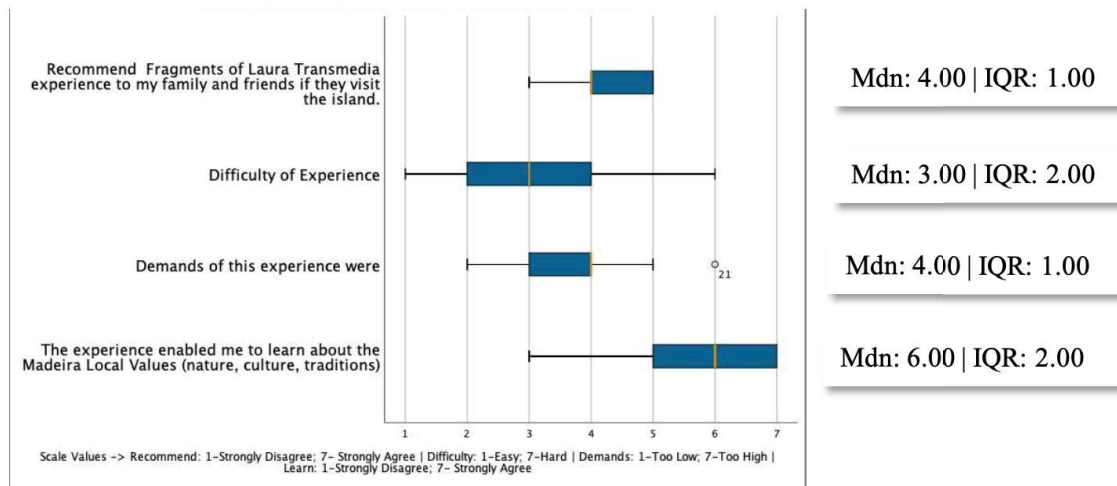


Figure 6:11 – Visitors’ median scores for the single Likert items regarding: Recommending of the FoL TEE Experience to others; difficulty and demands of the FoL TEE; and how FoL TEE experience enabled learning about Madeira local values.

Finally, a Spearman’s rank-order correlation was run to determine if there was a relationship between a tourist’s memorable experience (MTE scale scores) and the overall user experience (UEQ scores). Results indicate that there was a strong, positive correlation between the two, which was statistically significant [$r = 0.566$, $N=35$ $p = 0.000$].

Results show that the FoL TEE experience increased the participants’ knowledge regarding Madeira local values. There was a significant increase in the median scores throughout the three evaluated stages (before FoL LAMS, after FoL LAMS, after FoL Hypermedia) of the TEE experience (see Figure 6:12). A Friedman test showed that these differences were statistically significant $\chi^2(2) = 44.656$, $p = 0.000$. Post hoc analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $p < 0.017$. Furthermore, results show that significant differences occur throughout by interacting with two different components of the TEE experience. Each component of the FoL TEE experience increased the participants’ knowledge of Madeira local values.

There was a significant difference in the Median scores of the MQS, before participants started the FoL LAMS (MQS1_BeforeFoLAMS) and after they finished the FoL LAMS (MQS2_AfterFoLAMS), ($Z = -3.000$, $p = 0.003$). A significant difference was also found in the MQS score before participants started the tour (MQS1_BeforeFoLAMS) and in the MQS score by the end of all the FoL TEE experience (MQ3_AfterHyper), ($Z = -4.930$, $p = 0.000$). Finally, there was a significant difference also in the Median scores, in the Median score after the FoL LAMS (MQS2_AfterFoLAMS) and after interacting with the FoL Hypermedia (MQ3_AfterHyper), ($Z = -4.985$, $p = 0.000$).

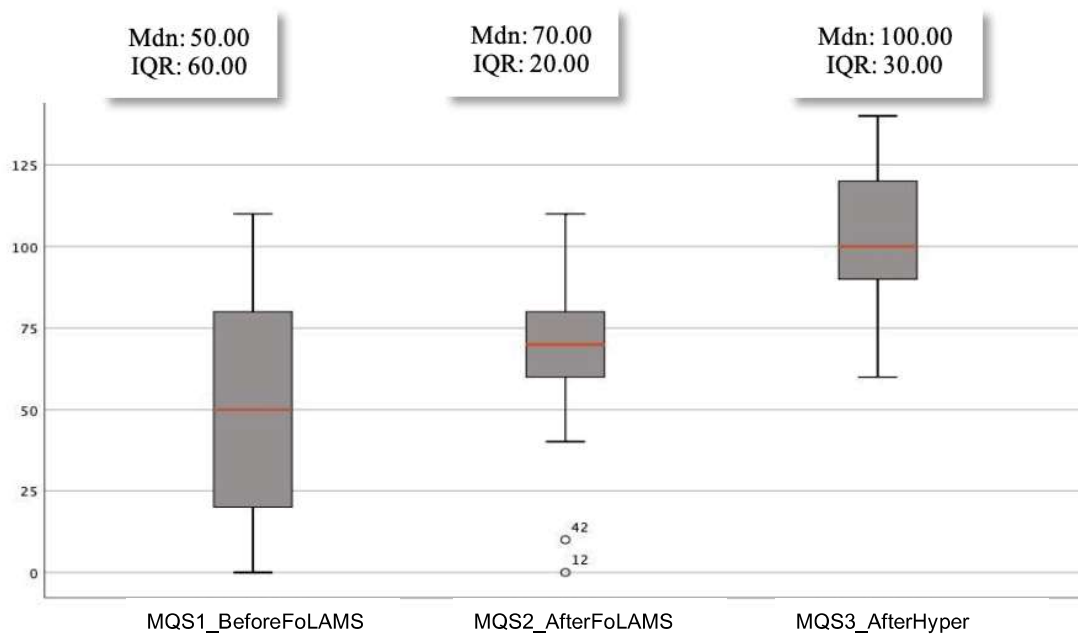


Figure 6:12 – Visitors’ Median Scores regarding the questions about Madeira local values increased across the three different stages of interaction with FoL TEE (MQS1_BeforeFoLAMS: Refers to the Median scores before the FoL Tour; MQS2_AfterFoLAMS: After interacting with the FoL LAMS; MQS3_AfterHyper: End of the experience after participants interacted with the FoL Hypermedia

6.5.4 Visitors: Qualitative Results from the Interviews

The following sections outline the main themes and insights emerging from the Thematic Analysis [BrCl06] of the 45 interviews. The methodology is described in section 6.3. The themes and findings are complemented with illustrative quotes extracted from the participants’ interviews. For practical reasons, each participant quote was assigned a unique

identification code (e.g: **P0VF_0**). The characters before the “_” refer to the id of the participant who the quote belongs to, followed by a letter that indicates if the participant did the full FoL TEE experience, or only the FoL LAMS (example of a quote id: “**P0VF_0**”; where “0” is participant id, “VF” means that it is a Visitors, and they did the Full experience. Quotes without the “F” means that participant only did the FoL LAMS).

FoL LAMS as an immersive experience: Participants appreciated the immersive qualities of the LAMS fiction. Five participants reported in the interview feeling immersed in the experience (e.g.: **P38VF_1**, **P39V_2**). Two participants mentioned how they were focused on the story and lost track of time (e.g.: **P18VF_3**) and 6 participants mention that the FoL LAMS had good duration and walking time (e.g.: **P36VF_4**). Two participants specifically said they wanted the experience to last longer and only 1 participant wished that it was shorter.

P38VF_1: This was an experience where I was really immersed in Laura’s Story (...) you can really be in that time... that is not the present ... you are really there.

P39V_2: I feel like this is truly an immersive experience, where the user is “hooked”, the user attention is captivated. It allows to go over a series of points following the story.

P18VF_3: Actually, I realized I was here but I was really focused on the story. So that was a cool experience.

P36VF_4: Very informative. Got a lot more knowledge about the Madeira Island. Yeah, I think it was just perfect length not too long, not too short. And the good thing was that there wasn't any uphill climbing... it was all coming down. So that was perfect.

Audience appreciation of the fictional narrative: The story (plot, characters and media production) was praised and appreciated by the audience (e.g.: **P39V_12**, **P10VF_19**, **P11VF_20**). In general, the duration and style of the clips worked well. Participants enjoyed the story, became immersed and emotionally involved (e.g.: **P37V_13**, **P3VF_14**). Nine participants mentioned how they connected with the character at an emotional level. They mentioned how they were invested in the protagonist’s journey and how they rooted for her accomplishments. Two participants particularly mentioned they were “worried about Laura” while watching the last clips of the story (e.g.: **P9VF_15**); Eight participants mentioned that her quest to protect nature was important (e.g.: **P30VF_17**). In particular, 1 participant reported being affected by the gossips because they were criticizing Laura (more details in the subsection below: the uniqueness of the Audio Gossips (e.g.:

P34VF_255); Two participants questioned the open ending of the story and why it did not have a “happy ending” (**e.g.: P34VF_18**). Two participants mentioned that would have preferred a non-linear presentation of the story as they felt it was demanding to follow all the clips in the author established order (**e.g.: P14VF_20.5, P13VF_20.6**).

P39V_12: The illustration and story ... Amazing. We really enjoyed the story a lot!

P37V_13: Yeah. So, I felt the story it was really easy to follow, and it was nice that you could relate to the story. And it wasn't boring. And it was nice that you could like through the story find information.

P3VF_14: But the story was very interesting. Like the beginning was very emotional for me, tragical and it touched my feelings.

9VF_15: I... we kept saying we're afraid she was gonna get burned for being a witch. (Both laughing)

P11VF_16: Quite unusual, and also the narrative it's very unusual... It's something you wouldn't expect as a tourist, (...) to get some fictional story, which is related to this area.

P30VF_17: I will say that Laura is a very brave character. I think she was... well it was an innovation, a woman who was trying to help other people trying to, well, you see the local elements or the local plants and things like that. So she was very brave, intelligent.

P34VF_18: The history is interesting but a closure should be given about what happened to Laura's book with her research.

P10VF_19: You going to want to try to figure out what's real or... in terms of history and story what's fictional?

P11VF_20 (complementing): Yeah. And the way in which the narrative kind of coalesces [fusion between history and story] to get the user experiencing it to learn what you [researchers] want them [tourists] to learn...

P14VF_20.5: (...) you have to follow everything [referring to the story clips] and that's pretty demanding.

P13VF_20.6: I may enjoy more, some non-linear storytelling, with the app running on background and when you are in a specific place on the island... It gives you a very strong haptic feedback and it tells you [referring to the application]: "look around... this is very specific for several reasons."

The uniqueness of the Audio Gossips: Participants appreciated the Audio Gossips feature of the FoL LAMS. Five participants specifically mentioned how they enjoyed the content of the gossip, describing it as something unusual and curious (**e.g.: P11VF_24**). Two participants enjoyed how the gossips captured the essence of living in a small location and related that back to their own cultures. Four participants explicitly appreciated how the gossips tied back with some bits and pieces of the story (**e.g.: P37VF_24, P34VF_25**). However, 10 participants mentioned that the gossips should have had subtitles because they were difficult to understand, especially when compared with the other media assets (**e.g.: P37VF_25, P33VF_26.5**).

P11VF_24: (...) especially these gossips were quite unusual but really cool idea, which I didn't quite get why they were there. So, some things were great in general, but then they didn't really serve some

purpose. Or either they serve as purpose; they were not evident to us. **P10VF**: Yeah, I love the idea, but like it didn't quite get the full grasp...

P37VF_25: I think the gossips were nice I'll say it was giving a different perspective to the story itself. – You know, the rumors kept spreading. It was nice, is kind of triggered this... like moral discussion. The only problem I think with the clips, like especially, I mean, especially with the rumors, that it's a bit hard to tell which one of the characters is like [speaking], especially with 2 females characters, when they're not animated [the gossips as media were not animated, just a static image with overlaid audio].

P34VF_26: Also, I got really frustrated using it when listening to ALL THOSE GOSSIPS, I was like “Oh this people hate her so much I want to listen to this shit. (Laughing) It was so... Annoying, it's like when you're watching TV series and your favourite character dies or something... “Ah f*ck I'm not watching this anymore, what's the point?” It was like really really like playing on my emotions, I was like “Noo!”

P33VF_26.5: Was it intentional that some of the clips did not have subtitles? [referring to the audio clips] they should be added, since sometimes it was hard to understand them.

Multimedia Pop-up Windows: This feature was seen as a way to engage visitors with the physical surroundings and the local community perspective. The two different kinds of Multimedia Pop-ups that enriched the FoL LAMS component of the TEE were highly appreciated by the participants. Six participants enjoyed how the introductory text-based pop-ups gave hints regarding where and what to do in the location (e.g.: **P16VF_27**, **P17VF_28**). Regarding the post-story pop-ups, 10 participants reported them being an excellent complement of the fictional story (e.g.: **P7VF_29**). Participants particularly liked to listen to and connect with the locals as it fuelled their curiosity towards specific local issues (e.g.: **P3VF_30**). However, 9 participants reported the synthesis of the video interviews being too light in information. Participants wanted more factual information (e.g.: **P18VF_31**, **P34VF_32**, **P38VF_33**). Two participants mentioned that they skipped the interviews' previews because they wanted to focus on the story and watch the local community content later. Two participants explicitly mentioned that they might not remember to look up the local community interviews after the mobile story experience finished (e.g. look at the website or in the library of the application).

P16VF_27: You know, what I liked when there was that comment that in front of you there is a bench.

P17VF_28: Oh yeah, that was so cool. We were like OMG!

P7VF_29: And it was very interactive that we had the little stories [referring to “extra content pop-up” of the website videos] as well, which were very nice to learn new stuff. **8VF**: Yeah. Because we were seeing the place [landmarks], like for example the threats [floods and wildfires – referring to natural disasters' topic], the little story [“extra content pop-up”] was helping us to introduce us to these threats for example.

P3VF_30: I think we were more involved into this comic story rather than scientific. **P4VF**: Yeah. 1: But in some moments I wanted [to learn more scientific matter] ... because there was this icon “if you want to learn more” ... and I wanted to do this. So, it means that it made me more curious about

something. **P5VF**: Also, it was nice to see local people, like, I always wonder about people. **P3VF**: Yes, that was also nice. **P4VF**: It made like, ahh she [interviewee] is local, what she will say [curious to learn]!? That was very interesting.

P18VF_31: I was a bit surprised that the videos were so short because I expected since they were not in the tour that they would be longer. I expected more details. But I really enjoyed them especially because it was local people telling about stuff

P34VF_32: I think the teasers are too short in the app.

P38VF_33: I value information, don't know about the rest of the tourists, but I like information. Either 3 minutes or 30 seconds about the little Bird or the forest, it was great. But I know that not everyone is like that...

360° Mixed Reality touchpoint - The Pharmacy: Participants had very different opinions about The Pharmacy. Ten participants explicitly refer to it as their favourite touchpoint, as the most exciting part of the experience (e.g.: **P36VF_37**, **P18VF_38**), while other 7 participants did not like it (e.g.: **P11VF_39**). Participants who really liked it enjoyed the visuals, discovering the ingredients, and how to interact with them. Hesitant participants mentioned that they did not enjoy playing games and, therefore, the VR environment (which interactions are modelled after a 3D game) was not appealing for them. Six participants mentioned that the interaction was hard to understand (e.g.: **P16VF_40**, **P34VF_42**). Four participants mentioned that The Pharmacy would be more appealing for a young audience (e.g.: **P20VF_43**). Most participants agreed that the interaction with the 360° MR environment could be improved in terms of the instructions given and some interaction aspects.

P36VF_37: I mean the whole 360° thing [referring to the pharmacy MR scene] was really cool and it worked very well. Yeah. The whole thing worked very well.

P18VF_38: So that was really really cool... And a bit unexpected. Because then you start acting. But it was really cool and I really enjoyed it. But I also got a bit confused because I thought it was mainly about picking up the objects for the Poncha. But then I realized there were also other items which you can touch to hear about them, which is cool but it was a teeny tiny bit confusing.

P11VF_39: Hmm... It's I mean it felt a little bit like it was a draft experience so it didn't quite make it... So, it's a cool idea that you could pick up ingredients [explore elements] and put it together [have a goal] (...)But it was a bit of experience it felt like it was made for kids rather than for grown-ups.

P16VF_40: It was not explained at all. Like I saw the recipe, we actually took a picture to have it, for later. And then, or maybe I didn't read it [instructions] completely but I didn't expect that from there [pharmacy] I have a task to do.

P34VF_42: It was very hard to navigate with Laura through the pharmacy... we were like... hitting the wall.

P20VF_43: There was something that I did not like, the Poncha video game. I did not enjoy it. It would be interesting to know if I did not like it because I'm 46 and maybe people with 24 years like it a lot?

Use of map-based interfaces in the urban space: In general, participants found the mobile application easy to use. However, 13 participants complained specifically about the interaction with the map and had difficulties in orienteering themselves because of the GPS inaccuracies (e.g.: P36VF_35, P34VF_36). Six of these participants mentioned that they already struggled with normal maps and applications involving maps. Suggestions from users pointed in the direction of drawing more similarities to the Google maps “driving mode” where the application would also give audio directions. Four participants mentioned that they felt “lost” at some points, 2 users saw this as an opportunity for further exploration of the city. Finally, 8 participants reported concerns with the traffic while exploring the city street with the application. Three participants also mentioned that the first moments of interacting with the application were more laborious, as they were unfamiliar with the concept of interacting with a LAMS. Nevertheless, the interaction became easier after becoming familiar with the sequence of tasks to perform (e.g.: P4VF_34).

P4VF_34: ...I wasn't sure how the story would progress, where it's going, so at the beginning I found it quite difficult to follow but after maybe two or three videos then I kind of just found what and the concept behind it. Then it got quite easy to follow.

P36VF_35: Well. I think that maybe the format the actual phone, the map was a bit disoriented at times. And it wasn't functioning all the time but ... But other than that it worked.

P34VF_36: With the map, we had some trouble because the GPS was sometimes inaccurate. And there was no other way of unlocking it. The sound guide or the audio gossip, so It was like we had to walk around and try to figure out what was the inaccuracy of the GPS. And try to compensate.

FoL LAMS Pair Experience: Experiencing FoL LAMS in pairs allowed participants to balance and share skills. Participants without “orientation skills,” for example, were glad to do the tour with someone else that could handle that aspect (e.g.: P39V_44). On the other hand, pairs of users complained about several shortcomings. Four participants who did the experience as 2 pairs mentioned that walking side-by-side in narrow streets while sharing a phone and wearing headphones was difficult. (e.g.: P13VF_46). Participants who did the experience in pairs stated that 1 participant was taking a more “active” role than the other. Three of these participants who were cast in a “passive role” “complained” about this, since they would not feel the vibration of the phone, for example, and had to ask the partner if they were close to a location with story content (e.g.: P32VF_45).

P39V_44: If it was up to her [pair], we would still be up there [lost behind] (laughs) 38VF: Each person has a different sense of orientation. Between the 2 of us, we were able to manage things well, but I think that if I was alone, I would be able to finish without a problem, I think the app is well developed in that sense.

P32VF_45: Since we were 2, I had to ask several times, are we close? Did it vibrate?

P13VF_46: (...) most of the time you have, like quite narrow sidewalks... So if other people come you have to go in the line, but then if you have headphones, you have to put headphones on headphones off.

The FoL Hypermedia component: All participants appreciated the FoL Hypermedia component of the TEE experience. They appreciated how the interviews with the locals allowed them to access facts and scientific content (**e.g.: P14VF_48**). Five participants mention how the fictional story and the interviews with locals strengthen each other (**e.g.: P32VF_49**). Eight participants mentioned how they liked the fictional story but also felt the need to access facts (**e.g.: P17VF_50, P10VF_51**) while 2 mentioned preferring it to the mobile fiction (**e.g.: P13VF_47**). Participants appreciated how the hypermedia portal enabled a connection with the locals and getting to know more about the local reality through the interviews. Fourteen participants mentioned the value of having access to the local community's point of view, and their different perspectives presented side by side. Participants felt empathy towards the locals and their stories. In general, participants mentioned that the interface, layout, and content organization of the FoL Hypermedia, was easy to follow (**e.g.: P7VF_52, P3VF_53**). Users enjoyed how the scientific information was delivered in a summarized and engaging form (**e.g.: P15VF_54**). Two participants mentioned that they had little time to explore the content of the FoL Hypermedia portal.

P13VF_47: I think I liked the website more than the tour experience,
P14VF_48: And so yes, I enjoyed the site much more because it actually contains some elements about the island culture I didn't know, for example, some cultural elements about her local herbs and that and so on, which I tried to ask people but these are kind of knowledge that at least in Funchal is kind of lost.
P32VF_49: I think that it [referring to the LAMS and web platform] can work separately, in fact just the website itself works, and just the mobile app works. But I think that the two works better. In the tour you are dividing the attention between the story and being outside [outdoor], so one [LAMS] complements the other [web platform].
P17VF_50: But I think it is connected [mobile story and website locals' interviews content] anyways. The same style it's just that when you have these short videos with the science, this, it's like it makes you want to hear more because that was science. It was not the storytelling, so that was like the truth, let's say... So for me, I was looking forward to see all the videos. Because I'm interested, maybe.
P10VF_51: (...) I think what you want from it [purpose of the experience], as far as I understand, is the stuff where you explore on the website and that I find fascinating. That really it's really great to learn all of that stuff we see... P11VF: The videos are great, the people are great! P11VF: Yeah people are great. Yeah. And the way in which that narrative kind of coalesces to get the user experiencing it to learn what you want them to learn... For me the Web content, which you get the snippets, within the experience but it's that content that's really interesting. But that might just be me and maybe I'm a bit of a bastard in that way. P10VF: Yeah, no I agree. P11VF: And I just know, again "get me to the facts"!
P7VF_52: Easy to follow [navigate the website] and I like the part with the locals. I just pressed and you had the little icons guns, and I just pressed locals [interviewees] and I saw like, you know, a botanist, a historian or something [local experts], it was really interesting. 6VF: I think it's very good to get to know the people from here.
P3VF_53: Very nice, very clear. 1VFYeah, clear... I think that first having the text then you have video [referring to the web page content organization] ...
P15VF_54: I think they [extra content videos] are very helpful because they are, they add more information and if you feel curious about the topics you can find more there. And it's also interesting to have different points of view, not from the scientist but also local people. So, you can learn much more about what's going on, about the Laurisilva and things like that.

FoL TEE as a learning experience about the local culture: Participants found the FoL TEE experience a different and useful way to get to know their destination's local values, and they learned things that are not normally found in the tourist guides (e.g.: **P34VF_22**; **P10VF_21**). Furthermore, 20 participants expressed how they enjoyed the entertaining way information was presented (through the fictional story or the interviews with locals), as distinct from a long textual description (e.g.: **P31VF_21.1**, **P31VF_21.2**). Four participants also mentioned that this was a good way to deliver the first overview of Madeiran culture (e.g.: **P16VF_23**). Participants enjoyed the combination of the fictional with the factual and hearing the perspectives of the locals.

P10VF_21: I think well done. It's really interesting, it's not really... well, it's outside the box [referring to FoL TEE]. P11VF (continuing): Absolutely. I've never actually experienced anything quite like that. So... P10VF: I think it's very carefully (thought)... P11VF(continuing): Yes, it is. Yeah absolutely.

P29VF_21.1: So this provides an easy and pleasant way to introduce people to the culture.

P31VF_21.2: I think it's important to reach people who are not so instructed, who are not going to study 20 pages of this information... so the clips are very good, are summarized and easy

P34VF_22: OK, So I think it was completely different than all the tourist stuff, I actually wrote that in the survey as well. Like you learn things that no tourist guides would usually tell you, I guess. So about the fauna and like people were cutting off trees, like, this is not very good things about the residents of the island, like the local culture but you still learn about it. So I think that's very valuable.

P16VF_23: (...)Then, when you go in the actual nature then you can say "Oh yes I remember!!", We can do this in the forest, or this happened here...

Suggestions regarding the FoL TEE target audience: Some participants, adults aged between 20-35 years-old, expressed concerns about how older generations might not appreciate using this kind of technology. At least 4 participants expressed concerns about how older adults might not be able to interact with it (e.g.: *P16_9*). On the other hand, 4 participants suggested that this sort of experience would be appealing for a young audience and schools, even more so if some gamification elements were added (e.g.: *P20_10*). On a similar note, 2 participants expressed how the interaction in The Pharmacy would be cherished by gamers (e.g.: *P23VF_11*). Note that most participants (30) had ages below 44 years old, with the oldest (2) being between 65-74.

P16VF_9: And also, [tourism in Madeira Island] it's mostly older adults. So, I don't know their perspective on this [referring to how older adults might struggle with the type of technology used in the FoL Tour].

P20VF_10: As a teacher, I would do this tour with students, (...) then I would use this in classes... this educational material for teenagers, is great. [Referring to if he brought his students to a field trip in Madeira]

P23VF_11: And one more thing to make it even more appealing to younger people for instance on the map, on the interactive map, every time you passed a certain place you got a tick... So instead of that maybe like something written like "Well done now you have done this, let's move on" [add gamification and reward elements] ... like an incentive [based in a scavenger hunt]

Opportunities for refinements: Several opportunities for improvements of the FoL TEE were highlighted by the interviews. Four participants mentioned that they would appreciate more specific and factual information about the landmarks and locations visited along the tour. In particular, they wished to know how and if the locations mentioned in

the story can be visited, the cost of tickets, schedule, history (**P34VF_7**). Two participants mentioned they would like more interaction between the content, application, and physical elements in the locations. It was suggested to add more Augmented Reality interactions (**e.g.: P39V_8**). Interesting to note is that at least 6 participants mention that they felt rushed to finish the tour because of the research study nature and set up. Some of them expressed the wish to spend more time at the locations exploring and even visiting the museums along the way (**e.g.: P9VF_5, P29VF_6**).

P9VF_5: *We were thinking, "oh they're following us"*

P29VF_6: *So, I missed [wanted] the feeling of enjoying the surroundings and views, without someone following us [shadowing]... you know? Because I know, we also have limited time [feeling rushed]... I would have to go back to experience [it] at ease.*

P34VF_7: *It would also be nice like to have more information on the places we visited like... the palace. Like Laura came here because something was here or yeah, some kind of background related... because like this garden place was actually really nice and I didn't learn anything about it, the garden or palace or something.*

P39V_8: *Maybe add another location, where we see something digital overlaid in reality, like for example the bis-bis bird we could do something and see him in the window of one of the houses.*

6.5.5 Results from the Local Resident Participants

This section presents the evaluation results from the local resident participants interaction with the FoL TEE. It is divided into four subsections: the first section reports the quantitative results from interaction with FoL LAMS; the second section reports on the interactions with the FoL Hypermedia; the third section summarizes results from the overall FoL TEE experience; the fourth section presents the qualitative results from the thematic analysis of the local participant interviews after completing the evaluation.

6.5.5.1 Local Residents: FoL LAMS Quantitative Results

Local participants were quite engaged with the FoL LAMS. Scores from the User Engagement Short Scale (UESS) were quite high. Looking across the different dimensions of the engagement scale, it is possible to see that all of them present quite high median values (see Figure 6:13).

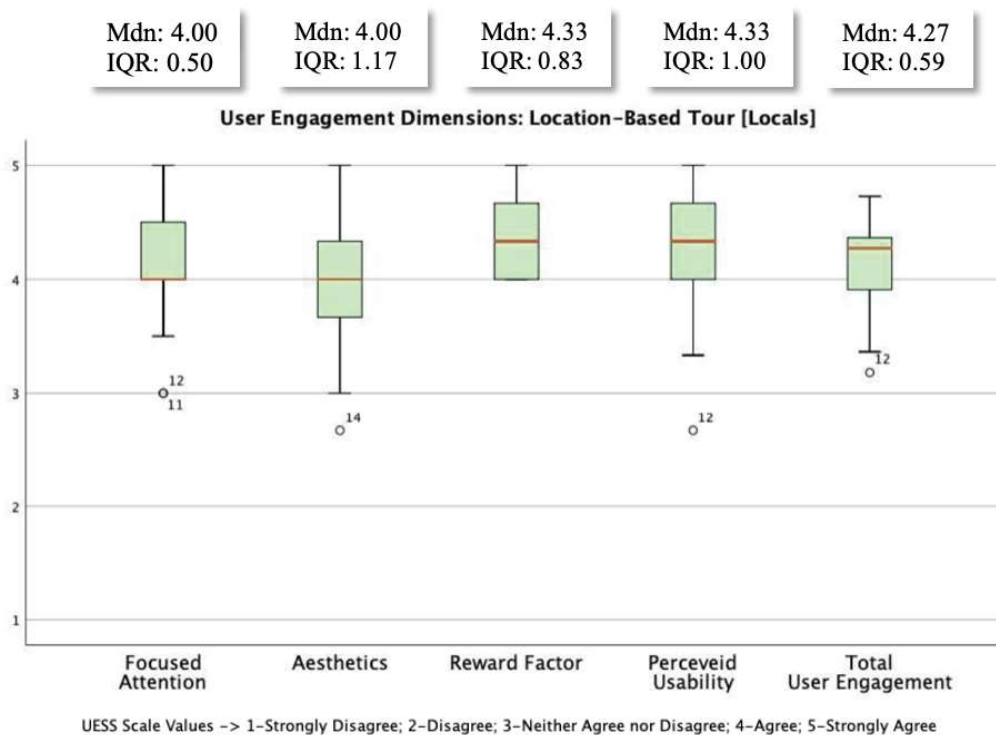


Figure 6:13 – Locals Median Scores and IQR for the four dimensions of engagement: Focused Attention (FA) Aesthetics Appeal (AE), Reward Factor (RW), Perceived Usability (PU) and Total UESS score regarding the experience with FoL LAMS

Even though the participants were locals, the high median score results show that participants felt that the experience enriched their knowledge of Madeira heritage and culture (see Figure 6:14, first box-plot).

According to the fairly high median scores from the Narrative Transportation Scale (NTS), most locals were involved to some extent in the FoL fictional narrative (see Figure 6:14, most on the right box plot). Furthermore, most local participants, while experiencing the story, felt involved in it. This is supported by the reported somewhat high median scores on the indicator for Presence in the narrative world, measured by the item *Sense of “Being there,”* and reinforced by the lower median values of the *Real-World Awareness* item (see Figure 6:14, middle box-plots).

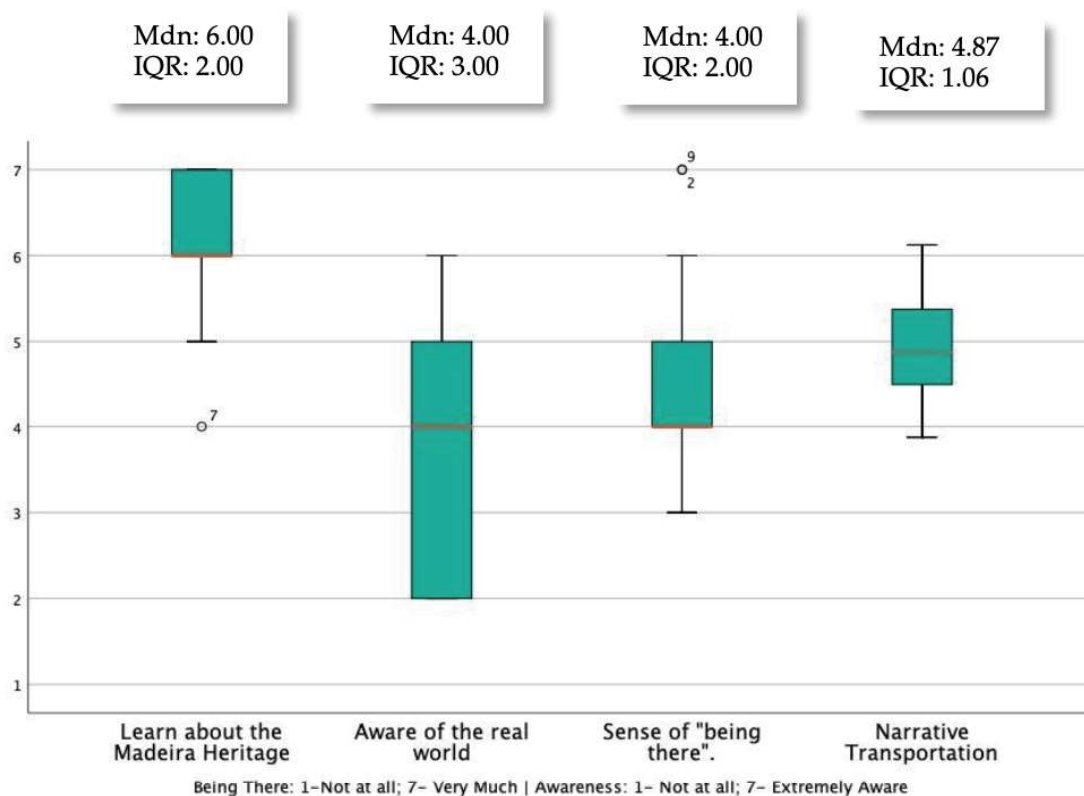


Figure 6:14 – Locals’ Median Scores and IQR for the single Likert items regarding Learning, Real-World Awareness, Presence, and Total scores for the NTS scale.

The FoL LAMS experience was not demanding, nor difficult, as highlighted by low median score values reported by the participants in the items regarding *Difficulty* and *Demands of the experience* (see Figure 6:15, first two box-plot items). Furthermore, for most locals the duration of the FoL LAMS was ideal, according to the average median score in the item, *Duration of the experience* (see the last box-plot in Figure 6:15).

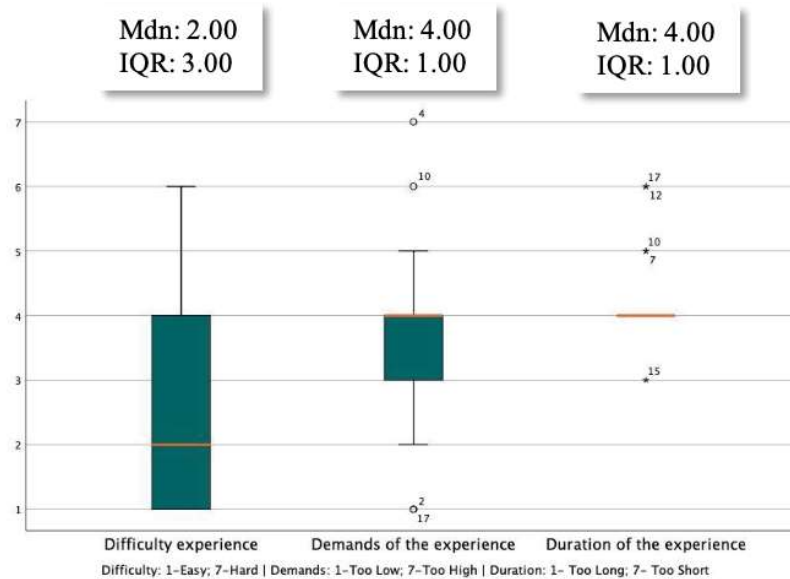


Figure 6:15 – Locals’ Median Scores and IQR for the single Likert items regarding Difficulty, Demands and Duration of the FoL LAMS

6.5.5.2 Local Residents: FoL Hypermedia Quantitative Results

In general, local participants found the FoL Hypermedia rewarding, fun, and worthwhile, as they reported high median scores in the items: *It was rewarding*; *This was fun*; *The visualization of the platform was worthwhile*. The FoL Hypermedia was also perceived as aesthetically and visually appealing, considering the high median scores reported in the items: *The web platform was aesthetically appealing*; *The web platform was visually appealing*. Furthermore, locals mentioned that the FoL Hypermedia content served as an enticement to continue exploring their own culture and the Island’s values (see Figure 6:16).

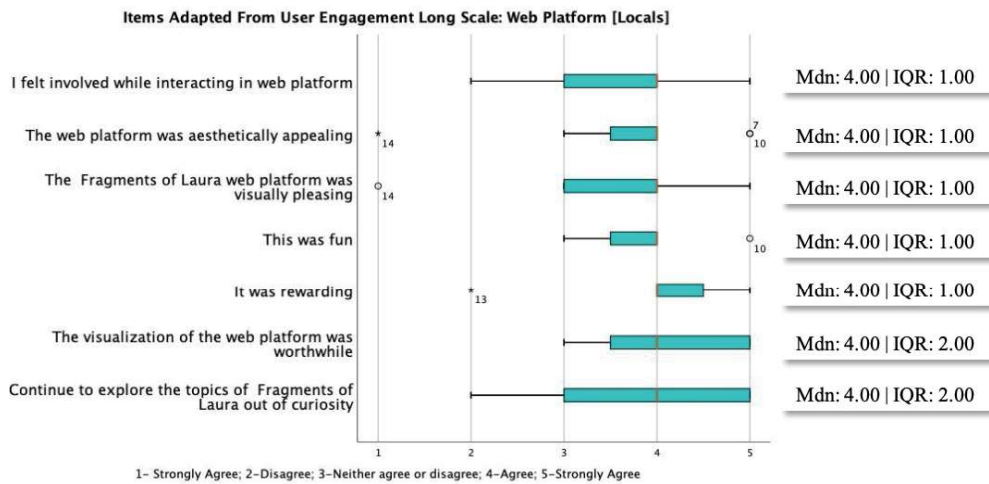


Figure 6:16 – Locals’ Median Scores and IQR for single Likert Items regarding: Curiosity, Reward, Fun, Visually and Aesthetically Pleasing and Involvement with the FoL Web Platform

6.5.5.3 Local Residents: FoL TEE Experience Quantitative Results (FoL LAMS and FoL Hypermedia)

Examining the User Experience Questionnaire (UEQ) results, we can see that locals had a pleasing experience with the FoL TEE experience, as median scores for the overall user experience as well the pragmatic and hedonic dimensions are high (see Figure 6:17 – Top). Furthermore, Figure 6:17 – Bottom, shows the results for the median scores reported in the eight antagonistic adjective pairs. From these word pairs, FoL TEE stands out as being inventive and interesting (see Figure 6:17 – Bottom).

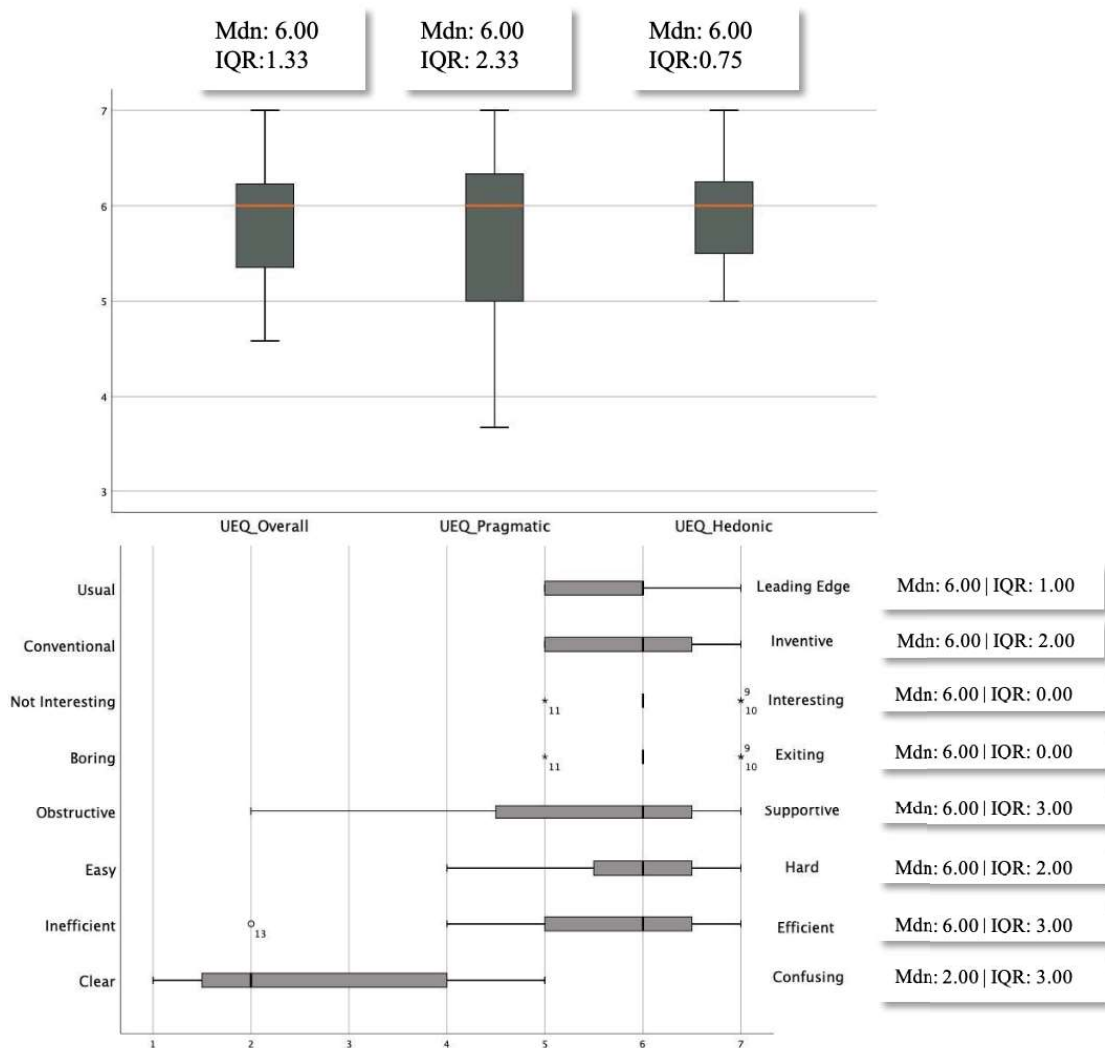


Figure 6:17 – Top: Locals’ Median Scores and IQR for the UEQ overall scale, Pragmatic and Hedonic quality; Bottom: Median score results for each word pair items that compose UEQ

The high median scores in the item, *Learn about Madeira local values*, supports that the FoL TEE experience enabled the majority of the participants to learn further about Madeira values they were not aware of. The results present low median scores for the items evaluating demands and difficulty, so the FoL TEE experience did not present itself as too demanding or difficult. Average median scores in the item *Recommend FoL to my family (..)* reveal that most local participants felt impartial about recommending FoL TEE experience to others (see Figure 6:18).

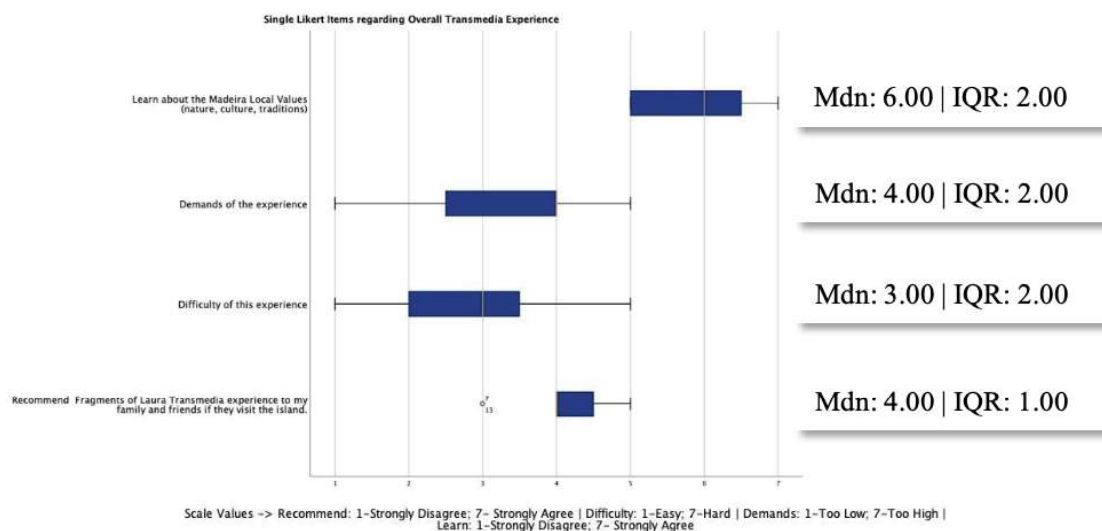


Figure 6:18 – Locals’ Median Scores and IQR for the single Likert items: How FoL TEE Experience enabled learning about Madeira local values; Demands and Difficulty of the FoL TEE experience and likelihood to Recommend FoL TEE to others

Results show that the FoL TEE experience increased the local participants’ knowledge regarding Madeira local values. This was supported by a Friedman test to understand if there were differences in the obtained scores in *Madeira Question Scale (MQS)*. The test revealed that there was a significant statistical difference in the *MQS* scores during the different stages (before FoL LAMS, after FoL LAMS, after FoL Hypermedia) of TEE experience $\chi^2(2) = 9.750, p = 0.008$ (see median scores and IQR in Figure 6:19). The Friedman test (and the median scores) indicates that, in each of three evaluated stages, the participants’ knowledge of Madeira local values increased. Post hoc analysis with Wilcoxon signed-rank tests was conducted (with a Bonferroni correction applied, resulting in a significance level set at $p < 0.017$) to understand if the difference was statistically significant across all three stages. Results show that there were significant differences in the scores *MQS1_BeforeFoLAMS* and *MQ3_AfterHyper* ($Z = -2.393, p = 0.017$), and in the scores *MQS2_AfterFoLAMS* and *MQ3_AfterHyper* ($Z = -2.401, p = 0.016$). However, there was no statistical difference between *MQS1_BeforeFoLAMS* and *MQS2_AfterFoLAMS*, indicating that, the new knowledge acquired by locals about Madeira was mostly due to the watching of the FoL Hypermedia component.

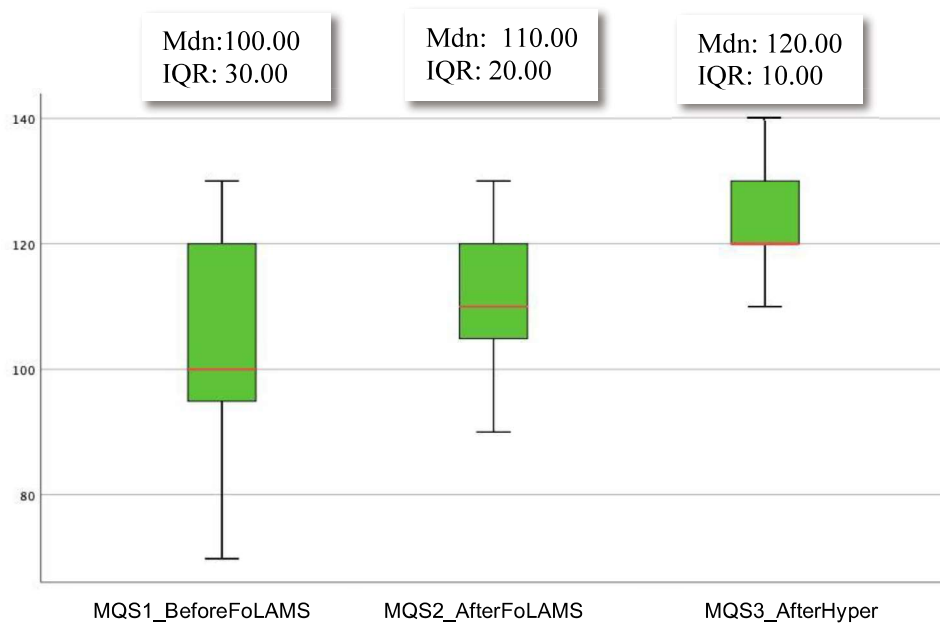


Figure 6:19 – Locals’ Median Scores regarding the questions about Madeiran local values increased across the three different stages of interaction with FoL TEE (MDS1_BeforeFoLAMS: Refers to the Median scores before the FoL Tour; MDS2_AfterFoLAMS: After interacting with the FoL LAMS; MDS3_AfterHyper: End of the experience after participants interacted with the FoL Hypermedia).

6.5.6 Local Residents: Qualitative Results from the Interviews

The following sections outline the main themes and insights emerging from the thematic analysis [BrCl06] of the 17 interviews conducted with the local participants. The description of the themes is complemented with illustrative quotes extracted from the participants’ interviews. Each participant quote was assigned a unique identification code (e.g.: **P0LF_0**). The characters before the “_” refer to the id of the participant who the quote belongs to. Where **P0** is participant id, **LF** stands for **Local** and **Full** experience, an id without the **F** means that participant did not complete the FoL TEE (not interacted with the FoL Hypermedia). Finally, the characters after the “_” represent the quote id).

The Pharmacy generated surprise: 360° MR touchpoint triggered a surprise effect and resulted in positive feedback from several participants (e.g.: **P15LF_9**). Although 5 participants reported having some difficulties with the interaction, especially at the beginning, they also agreed most of those problems can be solved if better instructions are given and a few interaction aspects improved (e.g.: **P17LF_10**).

P15LF_9: *I think that the pharmacy was very well done.*

P17LF_10: *At first is a bit difficult, the first contact, but then it was easy to interact with it.*

Multimedia Pop-up Windows from FoL LAMS worked as a curiosity trigger to browse the interview content on the FoL Hypermedia: The extra content videos presented in Multimedia Pop-ups after the story, aroused curiosity among most local participants, especially regarding the videos depicting popular knowledge. However, 2 participants mentioned that watching all the previews of the video interviews can become overwhelming and that they preferred to continue discovering the fictional story (**e.g.:** **P16LF_5**). Similar to the visitor's feedback, most local participants also felt that the video interviews were too short. Four participants mentioned that the information from the interviews might be relevant only for foreign visitors and that as locals, they probably would not end up exploring the (web) content after the story part of the experience had ended (**e.g.:** **P17LF_6**).

P16LF_5: Regarding the video teasers, I felt like it sometimes it was too much information. (...) We wanted to move forward in the story so sometimes we skipped it.

P17LF_6: I think that the video teasers are good specially for people who are not from here, for example the Poncha video we skipped because we already knew about it. But I think it is useful for people who don't know and want to know more.

Opportunities for improving FoL LAMS: Four local participants had some difficulties orienting themselves with the map, whether struggling with the inaccuracy of the GPS, or manipulating the map itself. Two participants mentioned some confusion with different types of interaction between the three different types of media; e.g., the blinking of the icons or double-clicking to open the content (**e.g.:** **P13LF_4**).

Participants felt there is an opportunity to add further exploration of the physical landscape. Two participants missed the physical connection of exploring the buildings because they were too focused on the mobile phone (**e.g.:** **P9LF_7**, **P17LF_8**).

P13LF_4: About the overall experience sometimes it was hard to navigate through everything and it was hard to understand the interface.

P9LF_7: I noticed that while we were walking, often we were looking more at the phone to check the map than to the surrounding buildings...maybe this was because we were from here... so we already knew the locations...

P17LF_8: It would be interesting to find certain elements along the path and then have people collecting them to use as input in the application, it could be plants or something related .. more as if it was a game.

FoL Hypermedia content as a source of local information: The content on the FoL Hypermedia was described positively, as being visually appealing and interesting in terms of topics (**e.g.:** **P8LF_11**). Five participants highlighted how straightforward the matters arising from the videos are presented, making it easy to learn (**e.g.:** **P7LF_12, 17LF_13**). In particular, 2 participants liked how the content could be selected by the topics they felt more interested in (**e.g.:** **P16LF_14**).

P8LF_11: Although the videos are short, they are highly informative, so it becomes interesting. For example, if people just want to know about the medicinal plants, they can choose to see just that video. People can choose to see what they are interested in, they don't need to see a whole video to get to the part that they are interested in.

P7LF_12: I enjoyed the videos, in particular the ones that have the scientists talking, they go straight to the point and it is easy to learn by watching the videos, the information is good.

P17LF_13: It gives interesting information that I think most of us are not aware of

P16LF_14: Yes. The videos were interesting in the way they explore the themes with experts and local knowledge. The given information was useful since it focuses on aspects that are important to understand and therefore maintain the balance of the ecosystem of the island. Plus, it incited me to deepen some topics.

FoL TEE as a learning experience for locals: Overall, locals learned from the TEE experience. Five locals mentioned how they learned some new facts about some of the landmarks and admitted learning new interesting things related to the Island's culture. FoL TEE was perceived as novel and valuable entertainment and a learning artefact that should be expanded (**e.g.:** **P7LF_1, P16LF_2**). Three participants suggested continuing expand the experience with more interaction points, landmarks, and even other stories. (**e.g.:** **P17LF_3**).

P7LF_1: *I enjoyed it, I have never done anything like this. It was a fun experience and I even learned some things about the region.*

P16LF_2: *I think that the application is well made. I like how it has a story, a connecting thread along a path. Then it gives interesting information about Madeira that most of us probably are not aware.*

P17LF_3: *I think that you should keep expanding, even if it is not this story, but keep following this sort of idea.*

6.6 Chapter Conclusion

In this chapter, the evaluation of FoL as a TEE experience was presented. The evaluation was designed mostly to investigate **RQ2**: How to design a TEE experience that delivers a memorable tourist experience while raising awareness towards local values present in the destination's context?

RQ2 unfolds into three further, specific sub-questions:

- **RQ2.1**: Can FoL TEE provide a fulfilling and memorable touristic experience?
- **RQ2.2**: To what extent did the two distinct yet interconnect components, FoL LAMS and FoL Hypermedia of the FoL TEE experience supported tour-ists to connect with the island local values and community?
- **RQ2.3**: Did FoL TEE enriched the knowledge about the local destination cultural and natural heritage in a significant way? If so, what role did the two FoL TEE components, and its respective features, played out?

Furthermore, this evaluation allowed for the gathering of data to understand if the Socio-cultural Wellbeing output components of the TEE framework was fulfilled. The evaluation of this component of the framework is linked with **RQ3**: How does the evaluation of the FoL TEE case study enrich the proposed theoretical TEE Framework?

The first two sections of this chapter described the design of the evaluation, detailing the measures and data collection protocol. This was followed by a description of the data analysis for both quantitative and qualitative data. The final results from the evaluation are discussed.

From the overall quantitative and qualitative results, FoL emerges as a successful TEE experience, bringing awareness about the destination and local community heritage and values, but also by providing a memorable touristic experience. The next chapter will discuss in further detail how this evaluation impacts all the research questions presented in this thesis.



7 Discussion and Conclusion

The final chapter of this thesis reflects on the results of the FoL TEE evaluation in light of each the research questions:

RQ1: *What existing insights can be synthesized from existing literature to be adapted and integrated into the design of a TEE tourist experience?*

RQ2: *How to design a TEE Experience that delivers a memorable tourist experience while raising awareness towards local values at destination's context?*

RQ3: *How does the evaluation of the FoL TEE case study enrich the proposed theoretical TEE Framework?*

The rest of this chapter summarises the research contributions, discusses the research limitations and future research directions, and concludes with some final remarks.

7.1 RQ1: What existing insights can be synthesized from existing literature to be adapted and integrated into the design of a TEE tourist experience?

This thesis presents a novel synthesis from the combination of an extensive body of related work around Transmedia Storytelling (TS), Entertainment-Education (EE), Location-Based Storytelling (LBS) and Cultural Heritage (CH) for tourism purposes. By performing the literature review process a lack of a clear relationship between the TS, EE, LBS, and CH artefacts and prototypes, and insights and lessons learned from literature,

was identified. This thesis identifies 13 Design Insights (DI) from literature and matches it with the features developed in each prototype iteration of the FoL TEE, and the novel TEE framework in general.

The list of DI was presented in Section 3.5 - Table 3-1, then highlighted when applied in the different stages of the development of the FoL TEE experience. Section 5.4 discusses in what way each DI was adapted and integrated into the design of FoL TEE. This can inspire and inform future designers in making decisions about features that they might include (or change) by looking at the FoL case study.

7.2 RQ2: How to design a TEE Experience that delivers a memorable tourist experience while raising awareness towards local values at destination's context?

RQ2 investigates a complex problem, which is best described through breaking the RQ into a multi-layered question. RQ2 was divided into three sub-research questions that will be now used to organize this discussion:

- RQ2.1: Can FoL TEE provide a fulfilling and memorable touristic experience?
- RQ2.2: To what extent did the two distinct yet interconnect components, FoL LAMS and FoL Hypermedia of the FoL TEE experience supported tourists to connect with the island local values and community?
- RQ2.3: Did FoL TEE enriched the knowledge about the local destination cultural and natural heritage in a significant way? If so, what role did the two FoL TEE components, and its respective features, played out?

When designing TEE experiences for tourists, there is much to gain in designing in alignment with the visitors' existing needs and desires. However, this is quite a complex task, because tourists encompass a wide variety of audiences; their desires and what they are seeking may vary considerably from one tourist segment to another, or on their age, nationality, and travel motivations. In general, consensus reports tourists desires centring around things that cannot be found in their home destinations [PeMo86], authenticity in their experiences [Wang99], enjoyment seeking [Kim14], and the urge to acquire new

knowledge [KiRi14]. FoL TEE design attempts to weave these different needs and desires into its experience. The choice for a TEE strategy was geared towards reaching and satisfying a broader tourist segment. On the one hand, the FoL LAMS experience appeals to tourists seeking enjoyment and adventure through the exploration of real local sites, while the FoL Hypermedia enables a connection with the local community and gives an authentic flavour to the experience. Together, the two aim to respond to tourists' desire to acquire new knowledge and understanding of the destination.

Therefore, in response to RQ2.1, FoL TEE was perceived as fulfilling and refreshing experience, was innovative, and quite unusual. Looking at the qualitative results of the Memorable Tourism Experience Scale, the FoL TEE experience emerges as satisfying across all dimensions, with high values reported for the Refreshing Experience, Fulfilment and Personal Travel Interest and Hedonism. The FoL TEE experience meets the tourists' motivations in terms of being an enjoyable and fun experience, in which visitors enjoyed the entertaining way information was presented; either through the fictional story or the video interviews, otherwise traditionally communicated through extensive pages of textual information.

Regarding tourists' desire to acquire new knowledge and understanding of the destination, the combination of the two FoL components was successful in giving tourists the satisfactory experience of accessing authentic and less mundane content that they would not otherwise find in traditional media typically produced for tourists. Hence, FoL TEE succeeded not only as an authentic local experience but as a more generally memorable tourist experience.

In connection to answering RQ2.2, we recall that one of the goals of FoL TEE was the creation of an experience that moved tourists to create a deep link with the destination local culture and heritage. RQ2.2 mirrors one of our design concerns, which was whether the two distinct yet interconnected TEE components could work together to achieve this goal, since one leverages on fictional storytelling while the other is based on more factual documentary-style content. Results show that visitors actually recognised the two components as complementary and brought satisfaction, engagement, and involvement with

the local heritage from the FoL LAMS, as well as generating empathy and respect towards the local community, and their history and issues, from the FoL Hypermedia.

The FoL LAMS was, for many, the most successful element of the experience. The design and story production was highly praised, and its characters and dramatic events engaged and immersed the audiences in the depicted story world, bringing them closer to the protagonist's battle to save the local natural heritage, making them root for her in her courageous battles. Furthermore, the narrative of FoL LAMS had a profound impact in how visitors view the FoL TEE as a memorable experience. Visitors who reported higher levels of narrative involvement and engagement in the LAMS experience also reported higher scores in the Memorable Tourism Experience (MTE) scale. This shows that visitors who connected at a deeper level with the FoL fictional narrative experience had a more memorable tourist experience than others. However, participants were disappointed about the lack of a happy ending as well as the open-ended finale, indicating care and interest for protagonist, the message and the themes of the fiction, and wanting to know more about the heroine's future ventures. In resonance with what other scholars found [FeAQ14, NJCW17], the FoL fictional narrative and character involvement strategies were quite effective in bringing the audience closer to the local heroine and highlighting values and issues important for the local community at that time, and in the present day.

Furthermore, the FoL Hypermedia worked as an enticement to continue to explore the Island and its heritage, and to understand its local values while allowing visitors to access authentic facts and scientific content from different perspectives. Visitors felt like they were getting to know the locals and empathised with them. The visitors praised the scientific content reported by the interviewed scientists, but also the "next-door neighbour" figure who provided their insights with sometimes contrasting perspectives on Island reality. Higher levels of authenticity reported after browsing the Hypermedia component reflected on the high levels of reward experienced by the participants. The authenticity of the locals' interviews translated into the feeling of reward experienced with the FoL TEE experience.

Backed by encouraging results regarding to what degree both the tourism experience and the user experience with the overall FoL TEE experience were memorable, it is clear that the combination of the two components worked in harmony, reinforcing and integrating with each other. The FoL LAMS and Hypermedia components obtained high scores in the Hedonistic dimension of the user experience scale. This dimension refers to experiences associated with emotions such as pleasure, excitement, and enjoyment. Furthermore, the Local Culture dimension, from the MTE scale, representing visitors' experiences of friendly local people and "meaningfulness" of the travel, indicates travellers' engagement in personally significant activities [ChVa15] reported a high median score, indicating the FoL TEE was successful in invoking emotional connection with the Island's local values and community. Thus, RQ2 can be answered positively by saying that the combination of the two distinct yet interconnected TEE components supported tourists to emotionally connect with the Island's local values and its community.

Finally, concerning RQ2.3, results from different measures report encouraging outcomes. Visitors learned and enriched their knowledge about several topics regarding the local destination's heritage and culture. High values in the Knowledge MTE dimension and the Likert item "Transmedia Experience enabled learning about Madeiran local values" show participants enriching their knowledge about the Island. Moreover, as can be seen from the interviews' data, participants praised the nature of the information delivery, defining it as an "unusual blend between fiction and facts," that was effectively condensed and that allowed visitors to get an engaging "first overview of Madeira's culture." Moreover, through the evaluation data, it was possible to understand how much did participants' knowledge was enriched. Results show a significant difference in the pre- and post-questionnaires measuring the visitor's knowledge about the local destination. By experiencing the FoL LAMS, participants acquired new knowledge on the destination, as compared to before the TEE experience. After engaging with the FoL Hypermedia participants doubled their knowledge on Madeira local values, as compared to before starting the FoL TEE experience. When comparing the two components, the FoL Hypermedia seemed to be the most effective in enriching visitors' knowledge, which is somewhat expected due to the factual and scientific nature of its content, and the journalistic style of the delivery. However, it should be noted that the knowledge enriching effect of the different

components could also be cumulative, as the Hypermedia component was always experienced after the LAMS. Nevertheless, the FoL LAMS, and in particular the fictional narrative, generated empathy with the character and created immersion in its world. The protagonist's message and nature preservation mission was cherished, generating in the audience care for the Island's natural patrimony, and interest in the historical facts and the locations that played a role in Laura's story.

In conclusion, the evaluation of the FoL TEE experience proved that its design was quite successful in delivering a memorable tourism experience, raising awareness towards local values.

7.3 RQ3 – How does the evaluation of the FoL TEE case study enrich the proposed theoretical TEE Framework?

This subsection reflects on how the TEE framework elements influenced (either positively or negatively) the design of the FoL media component, thus answering RQ3. In order to achieve this, the TEE framework will be described in all of its components, addressing how they feature in the FoL TEE.

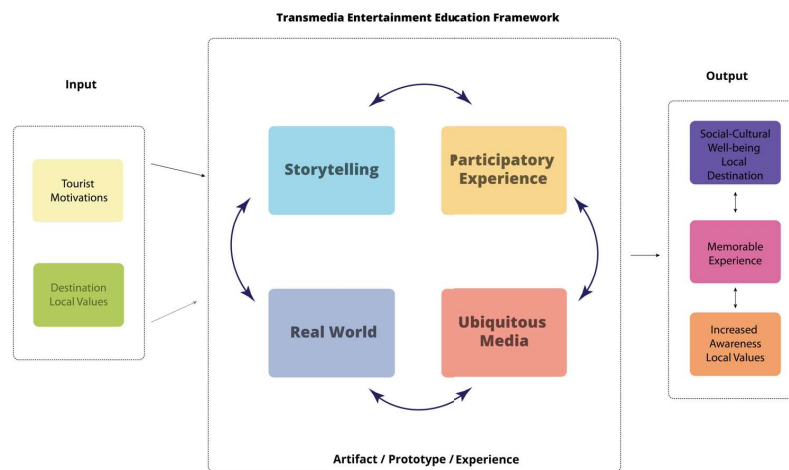


Figure 7:1 – Top: TEE Framework; Bottom: Mapping the different FoL TEE components and corresponding media features

TEE Input Components

The first two elements of FoL TEE framework concern the design **input** they provide to the TEE experience - namely, the **Tourist Motivations** and the **Destination Local values**. Tourists' motivations include the search for authenticity, the longing for a memorable experience, and an experience that would increase their understanding about a new destination while providing something entertaining and novel. To make sure the tourists' motivations were addressed, the FoL TEE design took care to incorporate authenticity into the experience through the historically-inspired fictional story background, the detailed depiction of costumes and the urban features of the city, the media reporting on community gossips, and the journalistic-style interviews populating the FoL Hypermedia. In addition, the whole experience was designed to provide visitors with new knowledge, a kind of information not always encountered in the classic material and tours delivered to the tourists. Finally, the experience was designed to be fun, entertaining, and engaging for a wide variety of audience, by including 2D animations and also immersive games mechanics, as well as documentary-style information delivered through different channels and platforms.

Regarding the **Destination Local Values** working as input for the content and experience design, local history, traditions, natural and heritage capitals were taken into consideration. Historical facts were researched with special attention given to folk remedies (as described in the story) and oral traditions (some of the gossips are inspired by anecdotes and oral tradition). The Laurisilva UNESCO Heritage forest, one the most valuable assets of the Island, features as a central issue in the story, with its preservation being the cause that the story's protagonist is fighting for. The forest currently shapes the Island and the locals' way of living in many ways; from maintaining the hydrological balance that keeps the island alive, to being of the most famous attractions for tourists who visit the island (tourism being the major economic force that keeps the island economy running). This is explained in the Hypermedia portal through interviews with local scientists.

The FoL TEE evaluation highlights how these two input components, **Tourist Motivations** and **Destination Local Values** were successfully deployed in FoL and worked as a

successful input for the experience. Both local and visiting participants highlighted the richness of authentic content several times; for example in the FoL LAMS, visitors realized the importance of Laura's quest to protect Laurisilva and its medicinal plants, while in the FoL Hypermedia locals explain scientific facts about the importance of the Laurisilva forest holds for the Island's ecosystem.

TEE Core Components

Four main elements are at the core of a TEE framework: **Storytelling**, **Ubiquitous Media**, **Participatory Experience**, and **Real-World**. The **Storytelling** element is present in both the FoL LAMS through the fictional narrative depicted in several episodes, and in the FoL Hypermedia through the edited video interviews with the locals. The fact that the fictional story is delivered through a location-aware multimedia platform, while the connection with the community is delivered through the hypermedia platform, represents the **Ubiquitous** nature of the FoL **Media** present in FoL TEE experience. The ubiquity of media is a component of the TEE framework that leverages on the engagement across different types of media and platforms. Derived from TS theories, the selected platforms/media must work together to support the story. The FoL TEE experience made use of a unique combination of media that yield mixed opinions among the participants.

The experience is **Participatory** in several aspects, starting from the participation of the audience in looking for the story fragments across the city, to making the medicinal remedy in Laura's pharmacy, as well as browsing the hypermedia content and contacting the local contributors through comment, emails, or other proposed means if they wish. Finally, the experience connects to the **Real-World** by being physically distributed in it, as well as thanks to the local community participation in providing content for the hypermedia platform, and occasionally suggesting visitors join local activities.

The results from the evaluation highlight that visitors had in overall positive experience with FoL TEE experience. Nevertheless, delving into each element in more detail, and looking at its success and limitations in the FoL TEE experience, In the FoL LAMS, the complexity of the **Storytelling** is more evident than in the FoL Hypermedia as the story was crafted to yield narrative and character involvement, as derived from EE theories.

The fictional story divides itself into seven Motion Comics, six Audio Gossips and one interactive 360° MR touchpoint, The Pharmacy, with all these media enabled through a mobile application.

In general, the duration and aesthetic style of the motion clips worked well. Although a few visitors mentioned that would have preferred a non-linear presentation of the story as they felt it was demanding to follow all the clips in the established order, something that concurs with previous literature [BaKW08, Webe17b]. However, the non-linearity of the plot might affect the efficacy of narrative transportation and character bonding. Further research would need to be conducted to establish this assumption.

The Audio Gossips were appreciated by both local and tourist participants due to their authenticity in portraying something characteristic of a tight-knit community. They were interpreted as something unusual and interesting, though for some visitors it was also hard to understand them due to language and local accent barriers. Both participants (visitors and locals) suggested the gossips should have had subtitles because they were difficult to comprehend. The decision to include the Audio Gossips in the FoL LAMS experience without using subtitles was a conscious decision at the time, the goal being to accompany the participants from one story point to the other without the need to look at the device's screen, thereby allowing visitors to enjoy the surroundings.

The 360° MR touchpoint, The Pharmacy, was designed to incorporate more agency in the storytelling as well as transporting the participant to a real-world location in the 19th century, so blending fiction and reality. The Pharmacy brings in-game mechanisms to enhance the participatory elements of the experience, supporting the visitors' actions within the story world. The Pharmacy touchpoint yielded a mix of, mostly positive, reactions. For some participants, The Pharmacy was their favourite part of the experience. Participants appreciated the high quality of the 3D content, the novel type of interaction and media, and discovering the different ingredients. In particular, the local participants appreciated the experience twist in depicting a drink that is familiar to them.

However, a couple of visitor participants did not enjoy The Pharmacy. It should be noted that they mentioned they did not like playing games, and therefore interacting in VR was not engaging for them. Generally, speaking participants (both locals and visitors) agreed that the interaction with the 360° MR touchpoint could be improved in terms of the instructions given and some interaction aspects. This indicates that including MVR and MR elements in the experience needs to be done with the awareness that some audiences, while drawn to the storytelling elements, might not be keen on VR games and interactions. Moreover, some hypothetical concerns were expressed regarding the age of the audience that might appreciate VR and games elements mixed in the experience.

Throughout the different evaluations conducted over this research process, it became clear that tourists are a demanding audience, with little tolerance for “bugs” or usability problems. If a component of the experience is too demanding, crashes, or takes too long, tourists may drop out in the middle of the experience. Their time in a destination is limited, and they want to enjoy it in the best way possible. As seen in literature review, and in the FoL LAMS, AR/VR content is appreciated by the participants but the interactions and tasks should produce a “wow factor” while still quite straightforward in terms of the interaction. Furthermore, and based on experience taken from the iterative process that The Pharmacy went through, it was essential to test this touchpoint early on the process as its previous version (360° Narrative – Old Pharmacy) had problems at the story and agency level. Hence, whenever possible, separate testing of the different channels and media could help to identify potential problems early on in the transmedia process. It could be the case that one media might be interfering with the whole experience, and this is only discovered later on in the process.

Reflecting on the **Real-World** core element of the experience, the FoL LAMS was successful in engaging the local residents and visitors with the narrative plot, as well as the locations where the story unfolds. The FoL LAMS mobile application was reported as easy to use, but several participants did struggle with the map interface. This issue might be relevant to the usability of the FoL application, but also with the participants’ familiarity with maps and orientation tasks. Voice and audio-activation interfaces, or even AR

glasses with information overlaid, could be helpful to facilitate the interaction with map-based interfaces and location-based stories in general.

Moreover, local and visiting participants enjoyed how Laura's story is embedded within the local culture and traditions through real-world locations. For some visitors the FoL LAMS could have been even further enriched with information about the locations to which the narrative is linked. They would have appreciated specific and factual information about the landmarks and locations visited along the tour. One of the most successful features of the FoL LAMS experience was the Multimedia Pop-ups Windows, because of the relationship that they created between the locations, the fictional story, and real-world locations. On the one hand, participants enjoyed how the Multimedia Pop-ups gave them hints on what to appreciate in the surrounding environment, and how it was connected with the fictional story in a way that blurred the line between real-world and the fictional world [What00]. This feature could have been exploited even further to prompt explorations within the story locations. Two visitors expressed how they missed the physical connection of exploring the buildings because they felt too focused on the mobile phone. It is worth reflecting how action in the **Real-World** is indeed a fundamental element in the TEE framework since it is intrinsic to the touristic experience to seek and discover more about the destination, though crafting "moments" in the experience, without the digital world interfering, could be valuable. Furthermore, interaction in, and with, the real-world also brings many challenges; for example, crowded places, or narrow passages, lack of accessibility, unsafe urban elements, traffic, etc. All of these need to be assessed and considered while designing the real-world interaction of the experience.

Local residents and visitors appreciated the synergy between the two distinct yet interconnected components, namely, the FoL LAMS and the FoL Hypermedia platform. They praised how the two different components offered a harmonizing experience. The FoL LAMS provided an immersive experience where the fictional story guided the discovery of the city, while the content of the Hypermedia channel allowed for participants to connect with the community and their current values and concerns. Visitors mentioned that the Multimedia Pop-ups, with the summaries of the local interviews, was an excellent complement to the fictional story. It was a good hint to go and browse the Hypermedia

component later on, as they felt the need for more information. The combination of the different media channel components worked well in offering different degrees of **Participation** to the audience. Literature reports on the difficulties of engaging audience across different media channels of a TS [YoDa18]. In the FoL TEE, this issue was addressed by adding follow up e-mails for participants who did not engage with both channels at the time of the evaluation, and sending all participants a reward (the selfie picture) delivered through e-mail with a reminder of the availability of the Hypermedia channel. However, while some visitors did engage with the Hypermedia channel once at home and having been reminded of it, others did not, for different reasons ranging from lack of time, lack of interest, or mere forgetfulness.

TEE Output Components

Reflecting on the **Output** components of the framework, namely the **Socio-cultural Wellbeing at local destination, the Memorable Experience**, and the visitors' **Increased Awareness about Local Values**, the overall the evaluation yielded positive results. Regarding the TEE output element, **Social Cultural Well-being**, it was essential to have local participants evaluating the FoL TEE to see how well received it was by them. The data allows us to understand that their experience with FoL overall was very positive. In general, local participants reported having an engaging experience with the FoL TEE, and they were positively surprised to be learning new things about their own local culture. In particular, the FoL TEE was perceived as novel and valuable entertainment, and a learning experience that should be expanded. Some local participants encouraged the expansion of the experience with more interaction points, landmarks, and even other stories. The FoL Hypermedia revealed itself to be the component from which the locals learned the most. Local participants praised how they appreciated the richness of the content in video interviews. This shows that, even for people who live on the Island, the TEE experience can be worthwhile, as it brings new knowledge for them as well, and motivates them to learn more.

Furthermore, findings from the focus groups with locals regarding an early version of FoL Hypermedia (Section 4.5.4) showed that locals enjoy seeing themselves, their products, and people they know personally, represented in the digital experiences. Future

designers of TEE experiences should leverage on this pleasure. This could contribute to the **Social Cultural Well-being** by building up the locals' pride towards their local values, but it could also contribute to the local values' conservation, valorisation. and authenticity. Local values can be lost over time and with them the authenticity of a destination. It is crucial, therefore, to continually capture and preserve ephemeral and intangible heritage.

The TEE framework output elements, **Memorable Experience** and **Increased Awareness about Local Values**, were already partially addressed in answering the RQ2. It is important to highlight here how including these two elements as part of the framework actually worked as a driving force for the design of several elements in the FoL. For example, **Increased Awareness about Local Values**, made it essential to have a balance between folk and scientific knowledge, and between reason and emotional content, in the FoL TEE experience. This was achieved by combining the FoL fictional narrative and the local interviews. Furthermore, the video interviews were complemented with media such as infographics, animations, and visual summaries to help viewers retain information. Such features facilitated participants (both visitors and local residents) in increasing their knowledge of the local values present in the FoL TEE. Finally, the framework element, **Memorable Experience**, refers to the visitors' feelings and emotions experienced during the TEE experience. The visitors' results showed that they had a positive experience with FoL TEE and felt like the time that they dedicated to the TEE experience was worth spending. This reveals that efforts to include the **Tourists Motivations** in the touch-points of the FoL TEE experience were fruitful.

7.4 Research Summary and contributions

The goal of this research and thesis dissertation has been to study, design, develop, and evaluate a framework that leveraged on TS and EE to create tourism experiences that can promote awareness towards the values present in the destination's local context. The approach was threefold:

1. To propose a theoretical framework inspired by previous TS models, EE theories, and Tourism experience research
2. To draw from TS practice, location-based storytelling experiences, and past cultural heritage research to create a series of design insights to inform the design of a TEE experience
3. To create, iterate and evaluate the FoL experience, following the TEE framework

This process yields the following research contributions:

1. The novel Transmedia Entertainment Education Framework
2. The identification of a set of 13 Design Insights gathered from relevant related work used to inform the design of experiences following the TEE Framework
3. The design of the FoL, following the proposed TEE framework elements and design insights
4. The results of the evaluation of FoL TEE experience within a real-world context, confirming the success of the TEE framework

This research output from this thesis can inspire and lead the design of future TEE experiences to promote awareness towards the local values present in the destination's local context, and eventually lead to a more sustainable tourism experience.

7.5 Limitations

The practical and research work presented throughout this thesis presents several limitations that are inherent in the transmedia nature of this research and its cross-disciplinarity that spans the different fields of Tourism, Digital Media, Transmedia Storytelling, and Entertainment Education. These limitations are explored under the following topics:

Theoretical Limitations

The theoretical areas of existing research that feed into this thesis are vast and complex ones, which renders it hard to harness and perform a thorough sweep of all of the existing contributions. The research work presented in this thesis is at the crossroads of research and industry. From the industry side, many experiences and products that are already in the market are not documented nor evaluated, making it hard to find documentation and understand their outputs and learn from them. On the other hand, research prototypes and experiences developed within the academic context are not always available as a product or prototype, so making it hard to evaluate with the intended target audience.

It should be acknowledged, therefore, that the proposed TEE Framework presented in this research can be interpreted as an initial attempt to provide new perspectives, and forms a basis of a unified framework. Hopefully, this first attempt will inspire future efforts in developing experiences aimed at establishing new points of dialogue between locals and visitors and that, consequently, such efforts would translate into proposing refinements and adjustments to the TEE framework. In a similar note, the DI synthesized from literature to complement the TEE framework can surely be further complemented with DI's from prototypes and products that might be found in the space between the research and industry experiences and that were not approached in the context of this research.

Content/Experience Limitations

Another key limitation of this research is the fact that the findings derived from the evaluation of the TEE framework case study have not yet been tested elsewhere. Further evaluations of different destinations' contexts would be needed in order to generalize the findings to other experiences under different cultural characteristics and the different

concerns and local values apparent. Furthermore, due to the nature of the research funding available for this topic, during the time this research took place the FoL experience was developed by a team of researchers with a wide variety of skills and backgrounds and this might be hard to replicate in an academic context. While this has been a great advantage for the purposes of this research, it might be hard to replicate, if not in industry settings. Moreover, visitors to the island have a variety of interests and preferred approaches to the local culture and nature, encouraging us to continue to collect and present the rich variety of stories about the cultural and natural heritage of the Island, highlighting the limitations in terms of content of the FoL TEE experience. More information about the history of the Island, facts about its economy, and the impact of tourism on the archipelago, were all desired topics that could be further expanded in the TEE experience.

Methodological and Evaluation Limitations

Moyle et al. [13] call for the inclusion of the visitors' perspectives in studies about interaction between locals and visitors in touristic islands. In trying to address this gap, several challenges were encountered in the strategies to reach tourists and engage them in the evaluation process. The research conducted could benefit from a larger sample of participants, though tourists are transient individuals only visiting destinations for a limited time. On reflection, some of the barriers were found when applying our methodology. The visitors are on holiday and/or on tourist mode with their time wisely planned, so participating in a research study is not a priority for them. Pressure to get through the study was often an issue and, as a result, some of the interim studies presented in this document were not done with the intended target audience as there was the concern that the experience design was not yet mature enough to be provided to a tourist.

Furthermore, it is important to realize that the evaluation presents limitations in evaluating the framework output component related to ensuring local community empowerment. Since the experience was designed with visitors in mind, the evaluation was tailored to evaluate visitors' experience. Part of it was adapted to evaluate locals on the specific output component that related to them. The results and data obtained from the local residents' sample could have been richer if the evaluation was designed specifically for a local resident sample with specific measures and goals related to understanding the levels of local empowerment provided by the TEE experience. The FoL

Hypermedia platform evaluation was limited in several ways, as the time given to participants to explore it was quite short due to the long duration of the whole evaluation protocol. The Hypermedia component was designed to be consumed later on, after the FoL LAMS and at the convenience of the participant, thereby giving participants time to explore the platform as much as they desired.

On a similar note, the evaluation conducted was not sufficient to understand if the TEE experience could reflect some sort of long-term behavior change in the visitors. This would only be possible through the design of long-term study that would incorporate evaluation moments at the destination's arrival moment, after the TEE experience and before leaving the Island, and eventually some time afterwards to see if the values and lessons learned would carry over towards future destinations and travels.

7.6 Future Work

The knowledge shared in this document supports experience designers to delve into designing interactive storytelling experiences that positively impact not only the tourists' experience but also the local communities. In the context of the FoL TEE experience case study, and referring back to one of the limitations found in the present work, it would be valuable to run a longitudinal study that evaluates the impact of the FoL TEE experience, both on the visitors and the locals, in the long run. Moreover, it would be interesting to develop more media channels and expand the content present in the FoL TEE. The experience could be expanded with local content but also with content that crosses the Macaronesia Islands.

Future efforts could be made into developing experiences by applying the TEE framework to other case studies, exploring different angles and different media to further inform the elements of the framework, and how to achieve a symbiosis between them. Such efforts would contribute to proposing refinements and adjustments to this proposed TEE framework. Furthermore, it would be relevant to keep refining the list of Design Insights, as the area of research and its scholarship progresses.

Finally, evaluations of digital media experiences targeting tourists, in particular TEE experiences aimed to enhance the tourist experience, remains a challenge to overcome.

Future work should focus on the development of alternative analytical measures for the tourism experience that do not rely solely on self-reporting feedback and which do not interfere with the experience itself.

7.7 Final Remarks

Although new digital technologies keep evolving rapidly, designers might feel unsure as to how to leverage them to address the demands of the tourism experience industry. The goal of this research is to provide a framework that combines TS models with EE theories, towards the goal of engaging tourists with sensitive topics, and possibly move them to embrace a local destination's values. By proposing the Transmedia Entertainment Education Framework, the aim is to achieve a common ground for designing transmedia tourism experiences that leverages the power of TS to engage, inspire, and gather tourists online and offline, with the persuasive potential of EE to raise awareness towards certain pressing themes.

Throughout the different stages and chapters described in this manuscript, the FoL case study has proved to be a successful example of a TEE experience. In this way, it is contributing to the advancement of sustainable tourism entertainment experiences that seek to engage tourists in a memorable experience, while raising awareness towards local heritage and fostering empathy and respect regarding the local community.

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Bibliography

- [AcKp15] ACIF ; KPMG: *Documento Estrategico Turismo Madeira-2015-2020*, 2015
- [ALTH10] AGRUSA, WENDY ; LEMA, JOSEPH D. ; TANNER, JOHN ; HOST, TANYA ; AGRUSA, JEROME: Integrating Sustainability and Hawaiian Culture into the Tourism Experience of the Hawaiian Islands. In: *PASOS Revista de turismo y patrimonio cultural* Bd. 8 (2010), Nr. 2, S. 247–264
- [Ask100] *Ask a Local app - Best recommendations from locals*. URL <http://askalocalapp.com/>. - abgerufen am 2017-09-21
- [BaKW08] BALLAGAS, RAFAEL ; KUNTZE, ANDRÉ ; WALZ, STEFFEN P.: Gaming Tourism: Lessons from Evaluating REXplorer, a Pervasive Game for Tourists. In: INDULSKA, J. ; PATTERSON, D. J. ; RODDEN, T. ; OTT, M. (Hrsg.): *Pervasive Computing, Lecture Notes in Computer Science* : Springer Berlin Heidelberg, 2008 — ISBN 978-3-540-79575-9, S. 244–261
- [BaMa10] BARROS, C. P. ; MACHADO, L. P.: The length of stay in tourism. In: *Annals of Tourism Research* Bd. 37 (2010), Nr. 3, S. 692–706
- [Bass96] BASSO, KEITH H.: *Wisdom Sits in Places: Landscape and Language Among the Western Apache*. 1st edition. Albuquerque : University of New Mexico Press, 1996 — ISBN 978-0-8263-1724-7
- [Baud17] BAUDOUIN, PHILIPPE: *Expert group report on digital accessibility and ICT for the EU Outermost Regions*, 2017
- [BCBH06] BELL, MAREK ; CHALMERS, MATTHEW ; BARKHUUS, LOUISE ; HALL, MALCOLM ; SHERWOOD, SCOTT ; TENNENT, PAUL ; BROWN, BARRY ; ROWLAND, DUNCAN ; U. A.: Interweaving Mobile Games with Everyday Life. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing*

Systems, CHI '06. New York, NY, USA : ACM, 2006 — ISBN 1-59593-372-7, S. 417–426

- [BDNN16] BALA, PAULO ; DIONISIO, MARA ; NISI, VALENTINA ; NUNES, NUNO: IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality. In: NACK, F. ; GORDON, A. S. (Hrsg.): *Interactive Storytelling: 9th International Conference on Interactive Digital Storytelling, ICIDS 2016, Los Angeles, CA, USA, November 15–18, 2016, Proceedings*. Cham : Springer International Publishing, 2016 — ISBN 978-3-319-48279-8, S. 3–11
- [BDTO17] BALA, PAULO ; DIONÍSIO, MARA ; TRINDADE, RUI ; OLIM, SANDRA ; NISI, VALENTINA ; NUNES, NUNO: Evaluating the influence of location and medium applied to mobile VR storytelling. In: *Proceedings of the 16th International Conference on Mobile and Ubiquitous Multimedia - MUM '17*. Stuttgart, Germany : ACM Press, 2017 — ISBN 978-1-4503-5378-6, S. 371–378
- [BeMA12] BENYON, DAVID ; MIVAL, OLI ; AYAN, SERKAN: Designing blended spaces. In: *BCS HCI*, 2012
- [BGKR09] BENFORD, STEVE ; GIANNACHI, GABRIELLA ; KOLEVA, BORIANA ; RODDEN, TOM: From Interaction to Trajectories: Designing Coherent Journeys Through User Experiences. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '09*. New York, NY, USA : ACM, 2009 — ISBN 978-1-60558-246-7, S. 709–718
- [Blog00] *Blog | Best Local Tips, Unusual Travel Ideas and Hidden City Gems*. URL [//www.secretcitytrails.com/blog/](http://www.secretcitytrails.com/blog/). - abgerufen am 2020-07-06. — Secret City Trails
- [BoCh18] BOLETIS, COSTAS ; CHASANIDOU, DIMITRA: Smart Tourism in Cities: Exploring Urban Destinations with Audio Augmented Reality. In: *Proceedings of the 11th Pervasive Technologies Related to Assistive Environments Conference on - PETRA '18*. Corfu, Greece : ACM Press, 2018 — ISBN 978-1-4503-6390-7, S. 515–521

- [BQOR14] BENYON, DAVID ; QUIGLEY, AARON ; O'KEEFE, BRIAN ; RIVA, GIUSEPPE: Presence and digital tourism. In: *AI & SOCIETY* Bd. 29 (2014), Nr. 4, S. 521–529
- [BrCl06] BRAUN, VIRGINIA ; CLARKE, VICTORIA: Using thematic analysis in psychology. In: *Qualitative Research in Psychology* Bd. 3 (2006), Nr. 2, S. 77–101
- [Brom00] BROMBACH, GUIDO: *Death at Berlin Wall*. URL <https://sprylab.com/en/projekte/mobile-edutainment-app-death-berlin-wall>
- [BuLa08] BUHALIS, DIMITRIOS ; LAW, ROB: Progress in information technology and tourism management: 20 years on and 10 years after the Internet—The state of eTourism research. In: *Tourism Management* Bd. 29 (2008), Nr. 4, S. 609–623
- [BuSu00] BUCHENAU, MARION ; SURI, JANE FULTON: Experience prototyping. In: *Proceedings of the conference on Designing interactive systems processes, practices, methods, and techniques - DIS '00*. New York City, New York, United States : ACM Press, 2000 — ISBN 978-1-58113-219-9, S. 424–433
- [BWMO12] BLUM, LISA ; WETZEL, RICHARD ; MCCALL, ROD ; OPPERMAN, LEIF ; BROLL, WOLFGANG: The final TimeWarp: using form and content to support player experience and presence when designing location-aware mobile augmented reality games. In: *Proceedings of the designing interactive systems conference* : ACM, 2012, S. 711–720
- [CACM05] CORREIA, NUNO ; ALVES, LUÍS ; CORREIA, HELDER ; MORGADO, CARMEN ; SOARES, LUIS ; CUNHA, JOSE C. ; ROMÃO, TERESA ; DIAS, A. EDUARDO ; U. A.: InStory: A System for Mobile Information Access, Storytelling and Gaming Activities in Physical Spaces. In: *ACE 2005* : ACM New York, N.Y. (USA), 2005, S. 102–110
- [CaDI15] CALDITO, LIDIA ANDRADES ; DIMANCHE, FREDERIC ; ILKEVICH, SERGEY: Tourist Behaviour and Trends. In: *Tourism in Russia: A Management Handbook* : Emerald, 2015, S. 31

- [ChHK12] CHIU, HUNG-CHANG ; HSIEH, YI-CHING ; KUO, YI-CHU: How to Align your Brand Stories with Your Products. In: *Journal of Retailing* Bd. 88 (2012), Nr. 2, S. 262–275
- [ChSi06] CHOI, HWANSUK CHRIS ; SIRAKAYA, ERCAN: Sustainability indicators for managing community tourism. In: *Tourism Management* Bd. 27 (2006), Nr. 6, S. 1274–1289
- [Chun17] CHUNG, JIN YOUNG: Online friendships in a hospitality exchange network: a sharing economy perspective. In: *International Journal of Contemporary Hospitality Management* Bd. 29 (2017), Nr. 12, S. 3177–3190
- [ChVa15] CHANDRALAL, LALITH ; VALENZUELA, FREDY-ROBERTO: Memorable Tourism Experiences: Scale Development. In: *Contemporary Management Research* Bd. 11 (2015), Nr. 3, S. 291–310
- [CiBa07] CIOLFI, LUIGINA ; BANNON, LIAM J.: Designing hybrid places: merging interaction design, ubiquitous technologies and geographies of the museum space. In: *CoDesign* Bd. 3 (2007), Nr. 3, S. 159–180
- [CiMc12] CIOLFI, LUIGINA ; MCLOUGHLIN, MARC: Designing for meaningful visitor engagement at a living history museum. In: *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design* : ACM, 2012, S. 69–78
- [Cohe79] COHEN, ERIK: A Phenomenology of Tourist Experiences. In: *Sociology* Bd. 13 (1979), Nr. 2, S. 179–201
- [CoHu09] COSTANZA, ENRICO ; HUANG, JEFFREY: Designable Visual Markers. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '09*. New York, NY, USA : ACM, 2009 — ISBN 978-1-60558-246-7, S. 1879–1888
- [Cro06] CROES, ROBERTICO R.: A paradigm shift to a new strategy for small island economies: Embracing demand side economics for value enhancement and

- long term economic stability. In: *Tourism Management* Bd. 27 (2006), Nr. 3, S. 453–465
- [CRRM14] CORREIA, N. ; ROMÃO, T. ; RICARDO, A. ; MOTA, T. ; MELO, M. J. ; CASTRO, R. ; CARVALHO, R. ; MIRANDA, A.: Design of an Interactive Experience with Medieval Illuminations: A Journey into the Beauty and Meaning of Medieval Portuguese Manuscripts. In: *Journal on Computing and Cultural Heritage* Bd. 7 (2014), Nr. 2, S. 1–19
- [Dama00] DAMASIO, ANTONIO: *The Feeling Of What Happens: Body, Emotion and the Making of Consciousness*. New Ed edition. London : Vintage, 2000 — ISBN 978-0-09-928876-3
- [DBNN15] DIONISIO, MARA ; BARRETO, MARY ; NISI, VALENTINA ; NUNES, NUNO ; HANNA, JULIAN ; HERLO, BIANCA ; SCHUBERT, JENNIFER: Evaluation of Yasmine’s Adventures: Exploring the Socio-Cultural Potential of Location Aware Multimedia Stories. In: *Interactive Storytelling, Lecture Notes in Computer Science* : Springer, Cham, 2015 — ISBN 978-3-319-27035-7, S. 251–258
- [DBTN15] DIONISIO, MARA ; BALA, PAULO ; TRINDADE, RUI ; NISI, VALENTINA ; HANNA, JULIAN ; UP, TIME’S: Lucid Peninsula: DreamScope - An Interactive Physical Installation. In: *Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition, C&C ’15, Glasgow, United Kingdom, June 22-25, 2015*, 2015, S. 377–378
- [Desi00] *Designing interactions with pervasive displays for location-based storytelling | Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: the Future of Design*. URL <https://dl.acm.org/doi/abs/10.1145/2686612.2686631>. - abgerufen am 2020-01-30
- [DeSo00] DENNETT, ADAM ; SONG, HANQUN: *Why tourists thirst for authenticity – and how they can find it*. URL <http://theconversation.com/why-tourists-thirst->

for-authenticity-and-how-they-can-find-it-68108. - abgerufen am 2017-09-21. — The Conversation

- [DiNL10] DIONISIO, MARA ; NISI, VALENTINA ; VAN LEEUWEN, JOS P.: The iLand of Madeira Location Aware Multimedia Stories. In: AYLETT, R. ; LIM, M. Y. ; LOUCHART, S. ; PETTA, P. ; RIEDL, M. (Hrsg.) ; HUTCHISON, D. ; KANADE, T. ; KITTLER, J. ; KLEINBERG, J. M. ; MATTERN, F. ; MITCHELL, J. C. ; NAOR, M. ; NIERSTRASZ, O. ; U. A. (Hrsg.): *Interactive Storytelling*. Bd. 6432. Berlin, Heidelberg : Springer Berlin Heidelberg, 2010 — ISBN 978-3-642-16637-2, S. 147–152
- [Dion15] DIONÍSIO, MARA SOFIA GOMES: *Seven stories: location based story-delivery system*, Msc Thesis, 2015
- [DiSB10] DiSALVO, CARL ; SENGERS, PHOEBE ; BRYNJARSDÓTTIR, HRÖNN: Mapping the Landscape of Sustainable HCI. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '10*. New York, NY, USA : ACM, 2010 — ISBN 978-1-60558-929-9, S. 1975–1984
- [EnRh08] ENGESER, STEFAN ; RHEINBERG, FALKO: Flow, performance and moderators of challenge-skill balance. In: *Motivation and Emotion* Bd. 32 (2008), Nr. 3, S. 158–172
- [Farm13] FARMAN, JASON: *The Mobile Story: Narrative Practices with Locative Technologies* : Routledge, 2013. — Google-Books-ID: ESGwAAAAQBAJ — ISBN 978-1-136-16956-4
- [FeAQ12] FERREIRA, SORAIA ; ALVES, A. ; QUICO, CÉLIA: Location based transmedia storytelling: The travelplot porto experience design. In: *Journal of Tourism and Development [Revista Turismo & Desenvolvimento]* Bd. 17 (2012), Nr. 18, S. 4
- [FeAQ14] FERREIRAA, SORAIA ; ALVESA, ARTUR PIMENTA ; QUICOB, CÉLIA: Location Based Transmedia Storytelling in Social Media—Peter’s TravelPlot Porto

Case Study. In: *E Review of Tourism Research (eRTR) ENTER 2014 Conference* (2014)

- [FrMD18] FRICH, JONAS ; MOSE BISKJAER, MICHAEL ; DALSGAARD, PETER: Twenty Years of Creativity Research in Human-Computer Interaction: Current State and Future Directions. In: *Proceedings of the 2018 on Designing Interactive Systems Conference 2018 - DIS '18*. Hong Kong, China : ACM Press, 2018 — ISBN 978-1-4503-5198-0, S. 1235–1257
- [FrSL05] FRITZ, F. ; SUSPERREGUI, A. ; LINAZA, MARIA TERESA: Enhancing cultural tourism experiences with augmented reality technologies. In: : 6th International Symposium on Virtual Reality, Archaeology and Cultural Heritage (VAST), 2005
- [FSPI08] FOTH, MARCUS ; SATCHELL, CHRISTINE ; PAULOS, ERIC ; IGOE, TOM ; RATTI, CARLO: Pervasive Persuasive Technology and Environmental Sustainability. In: . Sydney, 2008, S. 76
- [GaOt13] GAMBARATO, RENIRA RAMPAZZO ; OTHERS: Transmedia project design: Theoretical and analytical considerations. In: *Baltic Screen Media Review* (2013), Nr. 1, S. 80–100
- [GFFO06] GRETZEL, U. ; FESENMAIER, D. R. ; FORMICA, S. ; O'LEARY, J. T.: Searching for the Future: Challenges Faced by Destination Marketing Organizations. In: *Journal of Travel Research* Bd. 45 (2006), Nr. 2, S. 116–126
- [Goff02] GOFFMAN, ERVING: The presentation of self in everyday life. 1959. In: *Garden City, NY* (2002)
- [GrBK04] GREEN, MELANIE C. ; BROCK, TIMOTHY C. ; KAUFMAN, GEOFF F.: Understanding Media Enjoyment: The Role of Transportation Into Narrative Worlds. In: *Communication Theory* Bd. 14 (2004), Nr. 4, S. 311–327
- [GrBr00] GREEN, MELANIE C. ; BROCK, TIMOTHY C.: The role of transportation in the persuasiveness of public narratives. In: *Journal of Personality and Social Psychology* Bd. 79 (2000), Nr. 5, S. 701–721

- [Guge16] GUGENHEIMER, JAN: Nomadic Virtual Reality: Exploring New Interaction Concepts for Mobile Virtual Reality Head-Mounted Displays. In: : ACM Press, 2016 — ISBN 978-1-4503-4531-6, S. 9–12
- [HaBP02] HARDY, ANNE ; BEETON, ROBERT J. S. ; PEARSON, LEONIE: Sustainable Tourism: An Overview of the Concept and its Position in Relation to Conceptualisations of Tourism. In: *Journal of Sustainable Tourism* Bd. 10 (2002), Nr. 6, S. 475–496
- [HaWM18] HARGOOD, CHARLIE ; WEAL, MARK J. ; MILLARD, DAVID E.: The Story-Places Platform: Building a Web-Based Locative Hypertext System. In: : ACM Press, 2018 — ISBN 978-1-4503-5427-1, S. 128–135
- [HHBM08] HETHER, HEATHER J. ; HUANG, GRACE C. ; BECK, VICKI ; MURPHY, SHEILA T. ; VALENTE, THOMAS W.: Entertainment-Education in a Media-Saturated Environment: Examining the Impact of Single and Multiple Exposures to Breast Cancer Storylines on Two Popular Medical Dramas. In: *Journal of Health Communication* Bd. 13 (2008), Nr. 8, S. 808–823
- [HoEv07] HOLMLID, STEFAN ; EVENSON, SHELLEY: Prototyping and enacting services: Lessons learned from human-centered methods. In: . Bd. 10, 2007
- [HoMG02] HOLLAND, SIMON ; MORSE, DAVID R. ; GEDENRYD, HENRIK: AudioGPS: Spatial Audio Navigation with a Minimal Attention Interface. In: *Personal and Ubiquitous Computing* Bd. 6 (2002), Nr. 4, S. 253–259
- [HoVi20] HOLLOWAY-ATTAWAY, LISSA ; VIPSJÖ, LARS: Using Augmented Reality, Gaming Technologies, and Transmedial Storytelling to Develop and Co-design Local Cultural Heritage Experiences. In: LIAROKAPIS, F. ; VOULODIMOS, A. ; DOULAMIS, N. ; DOULAMIS, A. (Hrsg.): *Visual Computing for Cultural Heritage, Springer Series on Cultural Computing*. Cham : Springer International Publishing, 2020 — ISBN 978-3-030-37191-3, S. 177–204

- [HSTW17] HELLE, SEPPO ; SALMI, HANNU ; TURUNEN, MARKKU ; WOODWARD, CHARLES ; LEHTONEN, TEIJO: *MIRACLE Handbook : Guidelines for Mixed Reality Applications for Culture and Learning Experiences* (2017)
- [IjKP08] IJSSELSTEIJN, WIJNAND ; DE KORT, Y. A. W. ; POELS, KAROLIEN: The game experience questionnaire. In: *Manuscript in preparation* (2008)
- [JaCM20] JAVANSHIR, RYAN ; CARROLL, BETH ; MILLARD, DAVID: Structural patterns for transmedia storytelling. In: EDMOND, J. (Hrsg.) *PLOS ONE* Bd. 15 (2020), Nr. 1, S. e0225910
- [Jaff00] JAFFE, ERIC: *The App That Turns Tourists Into Locals*. URL <http://www.theatlanticcities.com/technology/2013/08/urban-buddy-turns-tourists-locals/6513/>. - abgerufen am 2019-01-28. — CityLab
- [Jenk08] JENKINS, HENRY: *Convergence culture: where old and new media collide*. Updated and with a new afterword. New York, NY : New York Univ. Press, 2008 — ISBN 978-0-8147-4295-2
- [KaCe16] KARAYILAN, EYUP ; CETIN, GUREL: Tourism Destination: Design of Experiences. In: SOTIRIADIS, M. ; GURSOY, D. (Hrsg.): *The Handbook of Managing and Marketing Tourism Experiences* : Emerald Group Publishing Limited, 2016 — ISBN 978-1-78635-290-3, S. 65–83
- [KeBr09] KEYSON, DAVID V. ; BRUNS, M.: Empirical research through design. In: *Proceedings of the 3rd IASDR Conference on Design Research*, 2009, S. 4548–4557
- [KhAh14] KHALID, MALIK ZAHRA ; AHMED, AALIYA: Entertainment-education media strategies for social change: Opportunities and emerging trends. In: *Review of Journalism and Mass Communication* Bd. 2 (2014), Nr. 1, S. 69–89
- [Kim14] KIM, JONG-HYEONG: The antecedents of memorable tourism experiences: The development of a scale to measure the destination attributes associated with memorable experiences. In: *Tourism Management* Bd. 44 (2014), S. 34–45

- [KiRi14] KIM, JONG-HYEONG ; RITCHIE, J. R. BRENT: Cross-Cultural Validation of a Memorable Tourism Experience Scale (MTES). In: *Journal of Travel Research* Bd. 53 (2014), Nr. 3, S. 323–335
- [KiRM12] KIM, J.-H. ; RITCHIE, J. R. B. ; MCCORMICK, B.: Development of a Scale to Measure Memorable Tourism Experiences. In: *Journal of Travel Research* Bd. 51 (2012), Nr. 1, S. 12–25
- [Kitt68] KITTO, H. D. F.: *Greek tragedy: a literary study*, University paperbacks, UP 140. London : Methuen, 1968 — ISBN 978-0-416-68900-6
- [KiYo17] KIM, JONG-HYEONG ; YOUN, HYEWON: How to Design and Deliver Stories about Tourism Destinations. In: *Journal of Travel Research* Bd. 56 (2017), Nr. 6, S. 808–820
- [KRPC00] KATIFORI, AKRIVI ; ROUSSOU, MARIA ; PERRY, SARA ; CIGNONI, PAOLO ; MALOMO, LUIGI: The EMOTIVE Project - Emotive virtual cultural experiences through personalized storytelling, S. 10
- [Lee04] LEE, KWAN MIN: Presence, Explicated. In: *Communication Theory* Bd. 14 (2004), Nr. 1, S. 27–50
- [LiGG13] LINAZA, MARÍA TERESA ; GUTIERREZ, AITOR ; GARCÍA, ANDER: Pervasive Augmented Reality Games to Experience Tourism Destinations. In: XIANG, Z. ; TUSSYADIAH, I. (Hrsg.): *Information and Communication Technologies in Tourism 2014*. Cham : Springer International Publishing, 2013 — ISBN 978-3-319-03972-5, S. 497–509
- [Loqa00] *Loqal - Android Apps on Google Play*. URL <https://play.google.com/store/apps/details?id=com.integral.loqal&hl=en>. - abgerufen am 2017-09-21
- [Macc73] MACCANNELL, DEAN: Staged authenticity: Arrangements of social space in tourist settings. In: *American journal of Sociology* Bd. 79 (1973), Nr. 3, S. 589–603

- [Macc76] MACCANNELL, DEAN: *The Tourist: A New Theory of the Leisure Class* : University of California Press, 1976. — Google-Books-ID: 6V_MQzy021QC — ISBN 978-0-520-21892-5
- [MaJo07] MANYARA, GEOFFREY ; JONES, ELERI: Community-based Tourism Enterprises Development in Kenya: An Exploration of Their Potential as Avenues of Poverty Reduction. In: *Journal of Sustainable Tourism* Bd. 15 (2007), Nr. 6, S. 628–644
- [Maka12] MAKARECHI, KIA: „Bear 71“: *Interactive Film At Sundance Tells Dark Side Of Human Interaction With Wildlife*. URL http://www.huffingtonpost.com/2012/01/23/bear-71-interactive-film-sundance_n_1225040.html. — „Bear 71“: Interactive Film At Sundance Tells Dark Side Of Human Interaction With Wildlife
- [Maye09] MAYER, RICHARD E.: *Multimedia Learning*. 2. Aufl. Cambridge : Cambridge University Press, 2009 — ISBN 978-0-511-81167-8
- [MFGR12] MARINI, DANIELE ; FOLGIERI, RAFFAELLA ; GADIA, DAVIDE ; RIZZI, ALESSANDRO: Virtual reality as a communication process. In: *Virtual Reality* Bd. 16 (2012), Nr. 3, S. 233–241
- [MFMP11] MURPHY, SHEILA T. ; FRANK, LAUREN B. ; MORAN, MEGHAN B. ; PATNOE-WOODLEY, PAULA: Involved, Transported, or Emotional? Exploring the Determinants of Change in Knowledge, Attitudes, and Behavior in Entertainment-Education. In: *Journal of Communication* Bd. 61 (2011), Nr. 3, S. 407–431
- [MiCo99] MILGRAM, PAUL ; COLQUHOUN, HERMAN: A taxonomy of real and virtual world display integration. In: *Mixed reality: Merging real and virtual worlds* (1999), S. 5–30
- [MiTT17] MINOCHA, SHAILEY ; TUDOR, ANA-DESPINA ; TILLING, STEVE: Affordances of Mobile Virtual Reality and their Role in Learning and Teaching. In: . University of Sunderland’s St. Peter’s Campus, UK, 2017

- [Mixe00] *Mixed Reality platform • Conducttr • Make Everyone's Life an Adventure.*
URL <https://www.conducttr.com/mixed-reality-platform/>. - abgerufen am 2020-02-02
- [MoWC10] MOYLE, BRENT ; WEILER, BETTY ; CROY, GLEN: Tourism interaction on islands: the community and visitor social exchange. In: *International Journal of Culture, Tourism and Hospitality Research* Bd. 4 (2010), Nr. 2, S. 96–107
- [Moye08] MOYER-GUSÉ, EMILY: Toward a Theory of Entertainment Persuasion: Explaining the Persuasive Effects of Entertainment-Education Messages. In: *Communication Theory* Bd. 18 (2008), Nr. 3, S. 407–425
- [Murp13] MURPHY, PETER: *Tourism: A Community Approach (RLE Tourism)*. 1. Aufl. : Routledge, 2013 — ISBN 978-0-203-06853-3
- [NDBG19] NISI, VALENTINA ; DIONISIO, MARA SOFIA ; BALA, PAULO ; GROSS, TOM ; UP, TIME'S ; NUNES, NUNO JARDIM: Lucid Peninsula, a Physical Narrative Art Installation Comprising Interactive 360° Virtual Reality Components: In: *International Journal of Creative Interfaces and Computer Graphics* Bd. 10 (2019), Nr. 1, S. 1–15
- [NDHF00] NISI, VALENTINA ; DIONISIO, MARA ; HANNA, JULIAN ; FERREIRA, LUIS ; NUNES, NUNO: Yasmine's Adventures: An Interactive Urban Experience Exploring the Sociocultural Potential of Digital Entertainment. In: , *LNCS 9353*. Bd. Lecture Notes in Computer Science (LNCS) : Springer, S. 343–356
- [NeBL14] NEUHOFER, BARBARA ; BUHALIS, DIMITRIOS ; LADKIN, ADELE: A Typology of Technology-Enhanced Tourism Experiences. In: *International Journal of Tourism Research* Bd. 16 (2014), Nr. 4, S. 340–350
- [NeBL15] NEUHOFER, BARBARA ; BUHALIS, DIMITRIOS ; LADKIN, ADELE: Technology as a Catalyst of Change: Enablers and Barriers of the Tourist Experience and Their Consequences. In: *Information and Communication Technologies in Tourism 2015* : Springer, Cham, 2015, S. 789–802

- [NiCD16] NISI, VALENTINA ; COSTANZA, ENRICO ; DIONISIO, MARA: Placing Location-Based Narratives in Context Through a Narrator and Visual Markers. In: *Interacting with Computers* (2016)
- [NiHa00] NISI, VALENTINA ; HAAHR, MADS: Weird View: Interactive Multilinear Narratives and Real-Life Community Stories. In: *Crossings* Bd. 4, Nr. 1, S. 13
- [NiOa09] NISI, VALENTINA ; OAKLEY, IAN: Locative narratives as experience: A new perspective on location—aware multimedia stories. In: *Touchpoint Journal* Bd. 1 (2009)
- [NiOH06] NISI, VALENTINA ; OAKLEY, IAN ; HAAHR, MADS: Inner City Locative Media: Design and Experience of a Location-Aware Mobile Narrative for the Dublin Liberties Neighborhood. In: *Intelligent Agent*. Bd. 6, 2006
- [NiOP10] NISI, VALENTINA ; OAKLEY, IAN ; POSTHUMA DE BOER, MARTINE: Locative Narratives as Experience: a new perspective on Location Aware Multimedia Stories. In: . Porto, Portugal, 2010
- [NJCW17] NOBREGA, RUI ; JACOB, JOAO ; COELHO, ANTONIO ; WEBER, JESSIKA ; RIBEIRO, JOAO ; FERREIRA, SORAIA: Mobile location-based augmented reality applications for urban tourism storytelling. In: *2017 24º Encontro Português de Computação Gráfica e Interação (EPCGI)*. Guimaraes : IEEE, 2017 — ISBN 978-1-5386-2080-9, S. 1–8
- [Nova08] NOVACEK, MICHAEL J.: Engaging the public in biodiversity issues. In: *Proceedings of the National Academy of Sciences* Bd. 105 (2008), Nr. Supplement 1, S. 11571–11578
- [Nuen16] NUENEN, TOM VAN: The production of locality on peer-to-peer platforms. In: ALVARES, C. (Hrsg.) *Cogent Social Sciences* Bd. 2 (2016), Nr. 1, S. 1215780
- [NWDO04] NISI, VALENTINA ; WOOD, ALISON ; DAVENPORT, GLORIANNA ; OAKLEY, IAN: Hopstory: An Interactive, Location-Based Narrative Distributed in Space and Time. In: GÖBEL, S. ; SPIERLING, U. ; HOFFMANN, A. ; IURGEL, I. ; SCHNEIDER, O. ; DECHAU, J. ; FEIX, A. (Hrsg.): *Technologies for Interactive*

Digital Storytelling and Entertainment, Lecture Notes in Computer Science : Springer Berlin Heidelberg, 2004 — ISBN 978-3-540-22283-5, S. 132–141

- [ObCH18] O'BRIEN, HEATHER L. ; CAIRNS, PAUL ; HALL, MARK: A practical approach to measuring user engagement with the refined user engagement scale (UES) and new UES short form. In: *International Journal of Human-Computer Studies* Bd. 112 (2018), S. 28–39
- [ObTo13] O'BRIEN, HEATHER L. ; TOMS, ELAINE G.: Examining the generalizability of the User Engagement Scale (UES) in exploratory search. In: *Information Processing & Management* Bd. 49 (2013), Nr. 5, S. 1092–1107
- [OhFJ07] OH, H. ; FIORE, A. M. ; JEOUNG, M.: Measuring Experience Economy Concepts: Tourism Applications. In: *Journal of Travel Research* Bd. 46 (2007), Nr. 2, S. 119–132
- [OKGB07] O'HARA, KENTON ; KINDBERG, TIM ; GLANCY, MAXINE ; BAPTISTA, LUCIANA ; SUKUMARAN, BYJU ; KAHANA, GIL ; ROWBOTHAM, JULIE: Collecting and Sharing Location-based Content on Mobile Phones in a Zoo Visitor Experience. In: *Computer Supported Cooperative Work (CSCW)* Bd. 16 (2007), Nr. 1–2, S. 11–44
- [PaDi14] PAOLINI, PAOLO ; DI BLAS, NICOLETTA: Storytelling for Cultural Heritage. In: CONTIN, A. ; PAOLINI, P. ; SALERNO, R. (Hrsg.): *Innovative Technologies in Urban Mapping*. Bd. 10. Cham : Springer International Publishing, 2014 — ISBN 978-3-319-03797-4, S. 33–45
- [PeMo86] PEARCE, PHILIP L. ; MOSCARDO, GIANNA M.: The Concept of Authenticity in Tourist Experiences. In: *The Australian and New Zealand Journal of Sociology* Bd. 22 (1986), Nr. 1, S. 121–132
- [Phil00] *Philippines shuts tourist island of Boracay to tourists for 6 months - CNN*. URL <https://edition.cnn.com/2018/04/04/asia/philippines-duterte-boracay-shutdown-intl/index.html>. - abgerufen am 2020-04-05

- [Phil12] PHILLIPS, A.: *A Creator's Guide to Transmedia Storytelling: How to Captivate and Engage Audiences Across Multiple Platforms, Business Books* : McGraw-Hill Education, 2012 — ISBN 978-0-07-179152-6
- [PiGi11] PINE, B JOSEPH ; GILMORE, JAMES H: *The experience economy* : Harvard Business Press, 2011
- [PiGi99] PINE, B. JOSEPH ; GILMORE, JAMES H.: *The Experience Economy: Work is Theatre & Every Business a Stage* : Harvard Business Press, 1999 — ISBN 978-0-87584-819-8
- [Pitt11] PITTARELLO, FABIO: Designing a Context-aware Architecture for Emotionally Engaging Mobile Storytelling. In: *Proceedings of the 13th IFIP TC 13 International Conference on Human-computer Interaction - Volume Part I, INTERACT'11*. Berlin, Heidelberg : Springer-Verlag, 2011 — ISBN 978-3-642-23773-7, S. 144–151
- [PKCI08] PAAY, JENI ; KJELDSKOV, JESPER ; CHRISTENSEN, ANDERS ; IBSEN, ANDREAS ; JENSEN, DAN ; NIELSEN, GLEN ; VUTBORG, RENÉ: Location-based storytelling in the urban environment. In: *Proceedings of the 20th Australasian Conference on Computer-Human Interaction Designing for Habitus and Habitat - OZCHI '08*. Cairns, Australia : ACM Press, 2008 — ISBN 978-0-9803063-4-7, S. 122
- [PoGS17] POPPE, ERIK ; GILGEN, DÉsirÉE ; SAFRUDIN, NIZ: Virtual Reality Goes Mobile in the Digital Age. In: OSWALD, G. ; KLEINEMEIER, M. (Hrsg.): *Shaping the Digital Enterprise*. Cham : Springer International Publishing, 2017 — ISBN 978-3-319-40966-5, S. 309–330
- [PPCM00] PAULAUŠKAITE, DOMINYKA ; POWELL, RAYMOND ; COCA-STEFANIAK, J. ANDRES ; MORRISON, ALASTAIR M.: Living like a local: Authentic tourism experiences and the sharing economy. In: *International Journal of Tourism Research*, S. n/a-n/a

- [Prat12] PRATTEN, ROBERT: The Roswell Experience – transmedia storytelling for America’s small towns.
- [Prat15] PRATTEN, ROBERT: *Getting started with transmedia storytelling: a practical guide for beginners - 2nd edition*, 2015 — ISBN 978-1-5153-3916-8
- [Pren04] PRENTICE, RICHARD: Tourist Motivation and Typologies. In: LEW, A. A. ; HALL, C. M. ; WILLIAMS, A. M. (Hrsg.): *A Companion to Tourism* : Blackwell Publishing Ltd, 2004 — ISBN 978-0-470-75227-2, S. 259–279
- [PrRa04] PRAHALAD, C.K. ; RAMASWAMY, VENKAT: Co-creation experiences: The next practice in value creation. In: *Journal of Interactive Marketing* Bd. 18 (2004), Nr. 3, S. 5–14
- [Quir00a] QUIRING, TYLER: Sustainable Stories: Integrated Transmedia as an Ecology of Storymaking
- [Quir00b] QUIRING, TYLER: *The NEST Story*. URL <http://nest.maine.edu/>. - abgerufen am 2019-07-19
- [RBOS19] RIZVIC, SELMA ; BOSKOVIC, DUSANKA ; OKANOVIC, VENSADA ; SLJIVO, SANDA ; ZUKIC, MERIMA: Interactive digital storytelling: bringing cultural heritage in a classroom. In: *Journal of Computers in Education* Bd. 6 (2019), Nr. 1, S. 143–166
- [RiMa00] RICHARDS, GREG ; MARQUES, LENIA: *Overtourism in Lisbon: is culture the salvation?* URL https://www.researchgate.net/publication/332111673_Overtourism_in_Lisbon_is_culture_the_salvation. - abgerufen am 2019-07-19. — ResearchGate
- [RoBa17] ROUSE, REBECCA ; BARBA, EVAN: Design for Emerging Media: How MR Designers Think About Storytelling, Process, and Defining the Field. In: NUNES, N. ; OAKLEY, I. ; NISI, V. (Hrsg.): *Interactive Storytelling, Lecture Notes in Computer Science* : Springer International Publishing, 2017 — ISBN 978-3-319-71027-3, S. 245–258

- [RoDi18] ROUSE, REBECCA ; DIONISIO, MARA: *Looking Forward, Looking Back: Interactive Digital Storytelling and Hybrid Art Approaches*. 43654502 Bytes : Carnegie Mellon University: ETC Press, Pittsburgh, PA, 2018 — ISBN 978-0-359-11468-9
- [Saar06] SAARINEN, JARKKO: Traditions of sustainability in tourism studies. In: *Annals of Tourism Research* Bd. 33 (2006), Nr. 4, S. 1121–1140
- [SaPa02] SALVAT, BERNARD ; PAILHE, CLAIRE: Islands and coral reefs, population and culture, economy and tourism : world view and a case study of French Polynesia · Documentation Ifrecor Bd. Tourism, Biodiversity and Information", Vol. 14 (2002), S. 213–231 (2002)
- [ScAb95] SCHANK, ROGER C. ; ABELSON, ROBERT P.: Knowledge and Memory: The Real Story. In: WYER, R. S. (Hrsg.): *Knowledge and Memory: The Real Story* : Lawrence Erlbaum Associates, 1995, S. 1–85
- [ScBF14] SCOLARI, C. ; BERTETTI, P. ; FREEMAN, M.: *Transmedia Archaeology: Storytelling in the Borderlines of Science Fiction, Comics and Pulp Magazines* : Springer, 2014. — Google-Books-ID: CxonBQAAQBAJ — ISBN 978-1-137-43437-1
- [Sche99] SCHEYVENS, REGINA: Ecotourism and the empowerment of local communities. In: *Tourism Management* Bd. 20 (1999), Nr. 2, S. 245–249
- [SCRS03] SINGHAL, ARVIND ; CODY, MICHAEL J. ; ROGERS, EVERETT M. ; SABIDO, MIGUEL: *Entertainment-Education and Social Change: History, Research, and Practice* : Routledge, 2003. — Google-Books-ID: 4ySRAGAAQBAJ — ISBN 978-1-135-62456-9
- [Sebe10] SEBELE, LESEGO S.: Community-based tourism ventures, benefits and challenges: Khama Rhino Sanctuary Trust, Central District, Botswana. In: *Tourism Management* Bd. 31 (2010), Nr. 1, S. 136–146
- [Shel05] SHELDON, PAULINE: *The Challenges to Sustainability in Island Tourism* (2005)

- [SiRo01] SINGHAL, ARVIND ; ROGERS, EVERETT M.: The entertainment-education strategy in communication campaigns. In: *Public communication campaigns* Bd. 3 (2001), S. 343–356
- [SiRo12] SINGHAL, ARVIND ; ROGERS, EVERETT: *Entertainment-Education: A Communication Strategy for Social Change* : Routledge, 2012 — ISBN 978-1-135-66942-3
- [SiRo02] SLATER, MICHAEL D. ; ROUNER, DONNA: Entertainment—Education and Elaboration Likelihood: Understanding the Processing of Narrative Persuasion. In: *Communication Theory* Bd. 12 (2002), Nr. 2, S. 173–191
- [SiSa16] SLATER, MEL ; SANCHEZ-VIVES, MARIA V.: Enhancing Our Lives with Immersive Virtual Reality. In: *Frontiers in Robotics and AI* Bd. 3 (2016)
- [SoSu09] DE SOUSA E SILVA, ADRIANA ; SUTKO, DANIEL M.: *Digital Cityscapes: Merging Digital and Urban Playspaces., Digital Formations (Book 57)* : Peter Lang Publishing Inc., 2009
- [Souz06] DE SOUZA E SILVA, A.: From Cyber to Hybrid: Mobile Technologies as Interfaces of Hybrid Spaces. In: *Space and Culture* Bd. 9 (2006), Nr. 3, S. 261–278
- [SpHN19] SPEICHER, MAXIMILIAN ; HALL, BRIAN D. ; NEBELING, MICHAEL: What is Mixed Reality? In: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, CHI '19*. Glasgow, Scotland Uk : Association for Computing Machinery, 2019 — ISBN 978-1-4503-5970-2, S. 1–15
- [Spot00] *Spotted by Locals: city guides by insiders*. URL <https://www.spottedbylocals.com/>. - abgerufen am 2019-01-28. — Spotted by Locals
- [Stac00] STACEY, JANE: *Tourism Policy Responses to the coronavirus (COVID-19)*. URL <https://www.oecd.org/coronavirus/policy-responses/tourism-policy-responses-to-the-coronavirus-covid-19-6466aa20/#blocknotes-d7e20>. - abgerufen am 2020-07-06. — OECD

- [Stra00] *Stray Boots - scavenger hunt*. URL <https://www.strayboots.com/>
- [StSk03] STAMBOULIS, YEORYIOS ; SKAYANNIS, PANTOLEON: Innovation strategies and technology for experience-based tourism. In: *Tourism management Bd.* 24 (2003), Nr. 1, S. 35–43
- [Thei00] *The Immersive Engagement Model: Transmedia Storytelling for Social Change*. URL <http://www.social-marketing.com/immersive-engagement.html>. - abgerufen am 2017-05-09
- [Ther00] *The Revenge of the Origami Unicorn: Seven Principles of Transmedia Storytelling (Well, Two Actually. Five More on Friday)*. URL http://henryjenkins.org/blog/2009/12/the_revenge_of_the_origami_uni.html. - abgerufen am 2020-04-01. — Henry Jenkins
- [Thin00] *Things to Do in - Well Anywhere | Your Personal Tour Guide | Vayable*. URL <https://www.vayable.com/>. - abgerufen am 2017-09-27
- [TsBu16] TSCHEU, FRANCES ; BUHALIS, DIMITRIOS: Augmented Reality at Cultural Heritage sites. In: INVERSINI, A. ; SCHEGG, R. (Hrsg.): *Information and Communication Technologies in Tourism 2016*. Cham : Springer International Publishing, 2016 — ISBN 978-3-319-28231-2, S. 607–619
- [TSRT00] TSENE, LIDA ; SARIDAKI, MARIA ; ROINIOTI, ELINA ; TSAKARESTOU, BETTY ; CHRISANTHOPOULOU, CHISTINE: Playful Transmedia Storytelling: The case of Petite Poucette. In: *ResearchGate*
- [Tuss14] TUSSYADIAH, IIS P.: Toward a Theoretical Foundation for Experience Design in Tourism. In: *Journal of Travel Research Bd.* 53 (2014), Nr. 5, S. 543–564
- [Uncl00] *Uncle Roy All Around You: Implicating the City in a Location-Based Performance | Steve Benford, Martin Flintham, Adam Drozd, Rob Anastasi, Duncan Rowland, Nick Tandavanitj, Matt Adams, Ju Row-Farr, Amanda Oldroyd, Jon Sutton.* URL

- http://www.europeana.eu/portal/record/2022113/urn_ax-medis_00000_obj_a5e61424_e3f1_46ea_b471_99a9536a5a73.html. - abgerufen am 2015-07-03. — Europeana
- [Unit00] *Unity - Game Engine*. URL <https://unity3d.com/>. - abgerufen am 2016-06-24
- [User00a] *User Experience Questionnaire Handbook Version 2*. URL https://www.researchgate.net/publication/303880829_User_Experience_Questionnaire_Handbook_Version_2. - abgerufen am 2016-10-21
- [User00b] *User Experience Questionnaire (UEQ)*. URL <https://www.ueq-online.org/>. - abgerufen am 2019-06-03
- [Volo09] VOLO, SERENA: Conceptualizing Experience: A Tourist Based Approach. In: *Journal of Hospitality Marketing & Management* Bd. 18 (2009), Nr. 2–3, S. 111–126
- [Wang99] WANG, NING: Rethinking authenticity in tourism experience. In: *Annals of Tourism Research* Bd. 26 (1999), Nr. 2, S. 349–370
- [Webe00a] WEBER, JESSIKA: Augmented Reality Gaming: A new Paradigm for Tourist Experiences?, S. 11
- [Webe00c] WEBER, JESSIKA: *10 Ways to Make Tourism More Playful (Best Practices) : THE DIGITAL TOURISM THINK TANK*
- [Webe17b] WEBER, JESSIKA: *Designing engaging experiences with location-based augmented reality games for urban tourism environments*, Bournemouth University, Doctorate Thesis, 2017
- [Welc00] *Welcome to Pine Point*. URL <https://www.doclab.org/2010/welcome-to-pine-point/>. - abgerufen am 2017-09-20. — IDFA DocLab

- [What00] *What is Pervasive Entertainment? – Transmedia Storyteller*. URL <http://www.tstoryteller.com/what-is-pervasive-entertainment>. - abgerufen am 2017-08-04
- [WHBV07] WIRTH, WERNER ; HARTMANN, TILO ; BÖCKING, SASKIA ; VORDERER, PETER ; KLIMMT, CHRISTOPH ; SCHRAMM, HOLGER ; SAARI, TIMO ; LAARNI, JARI ; U. A.: A Process Model of the Formation of Spatial Presence Experiences. In: *Media Psychology* Bd. 9 (2007), Nr. 3, S. 493–525
- [WoMa08] WOODSIDE, ARCH G. ; MARTIN, DREW: 1 Tourism Management Theory, Research and Practice. In: *Tourism Management: Analysis, Behaviour and Strategy*, CABI (2008), S. 1 — ISBN 1845933230
- [Worl17] WORLD TRAVEL AND TOURISM COUNCIL: *World Travel and Tourism Council: Economic Impact 2017*, 2017
- [Worl20] WORLD TOURISM ORGANIZATION (UNWTO) (Hrsg.): *UNWTO Briefing Note – Tourism and COVID-19, Issue 1 – How are countries supporting tourism recovery?* : World Tourism Organization (UNWTO), 2020 — ISBN 978-92-844-2189-3
- [WuWa11] WU, BIAN ; WANG, ALF INGE: A pervasive game to know your city better. In: : IEEE, 2011 — ISBN 978-1-4577-0259-4, S. 117–120
- [WWGO07] WEIBEL, DAVID ; WISSMATH, BARTHOLOMÄUS ; GRONER, RUDOLF ; OTHERS: Presence vs. flow in the context of computer games. In: *International Society for Presence Research (ISPR)* (2007)
- [WWHS08] WEIBEL, DAVID ; WISSMATH, BARTHOLOMÄUS ; HABEGGER, STEPHAN ; STEINER, YVES ; GRONER, RUDOLF: Playing online games against computer-vs. human-controlled opponents: Effects on presence, flow, and enjoyment. In: *Computers in Human Behavior, Including the Special Issue: Internet Empowerment*. Bd. 24 (2008), Nr. 5, S. 2274–2291

- [XuBW17] XU, FEIFEI ; BUHALIS, DIMITRIOS ; WEBER, JESSIKA: Serious games and the gamification of tourism. In: *Tourism Management* Bd. 60 (2017), S. 244–256
- [YoDa18] YOUNG-SUNG, KWON ; DANIEL, H. BYUN: An exploration of the limitations of transmedia storytelling: Focusing on the entertainment and education sectors. In: *Journal of Media and Communication Studies* Bd. 10 (2018), Nr. 4, S. 25–33
- [ZCWY14] ZHENG, YU ; CAPRA, LICIA ; WOLFSON, OURI ; YANG, HAI: Urban Computing: Concepts, Methodologies, and Applications. In: *ACM Transactions on Intelligent Systems and Technology* Bd. 5 (2014), Nr. 3, S. 1–55
- [ZiFE07] ZIMMERMAN, JOHN ; FORLIZZI, JODI ; EVENSON, SHELLEY: Research through design as a method for interaction design research in HCI. In: *Proceedings of the SIGCHI conference on Human factors in computing systems* : ACM, 2007, S. 493–502

Appendix A. IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality

IVRUX: A Tool for analyzing Immersive Narratives in Virtual Reality

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Abstract. This paper describes IVRUX, a tool for the analysis of 360° Immersive Virtual Reality (IVR) story-driven experiences. Traditional cinema offers an immersive experience through surround sound technology and high definition screens. However, in 360° IVR the audience is in the middle of the action, everything is happening around them. The immersiveness and freedom of choice brings new challenges into narrative creation, hence the need for a tool to help the process of evaluating user experience. Starting from “The Old Pharmacy”, a 360° Virtual Reality scene, we developed IVRUX, a tool that records users’ experience while visualizing the narrative. Through IVRUX, we are able to reconstruct the user’s experience and understand where their attention is focused. In this paper, we present results from a study done using 32 participants and, through analyzing the results, provide insights that help creators to understand how to enhance 360° Immersive Virtual Reality story driven experiences.

Keywords: Virtual Reality • Digital storytelling • 360° Immersive Narratives

1 Introduction

The continuous emergence of new and more powerful media systems is allowing today’s users to experience stories in 360° immersive environments away from their desktops. Head-Mounted Displays (HMD) such as the Oculus Rift¹ and Google Cardboard², are becoming mainstream and offer a different way of experiencing narratives. In Immersive Virtual Reality (IVR), the audience is in the middle of the action, and everything is happening all around them. Traditional filmmakers are now tasked with adapting tightly controlled narratives to this new media that defies a single view point, strengthens immersion in the viewing experience by offering the freedom to look around but also presents challenges, such as the loss of control over the narrative viewing sequence and the risk of having the audience miss important exciting steps in

¹ <https://www.oculus.com/en-us/>

² <https://vr.google.com/cardboard/index.html>

the story. For this reason in 360° IVR, it is important to understand what attracts their attention to or distracts them from the story.

In this paper, we describe the development of IVRUX, a 360° VR analytics tool and its application in the analysis of a VR narrative scene. Our aim is to further advance the studies of user experience in 360° IVR by trying to understand how we can enhance the story design by analyzing the user’s perception of their experience in conjunction with their intentions during the visualization of the story.

2 Related work

In their summary on future Entertainment Media, Klimmt et al.[6] defend the argument that the field of interactive narrative is still in flux and its research is varied. IVR is currently being explored in several technologies and formats [3, 10, 13] One of the common links between these experiences is the freedom in the field of view. Directing a user’s gaze is essential if they’re to follow a scripted experience, trigger an event in a virtual environment, or maintain focus during a narrative. Currently, developers are compensating for the free movement of the user’s gaze by utilizing automatic reorientations and audio cues as in Vosmeer et al.’s work [13], at the risk of affecting user’s presence and immersion in the narrative. Such experiments demonstrate the need for a better understanding of user experience in VR, which can be advanced by capturing qualitative information about the user’s experience that can be easily visualized and communicated. Nowadays, eye-tracking is used to analyze visual attention in several fields of research. Blascheck et al [1] highlighted several methods for the visualization of gaze data for traditional video such as attention maps [4, 8] and scan path [9]. However, this is not the case for 360° IVR as the participants have the freedom to look around. Efforts into developing data visualizations that allow users to inspect static 3D scenes in an interactive virtual environment are currently being made [11, 12] but results are incompatible with dynamic content (video, 3D animation). Lowe et al. [7] research the storytelling capability of immersive video, by mapping visual attention on stimuli from a 3D virtual environment, recording gaze direction, and head orientation of participants watching immersive videos. Moreover, several companies are engaged in investigating this topic, such as Retinad³, CognitiveVR⁴, Ghostline⁵, by providing analytical platforms for VR experiences. However, little information is available about them as they are all in the early stages of development.

3 “The Old Pharmacy”

“The Old Pharmacy” is an 360° Immersive narrative scene, part of a wider trans-media story called “Fragments of Laura”, designed with the intention of informing users about the local natural capital of Madeira island and the medicinal properties of

³ <http://retinad.io/>

⁴ <http://cognitivevr.co/>

⁵ <http://ghostline.xyz/>

its unique plants. The storyline of the overall experience revolves around Laura, an orphan girl who learns the medicinal powers of the local endemic forest. In the “The Old Pharmacy” scene, Laura is working on a healing infusion when a local gentleman, Adam, interrupts her with an urgent request. The experience ends in a cliffhanger as a landslide falls upon our characters. For a summary of the story see Fig. 1.

The implementation of the IVR mobile application used was programmed using the Unity 5 game engine⁶. In this scene, we are presented with a 360° virtual environment of a pharmacy from the 19th century. The 360° Camera Rotation in the virtual environment is provided by the Google VR plugin⁷. All multimedia content is stored in the device and no data connection is needed. Information needed for analysis of the VR behavior is stored locally in an Extensible Markup Language (XML) file.

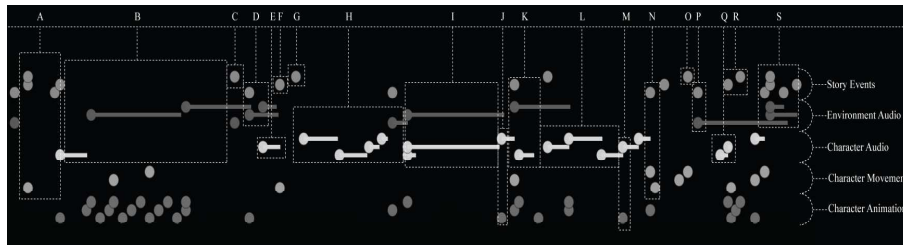


Fig. 1. IVRUX data mapping the plot points of the scene, coded alphabetically from A to S. Story Timeline A) Laura enters the scene, opens and closes door 1; B) Laura looks for ingredients; C) Door 2 opens; D) Thunder sound; E) Laura reacts to Adam’s presence; F) Adam enters the room; G) Door 2 closes; H) Dialogue between Laura and Adam; I) Laura preparing medicine; J) Laura points at table; K) Adam moves to table; L) Dialogue between Laura and Adam; M) Laura points at door 3; N) Adam leaves the room, opens door 3; O) Door 3 closes; P) Landslide; Q) Characters screaming for help; R) Laura leaves the room; S) End of scene.

4 IVRUX - VR Analytics Tool

In order to supply authors with useful insight and help them design more engaging 360° narratives, we developed a VR analytics prototype (IVRUX) to visualize the user experience during 360° IVR narratives. The implementation of IVRUX was also developed using Unity 5. The prototype, using the XML files extracted from the mobile device, organizes the analytics information into a scrubbable timeline, where we are able to monitor key events of five types: story events, character animation, character position (according to predefined waypoints in the scene), character dialogue and environment audio. The prototype allows the researcher to switch between three observation modes; the single camera mode, a mode for 360° panorama (see C in Fig.2) and a mode for simulation of HMD VR. The prototype replicates the story’s 3D environment and the visual representation of the user’s head tracking (field of view) by a semi-transparent circle with the identification number of the participant. Moreover a

⁶ <https://unity3d.com/>

⁷ <https://developers.google.com/vr/unity/>

line connecting past and present head-tracking data from each participant allows us to understand the participant’s head motion over time. Semi-transparent colored spheres are also shown, one represents the points of interest (PI) in the story, simulating the “Director’s cut” and the others represent the location of the two characters.

The scrubbable story timeline (see J in Fig. 2), presents the logged events and audio events. A scrollable panel (see B in Fig. 2) allows the user to choose which participant session to analyze and by selecting it, three pie charts (see A in Fig. 2) are shown indicating the ratio of time that the participant spent looking at one of the target spheres. Additionally, the timeline is also updated to represent the intervals of time where a participant is looking at each target (see D in Fig. 2).

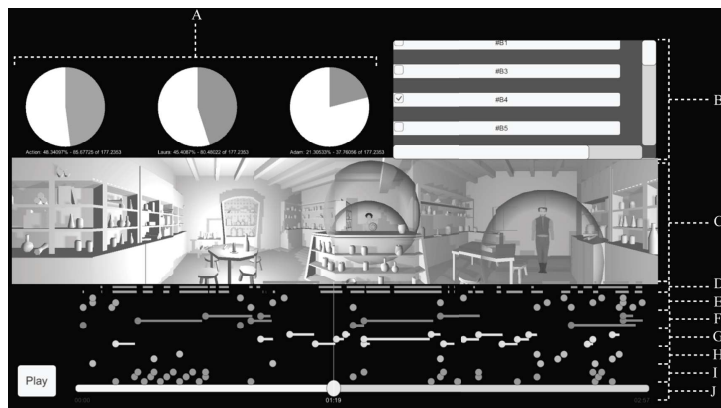


Fig. 2. IVRUX interface. A) Pie charts representing intervals of time where a participant is looking at target spheres; B) User selection scrollview; C) 360° panorama; D) Intervals of time where a participant is looking at target spheres; E) Story Events; F) Environment Audio; G) Character Audio; H) Character Movement; I) Character Animation; J) Scrubbable Timeline.

5 Methodology

To test IVRUX, we conducted a study with a total of 32 users (16 females), non-native English speakers, of which 31.3% were under the age of 25, 62.5% were within the 25-34 age range and 6.2% were over the age of 35. To assess participant homogeneity in terms of the tendency to get caught up in fictional stories, we employed the fantasy scale [2], with a satisfactory internal reliability ($\alpha = 0.53$). Two researchers dispensed the equipment (Google Cardboard with a Samsung Galaxy S4) with the narrative and took notes while supervising the evaluation. Participants were asked to view the 3-minute IVR narrative. Subsequently, the participants were asked to complete a post-experience questionnaire and were interviewed by the researcher (for questions see Table 1.); this process took, on average, 15 to 20 minutes. After collecting all the interview data, two researchers analyzed questions IQ1-4,7,9 and open coded the answers. In IQ1, 3, answers were classified into three levels of knowledge (low, medium and high). In IQ2,7, answers were classified positively and negatively. Finally, in IQ9, answers were classified according to the engagement with story plot,

environment exploration or both. We used the Narrative Transportation Scale (NTS) [5] to assess participant ability to be transported into the application’s narrative ($\alpha=0.603$).

Table 1. Semi-Structured Interview Table

ID	Question
IQ1	Please tell us what the story was about? Please re-tell in a few words the story that you have just seen.
IQ2	Was it difficult to follow the story? If yes, what made it difficult?
IQ3	Please draw the room you were in. (On the back of the sheet)
IQ4	What was the trajectory of Laura and Adam in the pharmacy? Please trace it in the drawing.
IQ5	What would you say was the most interesting element of this experience?
IQ6	Did you have the need to stop exploring/moving in the environment, to listen to the dialogue between the characters? If yes can you elaborate why?
IQ7	Were you following the characters and the story plot or were you expressly looking away from the characters?
IQ8	What part of the room did you look at more and why? Did you look at the shelves with the jars, opposite the counter? If so, why?
IQ9	Were you more engaged with the story plot or with exploring the environment?

6 Findings

6.1 Findings from questionnaires and interviews

The results from the NTS, which evaluates immersion aspects such as emotional involvement, cognitive attention, feelings of suspense, lack of awareness of surroundings and mental imagery, presented a mean value of 4.45 (SD=0.76).

From the analysis of the semi-structured interviews (see Fig. 3), most participants understood the story at the medium level (IQ1), while with regard to knowledge about the virtual environment (IQ3) participants generally demonstrated medium to high levels of reminiscence of the virtual environment. More than half of the participants had a high awareness of character movement (IQ4) and most participants did not have difficulties following the story (IQ2) and were not averse to the story (IQ7).

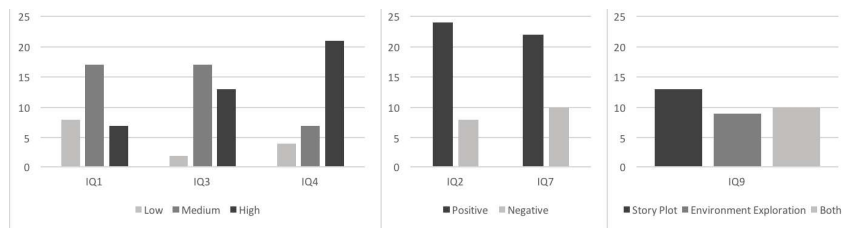


Fig. 3. Clustered column charts for participants scores in relation to the semi-structured interviews questions: IQ1, IQ2, IQ3, IQ4, IQ7 and IQ9

For example, participant A26 said “I took the opportunity to explore while the characters weren’t doing anything”. According to participants the most interesting elements of the experience (IQ5) were factors such as the 360° environment, the surprise effect (doors opening, character entry, thunder, etc.) and the immersiveness of the environment. For example, participant A3 stated “the thunder seemed very real

(...) I liked the freedom of choosing where to look.”, participant A6 mentioned ”I was surprised when the door opened and I had to look for Adam.”. When asked if they would prefer to explore around the environment or focus on the story, the answers were inconclusive; a portion of users believe that the combination made the experience engaging. For example, participant B9 said “I enjoyed both and the story complements the environment and vice-versa.”; moreover, participant B1 stated “At the beginning I was more engaged with the environment but afterwards with the story.”.

6.2 Findings from the IVRUX

Through the analysis of the data captured through the IVRUX, we noted that 48% of the time, participants were looking at the “Director’s cut” (M=85.31s, SD=14.82s). Participants spent 51.16% of the time (M=90.93s, SD=21.25s) looking at the female character and 15.37% (M=27.32s, SD=8.98s) looking at the male character. All users started by looking at the “Director’s cut” but after a couple of seconds, around 10 users drifted into exploring the environment. Of those 10 users, 8 chose to explore the left side rather than the right side of the pharmacy, where the table with the lit candle was situated. Once Laura, the protagonist started talking (B in Fig.1), the 10 who were exploring shifted their focus back to her and the story (“Director’s cut”). Around 9 users looked around the pharmacy as if they were looking for something (mimicking the protagonist’s action of looking for ingredients). When Laura stopped talking and started preparing the infusion (end of B in Fig.1), around 12 users started exploring the pharmacy, while the rest kept their focus on Laura. At the sound and action of the door opening, (C, D in Fig.1) 13 of the users shifted their attention immediately to the door. When Adam walked in (F in Fig.1) we observed the remaining users redirecting their attention to the door. As Laura started talking to Adam, 22 users refocused on Laura, however we noticed some delay between the beginning of the dialog and the refocusing. When the characters were in conversation, 20 users shifted focus between Adam and Laura. During the preparation of the medicine (I in Fig.1), 25 users kept their focus on Laura, while around 7 users started exploring. While all users followed the characters and trajectories, they did not follow indications to look at specific places (J, M in Fig.1). When Adam left the scene (N in Fig.1), all users redirected the focus to Laura. After the landslide, when Adam screamed (Q in Fig.1), none of the users were looking at the door from where the action sounds emanated.

7 Discussion

As we were developing IVRUX, through continuous user testing we understood that at the beginning, orientation of the virtual camera was influential in the user following the “Director’s cut”, therefore the placement and orientation of the camera should be carefully considered. When characters are performing the same actions for long periods of time or are silent, users tend to explore the environment. These “empty moments”, when users are exploring and plot is not developing, are best suited to directing the user’s attention to branched narratives or advertising. During the character’s

dialogue some participants were shifting focus between the two as they would in a real life conversation. A subset of our sample explored the environment during the dialogue; in the interview, users explained that once they knew where the characters were, it was enough for them to fall back on audio to understand the story. This is a clear illustration of freedom of choice in IVR that filmmakers have to embrace.

Lighting design emerged as crucial in drawing the attention of participants to specific elements in the narrative or environment. Users directed themselves towards areas that were better illuminated. Similarly, audio can also be used to attract attention – for example when a door opens (C, G in Fig. 1) or when characters speak, as participants were seen to focus their attention on the area where the noise originated. From the interviews, participants recalled the characters’ movements easily (IQ4); this was also observed in IVRUX as the participant’s head tracking accompanies the character’s movement. However, participants did not pay attention to where characters were pointing (J, M in Fig 1.). When concurrent events are happening (S in Fig. 1), it is difficult for participants to be aware of all elements, accentuating a need for a buffer time for awareness and reaction to the events. In VR, we need to adjust the pacing of the story, as has been suggested by the Oculus Story Studio [14].

“The Old Pharmacy” NTS’s values are average, this could be explained by two conditions: the average fantasy scale scores of participants and the short duration of the experience as mentioned by participants in IQ9 (e.g. participant B8 “If the story was longer, I would have been more focused on it.”). Contrary to what we expected, we did not find significant correlations between NTS and the amount of time spent looking at the “Director’s cut”. This could be justified by participants who defy the “Director’s cut” intentionally (IQ7) or unintentionally (participants who rely on the audio rather than looking at the characters). Authors must account for defiance in participants when designing the story narrative in 360° environments. In the interviews, participants highlighted the technology and the nature of the medium as one of the most interesting factors of the experience (IQ5): “It really felt like I was there” (Participant B8).

8 Conclusions & Future Work

In this paper, we have described the development, testing and results of IVRUX, a 360° VR analytics tool and its application in the analysis of IVR “The Old Pharmacy”. Results from our study highlight the potential of using VR analytics as a tool to support the iteration and improvement of 360° IVR narratives, by relaying information as to where the users are looking and how their focus shifts. Creators can now take informed decisions on how to improve their work. We were able to identify shortcomings of “The Old Pharmacy” narrative, such as the camera orientation, story pacing issues and lighting design. We hope that this encourages the further development of 360° IVR analytics tools to empower creators to test narrative design assumptions and create experiences that are immersive and engaging. Furthermore, we envisage the integration of biometric sensing feedback into IVRUX to enable visualization of the user’s body reaction to the narrative, superimposed on the IVRUX visualization already discussed. From the point of view of interactive storytellers, testing the tool

with further IVR narratives, such as IVR narrative with multiple story threads or a non-linear story is crucial to gathering guidelines to understanding user preference.

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10 References

1. Blascheck, T. et al.: State-of-the-Art of Visualization for Eye Tracking Data. (2014).
2. Davis, M.H.: Measuring individual differences in empathy: Evidence for a multidimensional approach. *J. Pers. Soc. Psychol.* 44, 1, 113–126 (1983).
3. Dionisio, M. et al.: Evaluation of Yasmine’s Adventures: exploring the socio-cultural potential of location aware multimedia stories. Presented at the Interactive Storytelling - 8th International Conference on Interactive Digital Storytelling, 2015 December 30 (2015).
4. Duchowski, A.T. et al.: Aggregate Gaze Visualization with Real-time Heatmaps. In: *Proceedings of the Symposium on Eye Tracking Research and Applications*. pp. 13–20 ACM, New York, NY, USA (2012).
5. Green, M.C., Brock, T.C.: The role of transportation in the persuasiveness of public narratives. *J. Pers. Soc. Psychol.* 79, 5, 701–721 (2000).
6. Klimmt, C. et al.: Forecasting the Experience of Future Entertainment Technology “Interactive Storytelling” and Media Enjoyment. *Games Cult.* 7, 3, 187–208 (2012).
7. Löwe, T. et al.: Visualization and Analysis of Head Movement and Gaze Data for Immersive Video in Head-mounted Displays.
8. Mackworth, J.F., Mackworth, N.H.: Eye fixations recorded on changing visual scenes by the television eye-marker. *J. Opt. Soc. Am.* 48, 7, 439–445 (1958).
9. Noton, D., Stark, L.: Scanpaths in eye movements during pattern perception. *Science*. 171, 3968, 308–311 (1971).
10. Peña, N. de la et al.: Immersive Journalism: Immersive Virtual Reality for the First-Person Experience of News. *Presence*. 19, 4, 291–301 (2010).
11. Pfeiffer, T.: Measuring and Visualizing Attention in Space with 3D Attention Volumes. In: *Proceedings of the Symposium on Eye Tracking Research and Applications*. pp. 29–36 ACM, New York, NY, USA (2012).
12. Ramloll, R. et al.: Gaze data visualization tools: opportunities and challenges. In: *Eighth International Conference on Information Visualisation, 2004. IV 2004. Proceedings*. pp. 173–180 (2004).
13. Vosmeer, M. et al.: Interaction in Surround Video: The Effect of Auditory Feedback on Enjoyment. In: Schoenau-Fog, H. et al. (eds.) *Interactive Storytelling*. pp. 202–210 Springer International Publishing (2015).
14. 5 Lessons Learned While Making Lost, /en-us/blog/5-lessons-learned-while-making-lost.

**Appendix B. Evaluating the Influence of
Location and Medium Applied to Mobile
VR Storytelling**

Evaluating the Influence of Location and Medium Applied to Mobile VR Storytelling

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Abstract

This paper investigates whether locality and medium affect the experience of interactive storytelling in the context of mobile Virtual Reality systems. For this purpose, we discuss the development of Fragments of Laura, a location aware multimedia application in a larger interactive transmedia story, where users can view a 360° narrative in a 3D environment. We conducted a user study with the intention of measuring Presence, Flow and Narrative Transportation and evaluate four scenarios resulting from the combination of two independent variables - location (existence and absence of links between the test location and the narrative location) and medium (tablet and mobile virtual reality with smartphones). Our results show that experiencing a narrative with links to the location were it was being tested, may lead to a significantly increased Flow, Presence, and Narrative Transportation.

Author Keywords

Digital storytelling; location aware virtual reality; flow; mobile virtual reality

ACM Classification Keywords

H.5.1. Information Interfaces and Presentation (e.g., HCI): Multimedia Information Systems — Artificial, augmented, and virtual realities;

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Introduction

With the increasing availability, power and portability of mobile computing, a growing interest has been paid to experiences that use mobile computing to deliver locative media, aiming at providing immersive experiences. For example, Pokemon Go [21] explores mobile computing for Mixed Reality, introducing gameplay elements of a virtual world into real life locations. Similarly, Location Aware Multimedia Stories (LAMS) are cinematically rendered narrated content related to specific locations and embedded in real spaces through the use of location aware mobile technologies. However, evaluating such systems is an important challenge for HCI research since traditional laboratory evaluation of location aware services is clearly biased as it limits the understanding of design and use and the development of cumulative knowledge regarding the design of such systems [4]. Recently researchers started to look at methods and techniques for staging and evaluating these systems in the wild [6], trying to understand the influence of elements such as context and content on these systems. Therefore, this paper describes ongoing work in studying the influence of locality and medium (namely, the immersive potential of mobile devices) in LAMS. We conducted an evaluation on a LAMS system named Fragments of Laura. With Fragments of Laura, we use a small portion of the experience to explore VR in locative storytelling, taking into account how medium and locality affects the VR experience. For this purpose, we evaluate four different scenarios of usage using combinations of two independent variables: location (linked or not linked to the virtual location) and device (a smartphone with a Google Cardboard, that we will from now on refer as MVR - Mobile Virtual Reality, and a tablet). We analyze the different scenarios based on

Flow, Presence and Narrative Transportation to discuss three main research questions: i) Is the experience of watching a 360° VR narrative affected by the location?; ii) To which extent does the medium where the narrative is presented affect the experience?; and iii) To what extent does medium and location where the 360° VR narrative is presented affect the experience?

Related Work

Mixed Reality and Location Aware Multimedia Story Milgram et al [13] have described Mixed Reality as encompassing the Reality-Virtuality continuum (RVC), according to the way the system mediates the relation between the user and the real world: not changing any cues the user perceives (Reality), adding simulated cues to real cues (Augmented Reality), adding real cues to simulated cues (Augmented Virtuality) or replacing all real cues with simulated ones (Virtual Reality). The factor of location is often explored in these systems to varied degrees, and relevant to our work. For example, Augerscope [17], a mobile mixed reality device for open-air museum experiences, overimposes video on real world locations. Similarly, McGookin et al. [11] explores the relationship between on-screen and in-environment content through digital AR graffiti in mobile devices. Finally, Brown et al. [1] explored the impact of different devices (mobile on-site, in VR and on the web) in a shared MR system for museum tours.

LAMS are locative media that aims at “telling stories that unfold in real space”, through the use of location aware mobile technologies. The assumption underlying all LAMS is that the overlaying of virtual information (the narrative) over the existing physical space increases the level of immersion in the narrative. The immersion in a LAMS system is due to the narrative’s

native capability to draw the audience's attention, a phenomenon called text hegemony hypothesis [18]. McMahan subdivides this phenomenon into perceptual immersion (achieved by ignoring the outside world) and psychological immersion (achieved by the user's mental absorption) [12]. Green and Brock [5] defend the existence of Narrative Transportation, which includes emotional involvement in the story, cognitive attention to the story, lack of awareness, feelings of suspense and mental imagery. From the definition of MR [13] is clear to acknowledge that LAMS are deeply linked to the concepts encompassing the RVC, namely on the mediation between user and real environment. While Mixed Reality systems are applied to a wide variety of fields, LAMS narrow their focus on Interactive Storytelling [2].

Interactive Storytelling in Mixed Reality

Interactive Storytelling in VR mostly focuses on the agency of the user [14] (the power given to users to let them choose alternates storylines in the narrative) or the engagement style that a user adopts. A user might adopt a passive style ("lean back") of someone who is watching a movie versus the active style ("lean forward") of someone playing a videogame [20]. With the wide availability of 360° surround video or VR another style ("lean in") has been suggested since the user is not completely "leaning back" nor completely "leaning forward" [20]. Finally, another common area of research of VR in IS is the affordances given by different technologies to explore 360° VR environments. Kwiatek et al. [9] recorded 360° panoramic views of a city and weaved them together in a multiple branch narrative for PC, exploring the poetry of Charles Causley in the context of his hometown. Kwiatek and Woolner [8] used a wraparound screen to

visualize a reconstructed 3D church and a touchscreen to affect the storyline. Mobile devices such as smartphones and tablets have used the devices' gyroscopes and accelerometers to enhance exploration of 3D environments. Yasmine's Adventures [4], a location aware multimedia story, uses mobile devices to explore 3D reconstructions of the Mehringplatz neighborhood in Berlin, while IDNA [22] uses a tablet as a medium to explore a 360° short film. To our knowledge, even though there are numerous works on the use of VR in IS, little research can be found comparing different mediums in order to determine how to best serve the interactive narrative. Based on the importance of locality in LAMS to improve the storytelling experience and the potential of VR applied to IS, this work aims to explore how the two fields can be merged to create a better storytelling experience. For this purpose, we study the influence of locality and medium in the context of mobile VR.

Fragments of Laura

Story / Concept

Fragments of Laura was designed with the intention of enabling users to explore overlooked landmarks in Madeira Island. Through the use of mobile devices (smartphones and tablets) a user is able to explore the village of Ponta de Sol (in the south of Madeira), finding interaction points spread out in the village that advance the narrative of the story. For this pilot study, we isolate a single application in a wider transmedia interactive story, which combines fictional and non-fictional storytelling elements with 360° VR leveraging the device's sensors to enable spatial exploration. The digital narrative concerns Laura, an orphan girl who learned the medicinal powers of the local plants from the Laurisilva (the endemic forest of Madeira).

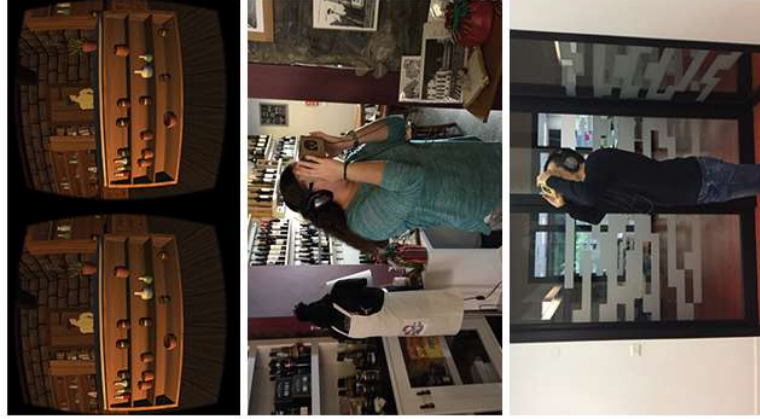


Figure 1: Mobile Virtual Reality (MVR) medium interface (top), on-site (middle) and off-site (bottom)



Figure 2: Tablet medium interface (top), on-site (middle) and off-site (bottom)

Throughout the story, Laura opens a pharmacy in Ponta do Sol. This pharmacy is based on an actual existing place, a pharmacy in the 1800s that now functions as a coffee shop (named "Old Pharmacy"). For this pilot study, the user can explore the 3D digital environment while the characters discuss the preparation of a medicinal tea. The experience ends in a cliffhanger as a landslide falls upon our characters, an event based on the 1803 landslides in Madeira.

The implementation of the mobile application used was programmed using the Unity 5 game engine [23]. The main interface is composed of a 3D room that when triggered loads a new scene with the story narrative. In this scene, we are presented with a 3D virtual environment of a pharmacy from the 19th century. Rotation in the virtual environment is provided by the Google Cardboard Unity plugin [24].

Method

Participants

A total of 20 users (13 females and 7 males) participated in this study, of which 25% were less than 25 years, 60% were within the 25-34 age range and 15% were above 35 years old. The majority (95%) were currently living in Portugal. This study was conducted in two separate locations: On-site - in which the virtual environment is strongly linked to the physical environment and Off-site - in which there is no link to the physical environment. In order to assess participants' homogeneity in terms of their empathic ability, we employed the fantasy scale, one of the four constructs of Davis' Interpersonal Reactivity Index (IRI) [3]. The fantasy scale measures an individual's tendency to get caught up in fictional stories and imagine oneself in the same situations as fictional

characters [3]. The internal reliability of the scale was satisfactory (Cronbach's $\alpha = 0.659$). In addition, we found no significant differences between the sample that tested the experience on-site ($M=3.628$, $SD=0.376$) and off-site ($M= 3.48$, $SD=0.55$).

Evaluation Setup

The on-site experience was fully contained in the Old Pharmacy. Two researchers dispensed the equipment with the application and took notes while supervising the evaluation. Similarly, the off-site evaluation was held at our research facilities. Overall, the experience took around 5 minutes. Subsequently, the participants were asked to fill a questionnaire of demographic data and measures of Narrative Transportation, Presence, Flow and Fantasy. This questionnaire took on average 10 minutes for a total duration of 15-20mn per subject.

Measures

The Narrative Transportation Scale (NTS) [5] was applied to assess participants' ability to be transported into the application's narrative. The scale's internal reliability was $\alpha = 0.592$. We used the 7-point Flow Short Scale [16] to evaluate the individual's ability to be absorbed by the experience and fluency while conducting it. Moreover, the scale also contains one extra item to measure the challenge of the experience ("For me personally the demands of this experience were:"). This additional item was measured using a 7-point scale (from "Too Low" to "Too High"). The internal consistency for the Flow scale was $\alpha = 0.845$. We use the mean values of the overall scale throughout this paper. The mean level of flow across all user sessions was ($M=4.45$, $SD=1.03$). Compared to scores attained with various activities and across various studies [15], the Flow score lies slightly below the overall mean ($T =$

Mean values of relevant measures according to the variable Location (on-site and off-site). N=20. AOS (Awareness of surroundings)				
	Flow	NTS	Presence	AOS
On-site	4.60 (SD=1.05)	4.81 (SD=0.62)	5.80 (SD=1.03)	4.60 (SD=2.06)
Off-site	4.30 (SD=1.06)	4.29 (SD=0.60)	4.80 (SD=1.03)	3.70 (SD=1.49)
Mean Values of relevant measures according to the variable Medium (Tablet and MVR). N=20. AOS (Awareness of surroundings)				
	Flow	NTS	Presence	AOS
Tablet	4.22 (SD=0.98)	4.54 (SD=0.43)	5.30 (SD=0.99)	2.50 (SD=0.53)
MVR	4.69 (SD=1.09)	4.56 (SD=0.84)	5.30 (SD=1.33)	1.60 (SD=0.516)

Table 1: Comparisons of mean values of relevant measures according to the variable Location and Medium. N=20

47). To evaluate Presence in the story, a single item was included in the questionnaire: "In the video narrative I had a sense of being there:". This item is in line with definitions of Presence as an experience [10]. Tables 1 and 2 summarize the results comparing the mean values of measures according to location and medium separately (Table 1) and both variables location and medium (Table 2).

Findings

In this section, we summarize our preliminary findings attempting to address the following research questions:

i) *Is the experience of watching a 360° VR narrative affected by the location?*

Flow mean values revealed to be slightly higher for the experience when taken on-site (M=4.60, SD=1.05). The data revealed that there are no significant differences in the demands when comparing the experience taken on-site (M=3.20, SD=1.229) and the experience taken off-site (M=3.30, SD=1.25).

Moreover, the values are above average indicating that the demands of the experience are not high. The narrative transportation values also revealed to be higher if the experience is taken on-site (M=4.81, SD=0.62). When comparing the sense of Presence, the data reveals that it was higher on-site (M=5.80, SD=1.03). Still, the values of the off-site experience are shown to be high (M= 4.80, SD=1.03), revealing that the sense of Presence is quite high for this experience. Participants were also more aware of the surroundings on the on-site experience (M=4.60, SD=2.06).

ii) *To which extent does the medium where the 360° VR narrative is presented affect the experience?*

When flow was compared by device type regardless of the location, the MVR revealed higher values for the flow (M=4.69, SD=1.09). Moreover, the demands of the experience seemed to be higher when using the tablet (M=3.50, SD=1.17) since the mean values were higher than for the MVR (M=3.00, SD=1.24). A surprising result was that the narrative transportation revealed to be independent from the device in which the narrative is displayed as the means for the tablet (M=4.54, SD=0.43) and the MVR (M=4.56, SD=0.84) reveal almost no difference. Similarly, when analyzing the differences of the sense of Presence (depending on the type of device used), the results show that the means values are the same (Tablet: M=5.30, SD=0.949; MVR: M=5.30, SD=1.33). However, there is a difference in the awareness of the surroundings.

These mean values revealed to be higher when using the tablet (M=2.50, SD=0.53); those for MVR (M=1.60, SD=0.516) were quite low, revealing a lack of awareness of the surroundings when using it.

iii) *To what extent does medium and location where the 360° VR narrative is presented affect the experience?*

When comparing the Flow means for each location and by device type, the results revealed that off-site the flow is higher when using the tablet (Tablet: M=4.48, SD=1.04; MVR: M=4.12, SD=1.16). When we analyze the results of flow on-site, the mean values revealed to be much higher on the MVR (M=5.26, SD=0.72). Off-site, the mean values for the demands appeared to be the same for both devices (M=3.20, SD=1.30). On-site, the mean values for the demands using the tablet (M=3.80, SD=1.09) are higher than using the MVR (M=2.80, SD=1.30). Some difference does emerge in the narrative transportation if we take into account the location and the device. Off-site, the NTS is higher when using the tablet as a device (Tablet: M=4.52,

SD=0.53; MVR: M=4.06, SD=0.64). On-site, the NTS is higher when using the MVR as a device (MVR: M=5.06, SD=0.76; Tablet: M=4.56, SD=0.38).

	Flow	NTS	Presence	AOS	
On-site	Tablet	3.9 (SD=0.94)	4.56 (SD=0.38)	5.40 (SD=1.14)	2.40 (SD=0.55)
	MVR	5.26 (SD=0.72)	5.06 (SD=0.76)	6.20 (SD=0.83)	1.60 (SD=0.55)
Off-site	Tablet	4.48 (SD=1.04)	4.52 (SD=0.53)	5.20 (SD=0.84)	2.60 (SD=0.55)
	MVR	4.12 (SD=1.16)	4.06 (SD=0.64)	4.40 (SD=1.14)	1.60 (SD=0.55)

Table 2: Comparisons of means of value of relevant measures according to the combinations of both variables Location (on-site and off-site) and Medium (Tablet and MVR).

work that on the immersive nature of VR headsets [19].

Using the tablet as a medium is more demanding when taking the experience on-site. This could be linked to various factors. The first factor is that handling the tablet is more physically demanding due to arm extension throughout the duration of the experience. Another factor, supported by literature [6], is that the experience is taken in a public space, requiring the user to be orienting the tablet towards other people, which might make them feel conscious of what others are thinking about the activity. Eventually the demands brought up by this last factor might be the reason why the flow off-site with the tablet is higher compared with the on-site, as in the off-site, the users are more at ease.

Conclusion and Future Work

This paper described whether locality and medium affect the experience of IS in the context of mobile VR systems. We evaluate four scenarios resulting from the combination of location and medium. Our results show that experiencing a narrative in the location linked to said narrative may lead to a significantly increased Flow, Presence and Narrative Transportation. In future work, we plan to expand the Fragments of Laura experience to several locations, and address one of the shortcomings of our study, the small sample of participants. Since this a pilot study, the sample is acceptable since we are using the study as guidance for future research. With more participants, we would be able to study how Flow, NTS and Presence are correlated. In regards to the findings, we feel positive that a bigger sample would support our claims about the influence of locality on interactive storytelling.

References

1. Barry Brown, Ian MacColl, Matthew Chalmers, Areti Galani, Cliff Randell, and Anthony Steed. 2003. Lessons from the Lighthouse: Collaboration in a Shared Mixed Reality System. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '03)*, 577–584. <https://doi.org/10.1145/642611.642711>
2. Marc Cavazza, Jean-Luc Lugin, David Pizzi, and Fred Charles. 2007. Madame Bovary on the Holodeck: Immersive Interactive Storytelling. In *Proceedings of the 15th ACM International Conference on Multimedia*, 651–660. <https://doi.org/10.1145/1291233.1291387>
3. Mark H. Davis. 1983. Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology* 44, 1: 113–126. <https://doi.org/10.1037/0022-3514.44.1.113>
4. Mara Dionisio, Mary Barreto, Valentina Nisi, Nuno Nunes, Julian Hanna, Bianca Herlo, and Jennifer Schubert. 2015. Evaluation of Yasmine's Adventures: Exploring the Socio-Cultural Potential of Location Aware Multimedia Stories. In *Interactive Storytelling*, Henrik Schoenau-Fog, Luis Emilio Bruni, Sandy Louchart and Sarune Baceviciute (eds.). Springer International Publishing, 251–258. Retrieved December 28, 2015 from http://link.springer.com/chapter/10.1007/978-3-319-27036-4_24
5. Melanie C. Green and Timothy C. Brock. 2000. The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology* 79, 5: 701–721. <https://doi.org/10.1037//0022-3514.79.5.701>
6. Henri ter Hofte, Kasper Løvborg Jensen, Petteri Nurmi, and Jon Froehlich. 2009. Mobile Living Labs 09: Methods and Tools for Evaluation in the Wild: <http://MI09.Novay.Nl>. In *Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '09)*, 107:1–107:2. <https://doi.org/10.1145/1613858.1613981>
7. Evangelos Karapanos, Mary Barreto, Valentina Nisi, and Evangelos Niforatos. 2012. Does Locality Make a Difference? Assessing the Effectiveness of Location-aware Narratives. *Interact. Comput.* 24, 4: 273–279. <https://doi.org/10.1016/j.intcom.2012.03.005>
8. K. Kwiatek and M. Woolner. 2010. Transporting the Viewer Into a 360 heritage story: Panoramic interactive narrative presented on a wrap-around screen. In *2010 16th International Conference on Virtual Systems and Multimedia (VSMM)*, 234–241. <https://doi.org/10.1109/VSM.2010.5665980>
9. Karol Kwiatek and Martin Woolner. 2010. Let Me Understand the Poetry: Embedding Interactive Storytelling Within Panoramic Virtual Environments. In *Proceedings of the 2010 International Conference on Electronic Visualisation and the Arts*, 199–205. Retrieved January 5, 2016 from <http://dl.acm.org/citation.cfm?id=2227180.2227210>
10. Kwan Min Lee. 2004. Presence, Explicated. *Communication Theory* 14, 1: 27–50. <https://doi.org/10.1111/j.1468-2885.2004.tb00302.x>
11. David K. McGookin, Stephen A. Brewster, and Georgi Christov. 2014. Studying Digital Graffiti As a Location-based Social Network. In *Proceedings of*

- the 32Nd Annual ACM Conference on Human Factors in Computing Systems (CHI '14), 3269–3278. <https://doi.org/10.1145/2556288.2557266>
12. Alison McMahan. 2003. Immersion, engagement and presence. *The video game theory reader* 67: 86.
 13. Paul Milgram and Fumio Kishino. 1994. A taxonomy of mixed reality visual displays. *IEICE TRANSACTIONS on Information and Systems* 77, 12: 1321–1329.
 14. Janet Horowitz Murray. 1997. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. The Free Press, New York, NY, USA.
 15. F. Rheinberg. 2004. Motivationsdiagnostik [Motivation diagnosis]. *Göttingen: Hogrefe*.
 16. Falko Rheinberg, Regina Vollmeyer, and Stefan Engeser. 2003. *Die erfassung des flow-erlebens*. na. Retrieved from https://www.researchgate.net/profile/Falko_Rheinberg/publication/247397022_Diagnostik_von_Motivation_und_Selbstkonzept/links/0a85e53884b4a2c55400000/Diagnostik-von-Motivation-und-Selbstkonzept.pdf
 17. Holger Schnädelbach, Boriana Koleva, Martin Flintham, Mike Fraser, Shahram Izadi, Paul Chandler, Malcolm Foster, Steve Benford, Chris Greenhalgh, and Tom Rodden. 2002. The Augurscope: A Mixed Reality Interface for Outdoors. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '02)*, 9–16. <https://doi.org/10.1145/503376.503379>
 18. Thomas Schubert and Jan Crusius. 2002. Five theses on the book problem: presence in books, film and VR. In *PRESENCE 2002-Proceedings of the fifth international workshop on Presence*, 53–59.
- Retrieved from <http://www.igroup.org/projects/porto2002/SchubertCrusiusPorto2002.pdf>
19. Jonmichael Seibert. 2014. An exploratory study on virtual reality head mounted displays and their impact on player presence. Retrieved January 13, 2016 from <https://baylor-ir.tdl.org/baylor-ir/handle/2104/9107>
 20. Mirjam Vosmeer, Christian Roth, and Ben Schouten. 2015. Interaction in Surround Video: The Effect of Auditory Feedback on Enjoyment. In *Interactive Storytelling*, Henrik Schoenau-Fog, Luis Emilio Bruni, Sandy Louchart and Sarune Baceviciute (eds.). Springer International Publishing, 202–210. Retrieved December 28, 2015 from http://link.springer.com/chapter/10.1007/978-3-319-27036-4_19
 21. Catch Pokémon in the Real World with Pokémon GO! Retrieved October 13, 2017 from <http://www.pokemongo.com/en-us/>
 22. IDNA - Spatial storytelling prototype for the iOS / by @apelab_ch @HeadMediaDesign. Retrieved June 24, 2016 from <http://www.creativeapplications.net/unity-3d/idna-spatial-storytelling-prototype-for-the-ios/>
 23. Unity - Game Engine. Retrieved June 24, 2016 from <https://unity3d.com/>
 24. Google Cardboard – Google VR. Retrieved June 24, 2016 from <https://vr.google.com/cardboard/index.html>

**Appendix C. Step by Step: Evaluating
Navigation Styles in Mixed Reality
Entertainment Experience**

Step by Step: Evaluating Navigation Styles in Mixed Reality Entertainment Experience

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Abstract. The availability of depth sensing technology in smartphones and tablets adds spatial awareness as an interaction modality to mobile entertainment experiences and showcases the potential of Mixed Reality (MR) for creating immersive and engaging experiences in real world contexts. However, the lack of design knowledge about interactions within MR represents a barrier to creating effective entertainment experiences. Faced with this challenge, we contribute a study of three navigation styles (NS) for MR experiences shown on a handheld device. The navigation styles range from fully virtual, through a mixed style that involves both on-screen and in-world activity, to fully real navigation. Our findings suggest that when designing an MR experience, the navigation style deployed should reflect the context, content and required interactions. For our MR experience, “The Old Pharmacy”, with its specific content, context and required interactions, results show that navigation styles relying on in-world activity leads to higher levels of Presence, Immersion and Flow.

Keywords: Mixed Reality·Mobiles Devices·Depth Perception·Navigation Style·User Experience·User Study

1 Introduction

After many years of promising research, virtual and augmented reality systems are becoming mainstream. The next generation of mobile and wearable devices, such as Google’s Project Tango [1] and Microsoft’s HoloLens [2], combine high-resolution graphics with sophisticated tracking and scanning systems. These devices enable consumers to access rich Mixed Reality (MR) spaces where digital and physical objects can interact in real time in application areas as diverse as gaming [3] education [4] and navigation [5, 6]. They promise advantages and benefits in terms of delivery of contextual information [7] and in supporting increased levels of user presence [8].

However, MR systems are highly diverse, spanning the spectrum of the Reality-Virtuality Continuum (RVC) [9] from entirely virtual to fully real. This diversity presents considerable challenges to designers, as there is a lack of design knowledge relating to how systems at different positions on the RVC spectrum will impact the experiences of their users. While this is true for a wide range of application areas, we believe it is particularly relevant to the domain of entertainment, where experiential qualities such as immersion, engagement and fun are foregrounded. We argue that, as

MR applications and use cases become more commonplace, it is important to understand how interaction techniques impact user experience and engagement in entertainment focused MR contents and applications.

In this paper, we contribute to advancing the understanding of MR entertainment experiences by studying the impact of Navigational Styles (NS) on the user experience of MR environments. This is valuable as navigating around digital content is a core feature of MR scenarios. Users can navigate MR environments by a range of mechanisms that parallel the RVC itself, from the use of controllers in virtual environment to fully real navigation in the physical world. Different styles result in very different experiences and, we argue, will translate into different entertainment outcomes.

The main contribution of this paper is a systematic study of the influence of navigation styles used in MR experiences supporting a range of on-screen and in-world activities. First, we classify three navigation styles covering the RVC: i) *Screen* (virtual based), ii) *Hybrid* (involving on-screen and in-world) and iii) *Spatial* (in-world). We then contrast these styles in terms of measures of presence, game experience and qualitative comments captured from participants in order to evaluate which navigation style provides a better experience from an entertainment point of view. Our findings reveal that a NS with in-world activity is preferred to a NS with virtual controls when trying to achieve higher levels of Presence, Immersion and Flow. Based on these results, we also contribute a discussion of how content, context and required interactions can inform designers' choice of a NS to better support compelling entertainment experiences.

2 Related Work

Milgram and Kishino's [10] define Mixed Reality within the "*Reality Virtuality Continuum*", encompassing Physical Reality, Augmented Reality and Virtual Reality. Combining Mixed Reality with a ubiquitous knowledge of the world forms what Dourish calls a "*ubiquitous human media*" [11]. Moreover, Cheek illustrates [12–14], how ubiquitous human media actually pushes people to become fully involved in social, physical and natural interactions [12, 15].

Immersion is a common word widely used to describe the level of involvement or engagement one experiences during activities such as playing games [16] [17]. It is relevant to mobile MR experiences as it may lead to increases in presence [18]. Presence is defined as an emergent property of an immersive system, and refers to the participant's sense of "*being there*" in the virtual world [19]. In a MR experience, participants need to be immersed in the virtual aspects of the experience but also maintain awareness of their surroundings for, at least, reasons such as safety. Due to the nature of MR, participants may never achieve full immersion [10] but greater immersion may lead to a stronger merging of the virtual and real worlds.

How to interact within MR experiences and navigation techniques are a core topic of study within both MR and VR communities. Indeed a substantial body of work can

be found in the VR field, where the study of immersive types of input for traditional VR systems and VR Head Mounted Displays (HMDs) have been investigated.

Initially, traditional VR systems restrained the users to their desk and limited their interactions with the virtual environment by enabling navigation through pointing devices, keyboards and game controllers [13]. Studies have demonstrated that the effectiveness of a VE is related with the sense of Presence it evokes; high levels of Presence are therefore seen as desirable [19]. Slater *et al.* showed that interaction techniques in VR play a crucial role in the determination of Presence [18]. These results are corroborated by Templeman *et al.*'s survey summarizing VR interaction techniques [20]. One theme within this research relates to the benefits of using the whole body in VR environments to increase levels of immersion and feelings of presence [21]. For example, numerous user studies concerning immersive travel techniques have been reported in the literature, such as those comparing different travel modes and metaphors for virtual environment applications [22]. Physical motion techniques were also studied, such as the use of a "lean-based" technique [23]. Slater *et al.*'s [24] indicated that naive subjects in an immersive virtual environment experience a higher subjective sense of presence when they locomote by walking-in-place ("virtual walking") than when they push-button-fly ("along the floor plane"). Later this study was replicated, adding real walking as a third condition [25] and showing this achieve yet higher scores for the presence. Similarly, Hwang [26] compares perceived field of view (FOV), levels of immersion and presence, task performance and usability among users of various VR platforms including hand-held devices. The results highlight that motion based interaction, a unique characteristic of hand-held platforms, can help presence/immersion and the perceived FOV.

More recently, technologies such as Oculus Rift¹ (with touch controllers), HTC Vive² and PrioVR³ have led to a new range of interaction techniques that seek to facilitate transitions between the physical and virtual worlds. Lopes et al. designed and tested mechanical devices targeted at providing electrical muscle stimulations such as stepping onto uneven ground [27] or the haptic sensation of hitting and being hit [28]. The work of Tregillus and Folmer, the VR-DROP and VR-STEP prototypes, use a smartphone's inertial sensor to simulate walking in mobile VR demonstrating that walking in place provides an immersive way to achieve virtual locomotion in mobile VR [39,40]. In fact, research shows that users immersed in VR experiences perform better if it displays the sensory data related to their surroundings [18]. With the incorporation of real world elements, research in VR is converging with MR. However, while trying to bridge virtual and real worlds, some of the above examples rely on complex technologies that require highly specific sensing or actuation setups. As such they are unavailable to current MR designers using commodity technology solutions. To better target this group, the current research focuses on prototyping through technology that is accessible, mobile and self-contained. It seeks to explore how existing

¹ www.oculus.com

² www.htcvive.com

³ www.priovr.com

mobile technology can bridge between the virtual and real worlds, while still providing natural interaction and high level of immersion.

The release of Project Tango led to a series of experimental concepts embracing the motion control abilities in several domains from games to education. Garden is a MR experience [3] enabling players to transform their real environment into a virtual garden where they can play in using Project Tango device as a HMD. Ghostly Mansion [32] is a first person story-driven hidden object game for the Project Tango device, where the player explores virtual rooms looking for hidden objects related to the story narrative. Project Tango applications also target commercial scenarios with applications such as Car Visualizer [33] (to view, walk around and interact with 3D representations of purchasable cars) or Home AR Designer [34] (that enables you to superimpose furniture in your home before you buy it, taking into account the real dimensions of the space). Additionally there are sandbox experiences (VRMT: Worldbuilder [35] and Tango Minitown [36]) and Project Tango applications with educational purposes such as Project Tangosaurs [37] or Solar Simulator [38]. These enable users to explore rich virtual content (in this case, dinosaurs and planets) as if they were in a museum setting.

In our work, we identify a gap in the study of interaction techniques applied to MR experiences that seek to entertain their users. We draw inspiration from related work in the VR field, specifically Slater et al.'s study [24], and Hwang's study [26] showing how motion tracking in VR positively affected the users' experience. Accordingly, the study in this paper looks at how different interaction techniques affect the users experience in a MR storytelling experience, with a special attention to the role of motion tracking. We analyse the user experience in terms of Presence and key game experience components such as flow and imaginative immersion. These are particularly relevant as prior literature has posited a link between feelings of Presence and "being in flow" during entertainment experiences [39].

3 MR Experience: "The Old Pharmacy"

"The Old Pharmacy" is an MR story-driven interactive experience where users explore a reconstruction of a 19th century pharmacy on a handheld device (Figure 1). The user, embodying the character of the proprietor Laura, is asked by a virtual character (a customer) to make a medicinal drink by gathering four objects, spread around the virtual pharmacy. To accomplish this task, the user must navigate and orient themselves in the virtual world and examine the objects within it. The pharmacy is a visually complex environment with many objects distributed around the space both horizontally and vertically (e.g. on furniture). The search task requires the user to move around and explore different viewpoints. The experience features a total of 15 selectable objects. When a user is within reaching distance of one of these, the object is highlighted visually with a glow effect and a user can select it with an on-screen tap. An audio dialogue between the customer and Laura elaborates on the properties of the object. When an object that is part of the set of ingredients needed to make the drink is selected the user receives encouraging on-screen and auditory feedback.

“The Old Pharmacy” experience was built using the Unity 5 game engine [40] for the Project Tango platform. Using depth perception information and computer vision algorithms, Project Tango can reconstruct mathematical models of the real world over time. The system estimates the movement of the device in relation to the real world, allowing for motion tracking (navigation and orientation) of the user holding the device. Abstracting from the technology behind it, this type of system showcases the potential of using knowledge of the surrounding world as input.



Fig. 1 “The Old Pharmacy” Mixed Reality Experience with room layout (orange dots are selectable objects and green objects are selectable objects that need to be collected).

4 Study: Navigation Styles in a MR Experience

4.1 Experimental Design

The study used a single independent variable: Navigation Style (NS). Three groups of participants experienced “The Old Pharmacy”, each with a different NS (see Figure 2). We used a between groups design, instead of a more powerful repeated measures design, as completing the experience once reveals the location of the key items and would strongly impact behaviour during subsequent runs through the system. The three NS are: *Screen*, *Hybrid* and *Spatial*. *Screen* is a baseline and interaction within the virtual environment is achieved by the common approach of manipulating two on-screen virtual joysticks, one to look around (view orientation) and one to walk (location). In the second style, *Hybrid*, we used the mobile device’s gyroscope and accelerometer to control the user’s orientation and a virtual joystick to enable navigation to different locations. Unlike *Screen*, this involves an MR experience, as device sensors translate the real world orientation into the virtual world. Finally, in *Spatial*, interaction relies solely on Project Tango motion tracking for controlling both orientation and translation. By creating a direct mapping between sensory–motor actions in both the real and virtual worlds, we aim to achieve a higher sense of realism and fidelity [41].

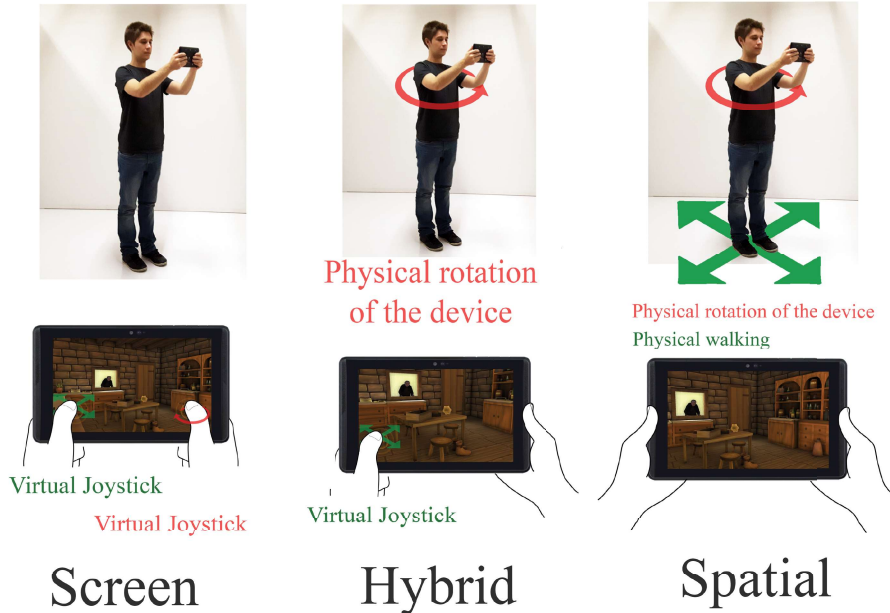


Fig. 2 Interaction techniques for Conditions: *Screen*, *Hybrid* and *Spatial*. The green represents navigation actions and red represents looking actions. Objects are selectable by touch in all conditions.

4.2 Demographics

We recruited 36 users (38.9% females) for the study using the university mailing list. Participants' ages ranged from 18 to 44 years (27.8% were less than 25 years, 63.9% within the 25-34 age range and 8.3% above 34 years old). Participants were randomly assigned among the navigation styles (12 per condition) and demographics captured previous experience with games, VR, HMD and smartphones on seven point Likert items. A Kruskal-Wallis test on this data showed no significant differences across the groups, indicating samples were homogenous.

4.3 Procedure and Measures

The trial was carried out in a controlled environment consisting of a 5m by 6m room without furniture. Participants were given a debriefing statement explaining the experiment in detail and signed a consent form. After completing demographics, they were handed a tablet device containing the "The Old Pharmacy" and given a short tutorial on the navigation style they were to use. They then completed the experience. Immediately after the trial, they completed a survey using the core module of the Game Experience Questionnaire (GEQ) [16], and the Igroup Presence Questionnaire (IPQ) [42]. The IPQ [43] features constructs of Spatial Presence, Involvement and Experienced Realism. Using it measures how the experience invoked a sense of Presence in

the participants. The GEQ seeks to capture in-the-moment qualities of a game experience and we expected that the GEQ modules components to vary amongst the three NS. The GEQ core module focuses on in-game experience by measuring Flow, Tension, Sensory and Imaginative Immersion, Competence, Positive Affect, Negative Affect, and Challenge, while the post-game module focuses on Positive Experience, Negative Experience, Tiredness and Returning to Reality.

Next, an experimenter conducted an unstructured interview, based on the observation notes, to capture comments on the overall experience and interaction with the system and content. Finally, participants completed the post-game module of the GEQ. This module captures a participant's opinions and reflections after an experience is complete. In total, each study session took around 45 minutes (10 minutes for the actual task).

4.4 Data Analysis

Scoring guidelines for each of the scales were followed to obtain the scores to measure the participants experience according to the navigation style. Due to the nature of data measured (ordinal data from Likert scales) and the small sample size, we performed separate non-parametric tests on each measure. These were one-way Kruskal-Wallis ANOVAs followed by Mann-Whitney *post-hoc* pairwise comparisons. We used an alpha value of $p < 0.05$. Due to the multiple comparisons made, Bonferroni corrections ($p < 0.05/3$) are typically applied. After careful consideration we opted to report the statistics without these corrections since we used non-parametric tests, which are in general more conservative. In the particular case of our study, performing Bonferroni corrections and specially taking into account the small sample size, could inflate type II errors [44]. Furthermore, in the interests of brevity, only significant results are reported.

4.5 Quantitative Data Results

IPQ data are plotted in Figure 3. Kruskal-Wallis tests showed that the sense of Presence (Total Presence $H(2)=11.18$, $p=0.004$) was different depending on the NS. Pairwise comparisons showed differences between *Screen* and *Spatial* conditions ($U=20.0$, $p=0.03$, $R=-0.50$) and between *Hybrid* and *Spatial* conditions ($U=26.0$, $p=0.008$, $r=-0.45$). We also performed Kruskal-Wallis tests on all three IPQ constructs, only two showed that the NS significantly influenced ratings: Experienced Realism ($H(2)=6.57$, $p=0.037$) and Spatial Presence ($H(2)=7.48$, $p=0.024$). Pairwise comparisons showed differences between *Screen* and *Spatial* conditions for Spatial Presence ($U=25.0$, $p=0.006$, $r=-0.46$). Regarding the Experienced Realism pair wise comparisons revealed that there was a significant difference between *Hybrid* and *Spatial conditions* ($U=31.50$, $p=0.019$, $r=-0.003$).

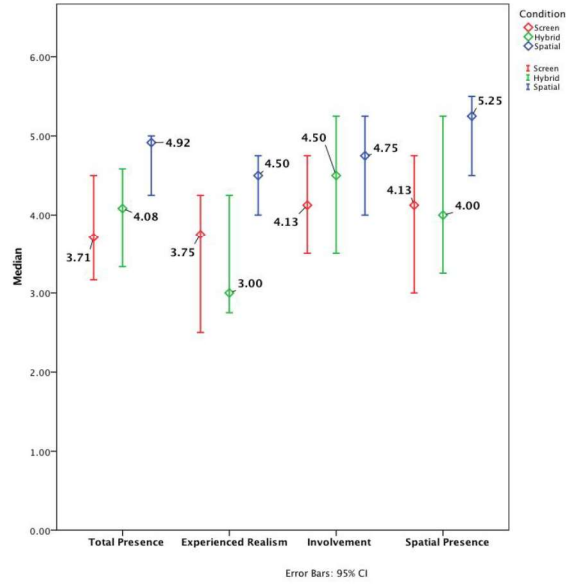


Fig. 3 Median Scores of Total Presence and IPQ components *Experienced Realism, Involvement* and *Spatial Presence*

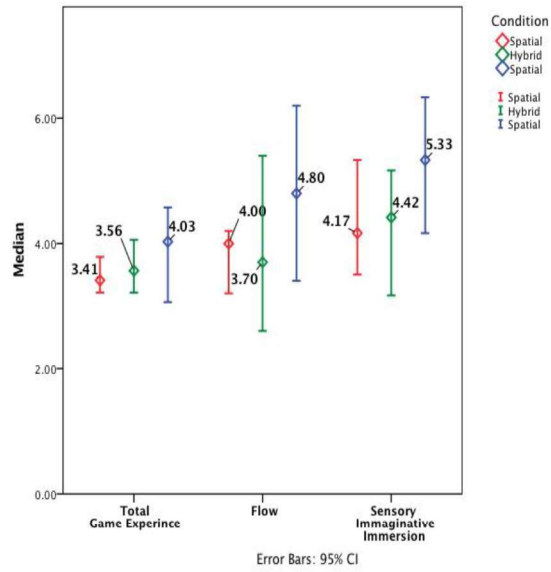


Fig. 4 Median Scores for Total GEQ and GEQ core module components *Flow* and *Sensory and Imaginative Immersion*

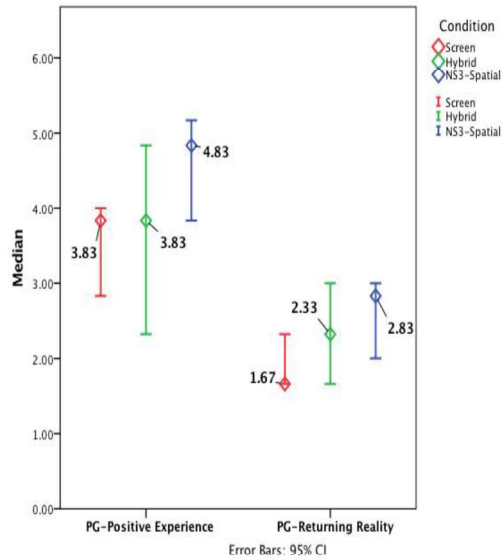


Fig. 5 Median Scores for GEQ post-game components Positive Experience and Returning to Reality and error bars representing confidence intervals at the 95% level.

GEQ data are shown in Figures 4 and 5. In terms of total game experience the Total GEQ scores demonstrated significant differences depending on the NS, $H(2)=6.47, p<0.039$). A post-hoc test showed differences between the *Screen* and *Spatial* conditions ($U=27.0, p=0.016, r=-0.40$). We also ran Kruskal-Wallis tests on the GEQ constructs which led to significant main effects in Sensory and Imaginative Immersion (SII) ($H(2)=6.75, p=0.034$) and Flow ($H(2)=8.42, p=0.015$). Post-hoc tests showed differences in the two constructs in conditions *Screen* and *Spatial* (SII- $U=31.0, p=0.018, r=-0.39$; Flow- $U=26.5, p=0.008, r=-0.44$) and between *Hybrid* and *Spatial* conditions (SII- $U=36.0, p=0.037, r=-0.35$; Flow- $U=28.5, p=0.021, r=-0.39$).

In the post-game GEQ items, there were significant differences in ratings for the factors of Returning to Reality ($H(2)=6.93, p=0.031$) and Positive Experience ($H(2)=6.91, p=0.032$). Post-hoc tests bore these out between *Screen* and *Spatial* (respectively: $U=28.5, p=0.011, r=-0.42$ and $U=31.5, p=0.019, r=-0.39$).

4.6 Qualitative Data Results

After gathering all the information expressed by participants during the unstructured interviews, a team of two researchers used open coding, where each researcher selected quotes and created high-level categories. These codes were then reviewed and merged or divided into new categories, as described below. We identify the participants' quotes with the navigation style and their session ID (e.g.: *Screen*-P30 – navigation style *Screen* participant session 30).

Interaction

Most participants in *Screen* agreed that navigation was inadequate, reporting difficulties in adapting to the controls (*Screen*-P30 “Controls were a surprise [...] I found them to control and to explore the virtual environment”). Moreover, the need for high cognitive effort to calculate movement in order to achieve accurate navigation was mentioned. In *Hybrid*, the number of users highlighting this problem was reduced, (*Hybrid*-P40 “I felt that I always had to be calculating my movement and my gaze.”, *Hybrid*-P33 mentioned confusion in the beginning of the experience “Using both joystick and my arms to pinpoint place and things was a bit confusing in the beginning”). In *Spatial*, one user expanded on difficulties experienced with the interaction mode (*Spatial*-P21 “If I wanted to look back, I felt forced to turn my whole body back”).

In *Screen* and *Hybrid*, fewer participants specifically mentioned the comfortable navigation (no tiredness, stress or pain), than in *Spatial* (*Spatial*-P9 “Walking around the room was an interesting experience; the control of the movement felt natural.”). However at least 2 participants specifically mentioned the possibility of problems if the experience was longer (*Spatial*-P20 “If the story was bigger, I would feel very tired, arms mostly, and concerned since the tablet gets hot.”).

Immersion in MR

More participants from *Hybrid* and *Spatial* than from *Screen* reported feeling immersed and experiencing a sense of being in the virtual world (*Spatial*-P15 “I had the sense that I, as a whole, got sucked into the virtual world. You just need to always keep mindful about where you step”, *Spatial*-P19 “I definitely felt part of the game. I walked to places to get my ingredients, I looked up and down to explore and, I was talking to a client.”). However participants from all the conditions explicitly felt like they were adding to the story and content (*Spatial*-P19 “I enjoyed being able to interact with lots of objects in the VE. It made me feel in control.”, *Screen*-P27 “I felt like I was building the story through the objects”). A couple of participants mentioned that the task given was short for them to really feel engaged and immersed. For example, *Hybrid*-P44 said: “I could not feel any empathy with the characters. I had no time to get to know them and get passionate about their struggles.”

Sense of Body

Across all conditions, several users made remarks regarding their sense of body in the MR environment. Some of the comments touched upon the relationship between the scale of the room and their size within it. Some users reported feeling big while, others felt like they were smaller than their real self. For example, *Screen*-P23 “I felt both tall and short. When looking up, the ceiling was to close. When looking down I felt too close to the ground.” Or *Hybrid*-P35 “I felt shorter in the game. The place that I recall I felt this mostly is near the window, as you look to the old lady, you get the sense she is quite tall.” Some users enjoyed this different sensation *Hybrid*-P42 “[...] I felt quite tall. It was a good sensation”, *Spatial*-P4 “I got the feeling I was shorter than I am [...] I found it interesting. It was like being in a hobbit house.”.

Participants from *Screen* and *Hybrid* did not mention experiencing differences in relation to how navigation input was mapped to response in the interaction modes. In contrast, in *Spatial* the mapping between navigation in the real world and the virtual world was noticed. *Spatial*-P16 mentioned “*I felt I walked faster in the game than in the real world. It was good, since it would cover more ground on the game without taking too much of my real space.*”

Some participants across all conditions also mentioned a desire to see their virtual body represented. They desired to see their hands while choosing the ingredients and their full body when looking down. *Spatial* -P17 “*The thing though, got strange when I first interacted with an object. I was expecting to see a hand picking it up.*” Or *Spatial*-P9, “*When I looked down I was expecting to see my feet. I wanted to see myself walking.*”.

Awareness of Real Space

Participants in *Spatial* were more aware of the real space; several participants commented about this issue. For example, one participant (*Spatial*-P17) initially thought that the tables in the real world were matching the tables in digital world. Another (*Spatial*-P16) mentioned that the real world space was smaller than the virtual. Awareness of the real space was also came across through comments regarding safety during walking. Some users were at relative ease while interacting (*Spatial*-P20 “*Unless there were holes in the ground, I felt safe playing the game*”; *Spatial*-P15 “*got sucked into the virtual world. You just need to always keep mindful about where you step.*”), while others expressed concern (*Spatial*-P16 “*I was worried about tripping in any of the chairs.*”; *Spatial*-P17 “*it needs a lot of space, if it’s bigger how can I play it safely?*”).

5 Discussion

The results show the *Spatial* condition produces a richer MR experience than the other two conditions in terms of a range of metrics from both the IPQ and GEQ. There are several caveats to this broad conclusion and we discuss the details below.

Interaction: The *Spatial* condition supports higher levels of presence than the baseline *Screen* and the *Hybrid* but in different ways. The first finding ties in with prior research [18] indicating that virtual controls lead to reduced presence compared to more natural navigation styles [8]. However, some aspects of presence were negatively affected by the *Hybrid* condition. Specifically, Experienced Realism dropped against the baseline. We suggest this is because the “hybrid” interaction scheme does not have a direct analogy in the real world - although its natural to control orientation in the scene with similar movements of the device, its challenging to integrate this real world activity with traditional on-screen input to control position. This finding is corroborated by observed user behaviour: participants walked in the *Hybrid* condition, despite the fact this had no impact on the game world. The *Spatial* condition performed uniformly well in terms of the Spatial Presence component. We suggest this is

due to participants' actions with their real body being accurately reflected by actions in the virtual world, leading to an increased sense of "being there"[41].

Content: The NS for an experience needs reflect the content in the experience. In our specific case, story content was scaffolded onto an exploration task. The goal was for participants to feel immersed and present in the story, not just the sensory experience. Results from the questionnaires suggest that the *Spatial* condition supported this goal - the natural body movements facilitated users in role playing the character of Laura as she moved around the virtual space. *Spatial*-P15 stated "I had a sense that I, as a whole, got sucked into the virtual world." However, the kind of mapping we present here would likely be unsuitable for other types of virtual experiences, such as those that involve driving or piloting vehicles. In these cases, the real motions used in the *Spatial* condition might negatively impact presence.

Context: In the experience in this study, the dimensions of the virtual world (the pharmacy) matched the dimensions of the space surrounding the participant (the experimental environment). In many experiences, this correspondence may be undesirable or hard to achieve. For example, to simulate a large virtual environment, a one-to-one mapping to a real space is likely impossible. In such a situation, the *Hybrid* condition described in this article may be more appropriate. Beyond this issue, *Spatial* also raises issues of safety and social acceptability. If applied in a large public space would an AR environment distract its users and therefore, potentially, endanger them? And how would non-participants react and relate to those engaged in the experience? These questions are substantially beyond the scope of work in this paper, but serve to highlight how the issue of NS can have broad reaching implications for the design and deployment of a MR experience.

6 Conclusion and Future Work

In this paper, we report on a study of the impact of navigation styles on mixed reality experiences. The results show that using navigation styles with in-world activity favorably impacts measures such as Flow, Presence and Immersion. Additionally, we identify that factors such as context, content and required interactions need to be considered when selecting a navigation style for a MR experience. For example, when deciding to include in-world activity, safety concerns (in real world situations) and ergonomic concerns (when considering longer experiences) should be considered. These concerns highlight the need for further studies in this area, specifically using similar experiences in real world context, varied contents and with a longer duration.

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References

1. Tango, <https://get.google.com/tango/>.
2. Microsoft: Microsoft HoloLens, <https://www.microsoft.com/microsoft-hololens/en-us>.
3. Sing, K.H., Xie, W.: Garden: A Mixed Reality Experience Combining Virtual Reality and 3D Reconstruction. In: Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems. pp. 180–183. ACM, New York, NY, USA (2016).
4. Zhang, J., Ogan, A., Liu, T.-C., Sung, Y.-T., Chang, K.-E.: The Influence of using Augmented Reality on Textbook Support for Learners of Different Learning Styles. Presented at the September (2016).
5. Möller, A., Kranz, M., Huitl, R., Diewald, S., Roalter, L.: A Mobile Indoor Navigation System Interface Adapted to Vision-based Localization. In: Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia. p. 4:1–4:10. ACM, New York, NY, USA (2012).
6. Rao, Q., Tropper, T., Grunler, C., Hammori, M., Chakraborty, S.: AR-IVI Implementation of In-Vehicle Augmented Reality. Presented at the September (2014).
7. Grubert, J., Langlotz, T., Zollmann, S., Regenbrecht, H.: Towards Pervasive Augmented Reality: Context-Awareness in Augmented Reality. *IEEE Trans. Vis. Comput. Graph.* 1–1 (2016).
8. Waterworth, J.: Human-experiential design of presence in everyday blended reality. Springer Berlin Heidelberg, New York, NY (2016).
9. Milgram, P., Takemura, H., Utsumi, A., Kishino, F.: Augmented reality: a class of displays on the reality-virtuality continuum. Presented at the (1995).
10. Milgram, P., Kishino, F.: A taxonomy of mixed reality visual displays. *IEICE Trans. Inf. Syst.* 77, 1321–1329 (1994).
11. Dourish, P.: Where the Action Is: The Foundations of Embodied Interaction. Cambridge: MIT Press (2001).
12. Cheok, A.D., Fong, S.W., Goh, K.H., Yang, X., Liu, W., Farzbiz, F.: Human Pacman: a sensing-based mobile entertainment system with ubiquitous computing and tangible interaction. In: Proceedings of the 2nd workshop on Network and system support for games. pp. 106–117. ACM (2003).
13. Cheok, A.D., Yang, X., Ying, Z.Z., Billinghamurst, M., Kato, H.: Touch-Space: Mixed Reality Game Space Based on Ubiquitous, Tangible, and Social Computing. *Pers. Ubiquitous Comput.* 6, 430–442 (2002).
14. Farbiz, F., Cheok, A.D., Wei, L., ZhiYing, Z., Ke, X., Prince, S., Billinghamurst, M., Kato, H.: Live three-dimensional content for augmented reality. *Multimed. IEEE Trans. On.* 7, 514–523 (2005).
15. Bowlby, J.: Attachment and Loss. , New York, NY, USA (1983).
16. Ijsselsteijn, W., de Kort, Y., Poels, K.: The Game Experience Questionnaire: Development of a self-report measure to assess the psychological impact of digital games. Manuscript in Preparation.
17. Ermi, L.: Fundamental Components of the Gameplay Experience: Analysing Immersion. (2005).
18. Slater, M., Usoh, M.: Body Centred Interaction in Immersive Virtual Environments. In: Artificial Life and Virtual Reality. pp. 125–148. John Wiley and Sons (1994).

19. Witmer, B.G., Singer, M.J.: Measuring Presence in Virtual Environments: A Presence Questionnaire. *Presence Teleoperators Virtual Environ.* 7, 225–240 (1998).
20. Templeman, J.N., Denbrook, P.S., Sibert, L.E.: Virtual Locomotion: Walking in Place through Virtual Environments. *Presence Teleoperators Virtual Environ.* 8, 598–617 (1999).
21. Brooks Jr, F.P., Airey, J., Alspaugh, J., Bell, A., Brown, R., Hill, C., Nimscheck, U., Rheingans, P., Rohlf, J., Smith, D., others: Six generations of building walkthrough: Final technical report to the National Science Foundation. (1992).
22. Chung, J.C.: A comparison of head-tracked and non-head-tracked steering modes in the targeting of radiotherapy treatment beams. Presented at the (1992).
23. Fairchild, K.M., Lee, B.H., Loo, J., Ng, H., Serra, L.: The heaven and earth virtual reality: Designing applications for novice users. In: , 1993 IEEE Virtual Reality Annual International Symposium, 1993. pp. 47–53 (1993).
24. Slater, M., Usoh, M., Steed, A.: Taking steps: the influence of a walking technique on presence in virtual reality. *ACM Trans. Comput.-Hum. Interact.* 2, 201–219 (1995).
25. Usoh, M., Arthur, K., Whitton, M.C., Bastos, R., Steed, A., Slater, M., Brooks, F.P., Jr.: Walking \gg Walking-in-place \gg Flying, in Virtual Environments. In: Proceedings of the 26th Annual Conference on Computer Graphics and Interactive Techniques. pp. 359–364. ACM Press/Addison-Wesley Publishing Co., New York, NY, USA (1999).
26. Hwang, J., Jung, J., Kim, G.J.: Hand-held virtual reality: a feasibility study. In: Proceedings of the ACM symposium on Virtual reality software and technology. pp. 356–363. ACM (2006).
27. Lopes, P., Ion, A., Kovacs, R.: Using Your Own Muscles: Realistic Physical Experiences in VR. *XRDS.* 22, 30–35 (2015).
28. Lopes, P., Ion, A., Baudisch, P.: Impacto: Simulating Physical Impact by Combining Tactile Stimulation with Electrical Muscle Stimulation. Presented at the (2015).
29. Tregillus, S.: VR-Drop: Exploring the Use of Walking-in-Place to Create Immersive VR Games. In: Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems. pp. 176–179. ACM, New York, NY, USA (2016).
30. Tregillus, S., Folmer, E.: VR-STEP: Walking-in-Place Using Inertial Sensing for Hands Free Navigation in Mobile VR Environments. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. pp. 1250–1255. ACM, New York, NY, USA (2016).
31. McGill, M., Boland, D., Murray-Smith, R., Brewster, S.: A Dose of Reality: Overcoming Usability Challenges in VR Head-Mounted Displays. Presented at the (2015).
32. Rabbx Inc.: Ghostly Mansion. (2015).
33. NVYVE Inc.: Car Visualizer.
34. Elementals Studio: Home AR Designer.
35. Defective Studios: WorldBuilder.
36. Lee, J.: Tango Minitown.
37. Project Tango: Project Tangosaurs.
38. Angstrom Tech: Solar Simulator.
39. Bracken, C.C., Skalski, P.: Immersed in Media: Telepresence in Everyday Life. Routledge (2010).
40. Unity - Game Engine, <https://unity3d.com/>.

41. Heeter, C.: Being There: The Subjective Experience of Presence. *Presence Teleoperators Virtual Environ.* 1, 262–271 (1992).
42. Schubert, T.W.: The sense of presence in virtual environments: A three-component scale measuring spatial presence, involvement, and realness. *Z. Für Medien.* 15, 69–71 (2003).
43. Turner, P.: The intentional basis of presence. In: *Proceedings of the 10th international workshop on presence.* pp. 127–134. Citeseer (2007).
44. Perneger, T.V.: What's wrong with Bonferroni adjustments. *BMJ.* 316, 1236–1238 (1998).

**Appendix D. Fragments of Laura:
Incorporating Mobile Virtual Reality
in Location Aware Mobile Storytelling
Experience**

Fragments of Laura: Incorporating Mobile Virtual Reality in Location Aware Mobile Storytelling Experiences

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ABSTRACT

As 360° immersive Mobile Virtual Reality (MVR) experiences are reaching a wider public, thanks to inexpensive and more powerful mobile technology available on the shelves, it is also rapidly growing as a research arena to investigate how to best design such VR experiences. Adding to this research direction, in this paper we report on an exploratory study designed to evaluate users perception in “Fragments of Laura”, a mobile location-aware storytelling experience that uses MVR in a public setting. Results from the study encourage us to pursue investigation as the experience was well received by the participants and provided an enjoyable experience, however, we discovered that there are still design challenges to overcome in order for MVR to be widely adopted within a public setting. Such as, finding the balance between multimedia and immersive multimedia, providing an “onboarding” time for such media and proper locations for the content consumption.

Author Keywords

Mobile VR; Location Aware; Mixed-Reality; User Experience; User study

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

INTRODUCTION

Advances in mobile computing allow for new experiences that take advantage of cutting-edge technology and increase performance available in devices such as smartphones and tablets. One recent area of development, which is spurring the attention in research, is virtual reality (VR). Today most smartphones can deliver VR content anywhere, from games to immersive 360 content, for marketing purposes or communication. VR content is everywhere. A whole new VR industry is growing around devices that we carry around in our pockets, such as Project Tango [31] or Daydream [32]. Similarly to location aware applications [13] which took advantage of the ubiquity of GPS devices embedded in our phones, VR apps are going mobile, moving outside of the desktop, taking advantage of the powerful and relatively inexpensive technology of current smartphones. New research challenges are emerging around the design and evaluation of mobile VR apps [4,33]. Like other types of mobile apps, VR needs to be considered in a mobility context, one that takes into consideration how immersion and other dimensions are affected by portable technology.

Erik Poppe et al [28] defined Mobile VR (MVR) system as a “system that creates the illusion of participation in a simulated environment, rather than external observation of such an *environment*, by replacing real sensory signals that the user perceives with simulated sensory signals through the use of portable technology”. However, we would like to specify that by “*portable technology*” we consider technology that only requires a smartphone and/or wireless

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HMD's to display the simulated environment, where the users can move freely without cords attached, as this enables the expansion of VR into other contexts and to offer a new range of experiences. MVR can take VR away from controlled environments such as household and laboratory settings "into the wild" of urban spaces providing opportunities for seamless interactions across the continuum between the real and the virtual [19]. We saw an opportunity here to explore the entertainment potential of MVR, and how it can be used to enhance the cultural heritage sites by using it within location aware multimedia stories (LAMS). LAMS is a sub-genre within the wider field of locative media [24,25] with a substantial tradition in HCI. In fact, several projects over the last two decades explored the association of digital media to specific locations or objects [8,10–12] in particular for tourism purposes [10,11,23]. Nevertheless, projects coupling MVR with LAMS are a quite an unexplored avenue that we see value in investigating.

We designed "Fragments of Laura", a LAMS experience, to instigate the study of how the use of MVR has the potential to enrich the user experience in a location-aware mobile storytelling tour. Furthermore, this is the perfect setting to study the user experience while interacting with such immersive multimedia in the "outside world". The quantitative and qualitative data analysis presents very encouraging results as in general participants received the experience very well. However, we also learned that we are only revealing the tip of the iceberg, as promising opportunities for further research were identified to overcome the design challenges that might detain MVR to be widely adopted within a public setting.

The main contributions of this work are: i) describing the design challenges of a LAMS enhanced with MVR ii) reporting on an exploratory study of the user experience; and iii) Proposal future research directions to help LAMS enhanced with MVR experiences overcome limitations and become adopted within a public setting.

RELATED WORK

Advances in mobile computing have contributed to the proliferation of systems that explore the Reality-Virtuality continuum [20]. According to this classification, a system that does not change any sensory cues perceived by the user is on the reality side of the continuum. On the contrary, a system that replaces all real cues with simulated cues is a Virtual Reality (VR) system [28]. In between these two extremes, we can have systems that add some simulated cues to existing real cues such as Augmented Reality (AR) systems. The recent advances in mobile technology and its subsequent use in systems exploring Augmented and Virtual Reality [34], lead to the adoption and experimentation of new range of interaction techniques and experiences, with the goal of facilitating the transition between the physical world and the virtual world [34]. In this section, we will briefly look at how location-based experiences incorporate new media in the Reality-Virtuality

spectrum such as AR and VR across the tourism domains. We concentrate on the ends of the Reality-Virtuality spectrum by studying VR experiences enabled by recent advances in mobile computing, especially those with an appeal for the tourism industry.

Location-based Entertainment Experiences

Several projects have explored the association of digital media and physical movement with the intention of providing rich, entertaining and educational experiences, as well as, connecting audiences and players with the location's culture and history. The bulk of such experiences have emerged as location-based games [10,18–20] location-based storytelling tours [9–11,23–26] and more recently augmented reality games [1,3,6,14,36].

Mobile AR applications successfully allow users to explore the environment through adding virtual layers to reality [19,20] thus resulting in a novel and interactive way of experiencing highly dynamic content [23, 25]. Up until now, mobile AR applications had a practical advantage when compared to VR since tourists would not possess the head mounted devices or computers required to interact with VR during their travels. But now we can surround the users with a new digital world that exists in 360 degrees.

Mobile Virtual Reality Experiences

Conceptually, VR places a participant into a tri-dimensional world that is delivered by a computer to a display, with image and auditory updates depending on participant input [29]. While most people associate VR with Head Mounted Displays, virtual environments can be accessed without requiring VR headset as in the case of 3D virtual world Second Life [37], relying on the computer screen as a display system. Regarding VR systems using Head Mounted Displays (HMD) as a display system, virtual environments can be delivered through various types of devices ranging from MVR (using VR headsets such as Google Cardboard and Samsung Gear VR) to desktop-driven VR (using VR headsets such as in HTC Vive, Oculus Rift and Sony PlayStation VR). Now that devices (smartphones) are already ingrained in our daily lives and with the mobility that they offer the potential for mass adoption of MVR, we are particularly interested in studying how MVR can reveal to be valuable in the tourism industry.

Mobile Virtual Reality Experiences for tourism

Guttentag [15] foresaw that VR would be useful for tourism, for planning, management, marketing and entertainment, education by providing accessibility to inaccessible places such as archaeological sites with consequent heritage preservation. So far, the bulk of the existing work combining VR and the tourism industry focuses on virtual travel [29], one example is UK's Open University's 3D virtual geology field trip as a simulation of the Skiddaw mountains in UK's Lake District [38]. The transition of VR towards mobile devices turned VR into a tool that can be easily used with the minimum hardware setup of a smartphone, and this fomented an emergence of MVR experiences allowing users to access and navigate

360° photo spheres and 360° videos of real or simulated places for educational purposes [2:2,30]. For example, Google Expeditions (GE) use interactive 360° videos for immersive virtual journeys in the classroom [39]. A commonality of these experiences is that they are designed to be seen in a specific environment (e.g. home, classroom), based on the realistic representation of reality [18] and to replace the tourism experience, not necessarily complement or augment it.

As Neuhofer [22] states, the use of innovative technologies has the potential to differentiate destinations and create unique experiences valued by the tourists. We believe that MVR has the potential to offer this to tourists not as substitutional tourism, but as a way to enhance the experience while visiting a location. A promising example is shown by the work of Minocha [21], as educators discuss the benefits of using Mobile VR GEs during physical field trips. Among the highlighted strengths to this combined approach was the fact that the children could view details that are not visible to the eye (e.g. geology and rock formations); see different points of view of the scenery; the opportunity to observe what that location is like in a number of different conditions (e.g., in different seasons).

We wish to contribute to the growing trend of supporting tourists with experiences that blend real and virtual with local culture and values, and by driving inspiration from both location aware experience principles and MVR principles with the aim to create an engaging user experience [27]. Furthermore, by coupling LAMS with Mobile VR, we aim to contribute to a better understanding of what is the user experience with Mobile VR in a public context as we identified insufficient literature concerning the study and use of Mobile VR technologies outside of the laboratory context.

“FRAGMENTS OF LAURA”: A LAMS FOR TOURISM AND CULTURAL HERITAGE

To study the challenges of designing and testing LAMS enhanced with MVR, we created “Fragments of Laura” (FoL). FoL was designed with the goal of raising awareness of participants regarding the natural and cultural heritage of the Island of [removed blind rev.]. For this purpose, the fictional story is based on a combination of historical

events, weaving science, traditions and folklore of the Island. Despite being set in the 19th century, many of the situations the main character faces, such as natural disasters, invasive species and the endangered natural patrimony of the Island are still relevant to our times. By presenting the fictional story, our goal is to entice the audience to further contemplate the richness of the Island and reflect on the sustainability of its patrimony by linking the proposed fiction with the current reality. The story is delivered across four story points narrating the adventures of the main character, Laura, where three of them are in the form of 2D video animations (see Figure 1 - points 1,2,4), and one is an interactive 3D reconstruction of Laura’s pharmacy/laboratory dating back the 19th century (see Figure 1 - point 3).



Figure 1. Screenshot of mobile application map interface (top); Screenshots of the motion comic (story points: 1,2 and 4) Screenshot of the interactive scene (story point:3)

LAMVR EXPERIENCE DESIGN AND IMPLEMENTATION

Motivated by the design of conventional LAMS, “Fragments of Laura” is delivered as a mobile application, which makes use of a map interface with icons representing meaningful locations. Each location is associated with a story point and its icon is representative of this association. Participants, supported by the map interface, must find the desired points by walking to a specific location. Once in the

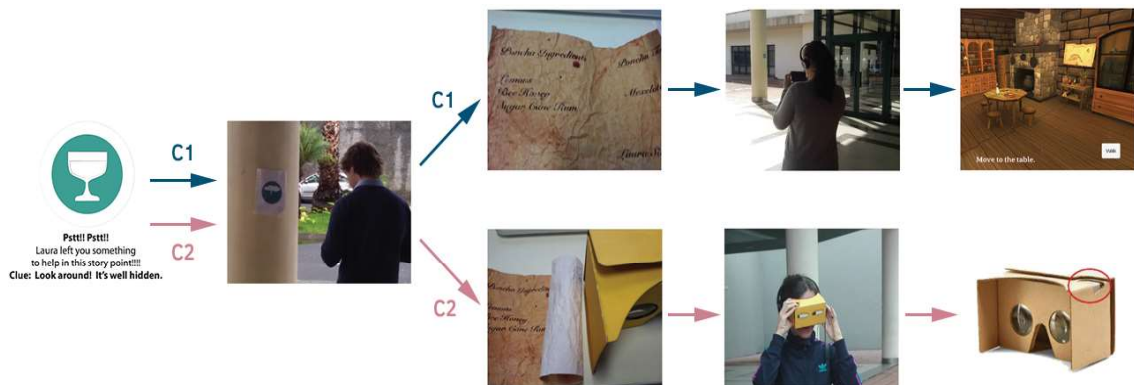


Figure 2. Differences between C1Screen and C2HMD in terms of the user experience

desired location, they must find a physical marker; the presence of a physical marker, see Figure 2 (left side), indicates the specific story location. Once the participant approaches the marker, the content is unblocked and the user can press the corresponding button to experience the content.

As mentioned before, FoL uses different media across the story points. Story points 1, 2 and 4 are multimedia videos, while 3 is an immersive multimedia (interactive story set in a VR). Two different types of multimedia are used, firstly, to not overload the user, as we anticipated that the MVR scene would be mentally and visually demanding. Upon the arrival to the third point, participants have to discover a hidden clue that helps them in the interactive scene (see Figure 2 left-middle side). In this point called: “*The Pharmacy*”, the protagonist of the story (Laura) is asked by a neighbour to make a medicinal drink. In order to complete the task, she needs to search through her establishment to find the right ingredients. The hidden clue has a recipe for this medicinal drink. Then the participant, embodying the character of Laura, must explore the virtual environment searching for the ingredients. During this process, the participant is informed about the qualities and benefits of such products through the dialogue between characters. Accomplishing this task requires the participants to navigate and orient themselves in the virtual environment. We chose to deliver this content in VR so that participants feel how it was to be in a 19th century pharmacy, see what kind of objects existed and embody the role of Laura while preparing the medicinal drink. Furthermore, to increase the appeal of the experience and to strengthen the connection with the location, we decided to include the hidden clue as a surprise element in the experience together with the novel MVR scene.

The 2D multimedia allows the participants to be more relaxed, assuming a more passive role and prompt the connection with the locations, while the MVR scene, allows participants to have agency in the experience and act as the character while exploring a pharmacy in the 19th century.

Regarding technical implementation, the FoL mobile application was programmed in C#, using the Unity game engine. The main interface is composed of a custom-made map interface; containing clickable buttons, see Figure 1 (Top).

RESEARCH METHODS

Since our goal was to research the effects of immersive VR technology in LAMS, we designed our study with two conditions (C1 and C2), corresponding to different levels of immersion and interaction in the interactive story points. For both conditions, the tour, locations, story, mobile application interface and goals for the interactive points are the same. The differences are in terms of the medium that supports the interactive MVR story point, and subsequent use of head-mounted displays (HMD). In the first condition the interactive MVR scene was delivered using only the

mobile phone screen display (not using any kind of HMD) therefore we will refer to this condition as from *C1Screen*. In the second condition, the interactive VR scene has been delivered using the mobile phone display in an HMD, the google cardboard, and we will refer to it as *C2HMD*.

The technical implementation of the mobile application, for both conditions, is also the same, using Google cardboard Virtual Reality kit [42] for 360-degree interaction. Both versions receive input from the gyroscope to detect changes in movement and orientation of the phone, translating these into the virtual environment of the Pharmacy camera view. However, in *C1Screen*, we do not use the stereoscopic feature of the cardboard kit. This feature is what allows the 3D to be visualized in an HMD (in our case Google cardboard) as in condition *C2HMD*. Finally, all the multimedia content is stored on the mobile device and no data connection is needed.

The difference of medium in for both conditions presented repercussions in terms of how the participants needed to navigate and orient themselves within the “*The Pharmacy*” MVR scene. We made sure that the tasks would be as similar and intuitive as possible for both conditions. Table 1 we summarize the differences between the conditions and Figure 2 illustrates them.

Like we explained before, upon the arrival to the interactive point, participants had to discover a hidden clue that will help them in the interactive scene (see Figure 2 bottom middle). For condition *C1Screen*, what the participants needed to find was the recipe for the medicinal drink including the ingredients, while for condition *C2HMD*, it was same recipe plus the cardboard to enable them to visualize the interactive scene. Given the context of our tour for condition *C2HMD*, the HMD’s could either be hidden in the experience location or given to the participant at the beginning. We chose to hide the cardboard together with the clue so that participants in condition *C2HMD* wouldn’t be influenced by it from the beginning of the experience.

	Medium	Interaction required	Clue
<i>C1Screen</i>	Mobile Phone Screen	Walk: Continuous touch in “Walk button” Object Selection: Touch input on virtual object	Recipe
	Mobile Phone Screen + Google Cardboard HMD	Walk: Continuous Pressing in Cardboard Button Object Selection: target virtual object and press the Cardboard Button	Recipe + Google Cardboard

Table 1. Summary of differences between conditions *C1Screen* and *C2HMD*

To gather the objects for the recipe participants, have to mainly “look around”, “walk” inside the pharmacy and select the objects. In *CIScreen* and *C2HMD* participants “look around” in the pharmacy by moving the phone up/down and left/right (360-degree interaction). To move around/walk in *CIScreen* participants need to press a “Walk” Button on the lower right corner of the screen (see Figure 2, top right) while in *C2HMD* they press the

cardboard button on the upper right corner of the cardboard (see Figure 4, bottom center). While the button is being pressed, the user is moving inside the 3D world; when the user stops pressing, the character also stops moving. This behaviour is similar to the “Walk” button in *CIScreen* and the cardboard button in *C2HMD*. Following Bowman’s [7] taxonomy of travel techniques both conditions have the same level of control meaning that travel can be started and stopped using a switch. Finally to select the object in *CIScreen* participants touch the object on the screen while in *C2Hybrid* look/aim to the object, a visual cue is presented and then they press the cardboard button.

In this way, we are studying very similar experiences in terms of locations, story, mobile app UI with one variant, the medium: HMD versus Screen Phone. This will allow studying the effect of using MVR coupled with a location-aware mobile storytelling tour and furthermore compare two different mediums in order to find the most suitable way to deliver such MVR experience.

Participants

A total of 24 users participated in the study (14 males and 10 females). The 24 participants were randomly assigned between two conditions (independent measures), having 13 participants in condition *CIScreen* and 11 participants in condition *C2HMD*. Each of the conditions will be explained in the next section. The participants age was gathered through age ranges, the sample’s age range with highest number of participants was between 25-34 years old (50%), followed by 37.5% of the participants with ages ranging between 18 and 24 years old, 8.3% between 35-44, and 4.2% between 45-54 years old (1 participant), for further details refer to table 2. Participants were recruited using a snowball sampling methodology. We decided to have different users in the two conditions (independent measures) to remove the carry-over effect, that would result from the user going through the experience more than once,

as this would most likely result in a decrease of engagement and motivation, from already knowing the story.

PROCEDURE

Participants upon arrival to the researcher’s office were explained the experiment protocol, given a consent form by the experimenters and asked to fill out a small questionnaire to gather some demographic data; this initial part of the procedure took no longer than five minutes.

Participants were then led to the start point of the experience, an outdoor public location within the University campus. Participants were handed a smartphone, a Samsung S5, equipped with headphones and with the “Fragments of Laura” mobile application installed and running. As the participants experienced the LAMVR tour, the experimenter observed from a distance of around 4-5 meters (shadowing). The experimenter had previously explained to the participant that he should ignore completely his presence, therefore the participants had to discover all the story points by interacting with the mobile application and looking around them to discover the physical markers. The tour lasted around 20 minutes and once the participant finished, the experimenter led him back to an office in order for the participant to fill out a questionnaire taking around 10 minutes. Finally, the experimenter conducted a semi-structured interview with a set of 5 predetermined questions, approaching, in general how did they felt about the experience, and eventually some questions that arose from the shadowing. This section of the procedure took no longer than 10 minutes. The overall experimental procedure lasted around 40 to 45 minutes and participants were compensated with a chocolate bar at the end.

Data Collection

In this section, we describe the tools and methods used to collect information on the overall user experience, when interacting with different technological mediums delivering an interactive story point. The data was gathered through quantitative data and qualitative data. The quantitative data was collected through a self-report questionnaire and to complement this data we shadowed the user during his experience and performed a semi-structured interview at the end of the experience.

Quantitative Data

To evaluate the user experience, we gathered measures

Condition	Gender		Age Range		Total		
	Freq.	Percent	Freq.	Percent			
1	Male	9	69.2%	18-24	3	23.1%	13
				25-24	8	61.5%	
	Female	4	30.8%	35-44	2	15.4%	
2	Male	5	45.5%	18-24	6	54.5%	11
				25-24	4	36.4%	
	Female	6	54.5%	45-54	1	9.1%	

Table 2. Participants Gender and Age Range Frequency data per condition

from a combination of predefined and validated scales:

Flow Short Scale [12]: a general measure of Flow developed by Rheinberg and colleagues in Germany. Participants are asked to report the activity they are currently performing and to evaluate its psychological features in relation to optimal experience on ten items using a 7-point Likert scale ranging from “not at all” to “very much”. The participants’ level of optimal experience is commonly calculated as the mean value of Flow items.

User Experience Questionnaire – UXQ [40]: is a questionnaire covering a comprehensive impression of user experience. It allows the users, in a very simple and immediate way, to express feelings, impressions, and attitudes that arise during an experience.

The UXQ contains six scales with 26 items. It analyses: the *Attractiveness* of the product, what is the overall impression of the product and if users like or dislike the product; the *Perspicuity* of the product, how easy is it to get familiar with the product; *Efficiency* of the product, if the users can solve their tasks without unnecessary effort; the *Dependability* of the product, if the user feels in control of the interaction; *Stimulation* of the product, is product use stimulating, exciting and/or motivating; and finally the *Novelty* of the product, is the product innovative, creative and/or catch the interest of users?

Game Experience Questionnaire (GEQ) [16]: has a modular structure and consists of three parts. Part one and two probe the players’ feelings and thoughts while playing the game; part three, the post-game module, assesses how players felt after they stopped playing. The core questionnaire, part one, assess game experience as scores on seven components: Immersion, Flow, Competence, Positive and Negative Affect, Tension, and Challenge. Users have to respond to the questions following a 5-point scale ranging from “not at all” (0) to slightly (1), moderately (2), fairly (3), and extremely (4). For each of the questionnaire components, the scores are computed as the average value of its items.

Qualitative data

Participants in the study were shadowed for the duration of the whole experiment. Our main goal by performing shadowing to our participants was to understand if we could gather more insights on the social aspect of the experience, both of the participants in relation to others passers-by and of the passers-by in relation to the participants. The researcher documented items such as; “Does the user seems comfortable in his interaction with the system, how many times does the user asks for help?” ; “Is the user looking uncomfortable and check his surroundings to see if people do look at him or stare at his actions?”; “Are people passing by looking at the user?”. All these items were on an observation sheet that the experimenter filled out during the shadowing. Beyond this observation protocol, the experimenter kept written notes about anything else he may have witnessed.

We also conducted semi-structured interviews to probe for participants’ impressions of the overall experience, to understand what did they enjoyed or struggled with the most. We also included questions particularly related to the interaction within the 3D interactive story point. Finally, we included questions related with to social aspect of the experience (e.g. if the participants were worried about passers-by and what they might be thinking about their actions and if that affected their behaviour in any way).

Data Analysis

All statistical analyses described below were performed with the SPSS version 24.

By following the scoring guidelines for each of the scales, we obtain the scores to measure the overall user experience. Due to the nature of data measured (ordinal data from Likert scales and Likert items) and the small sample size, it is most appropriate to apply a non-parametrical statistical test. Therefore, we will be testing for the difference between two unrelated sample conditions by using the non-parametric Mann-Whitney U test. Differences between the scores in each of the conditions were considered statistically significant at $p < 0.05$ and the median will be reported instead of the mean, since this statistic is more

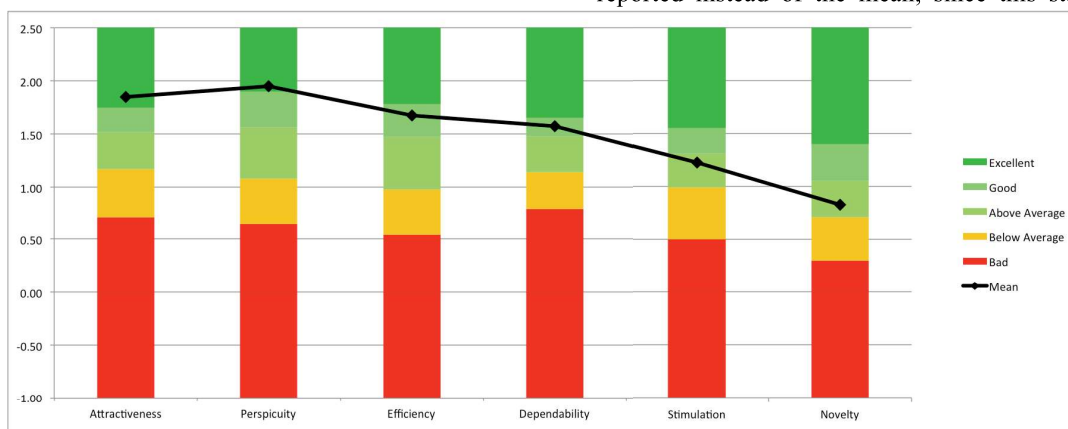


Figure 3. User Experience Questionnaire Results

appropriate for non-parametric results.

Regarding the qualitative data from the shadowing observations and the semi-structured interview, we used thematic analysis [8] to identify themes and patterns.

RESULTS

In this section, we present the results summarized into 4 main topics. Under each topic we present the related quantitative data (using the Mann-Whitney U test) and the results from both the observations and the semi-structured interviews. Participants' are identified by their condition and session IDs, e.g. C1 – 14, 15 (sessions 14 and 15 belong to condition 1).

FoL LAMS: Overall user experience

Scores from the qualitative data obtained show scores above average for all components from the UXQ, Figure 3. Results from the GEQ show above average median scores for the *Immersion*, *Flow*, *Competence*, and *Positive Affect*, while, low median scores were reported for *Tension* and *Annoyance*, as well as for *Negative Affect* and *Challenge*, see Figure 5.

Most enjoyable aspects: When we asked the participants in the interview, what did they enjoyed the most about the overall experience, ten participants mention the pharmacy interactive scene, split equally across conditions (C1 – 3, 5, 11, 14, 23; C2 – 2, 9, 21, 22, 24). Seven participants mentioned that what they really enjoyed was the mix of media between the multimedia videos and the 3D interactive scene (C1 – 11, 10, 17; C2 – 7, 21, 22, 24). Furthermore, nine participants highlighted that they appreciated how simple and intuitive the application was; Four participants mention how they enjoyed the visuals (C1 – 11, 10, 17; C2 – 21) and other four said that how much fun they had was the most enjoyable aspect of the experience (C2 – 12, 22; C1 – 16, 17). Several participants enjoyed the overall concept of the experience, 6 from *CIScreen* (C1 – 3, 6, 11, 14, 17, 19) and 3 participants from *C2HMD* (C2 – 9, 13, 18). Four participants especially pointed out enjoying the combination of using a map interface with physical markers spread out to mark the story points (C1 – 1, 11; C2 – 18, 22). C1-10 even pointed out how “it was an adventure to look for the story” and C1-11 really enjoyed that it was an outdoor experience.

Comparing Mediums: C1Screen VS C2HMD

Flow scores of users who participated in *C1Screen* (Mdn=47.0) did not differ significantly from participants in *C2HMD* (Mdn =49.0), $U = 71.00$, ns, $r=0.05$. The *Flow* median score was only slightly higher in *C2HMD*, but not reaching significance, Figure 4.. We did not find significant differences in the other user experience components except in terms of *Perspicuity*, meaning that in *C2HMD* (Mdn=0.75) participants had more difficulties in getting familiar with the experience and found it harder to use/interact with it than in *C1Screen* (Mdn=2.25), $U=29.50$, $p<0,05$, $r=-0.49$. Similarly, the scores in all of the Game Experience Questionnaire dimensions do not present

significant differences between participants in *C1Screen* from participants in *C2HMD*. Figure 5 shows a graphical comparison of the median scores in the two conditions.

In both conditions, there were usability and discomforts observed. In *C2HMD*, three participants had difficulties in using the cardboard, while seven participants of the same condition had problems in using the VR cardboard button. This issue was also pointed out in the interviews by some users. Only two of the *C1Screen* participants had problems with the “walk button”.

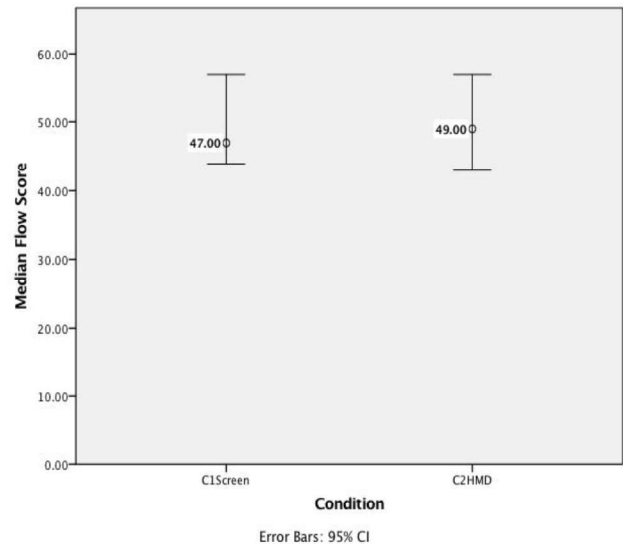


Figure 4. Flow Median Scores for both conditions

MVR interactive point

In the beginning of story point 3 (interactive scene), we observed two main reactions to it: surprise and confusion. We noticed that eight of the participants seemed really surprised (C2 – 9, 12, 15, 18, 21; C1 – 3, 4,10;) and other five looked like they were confused and weren't sure on what to do (C2 – 2, 13, 21; C1 – 3, 23). Two others even started laughing out loud (C2 – 22; C1 – 17).

We observed that 8 participants seemed to be uncomfortable while interacting with the interactive scene, four from each condition (C1 – 6, 4,19, 23; C2 – 2, 9, 13, 24). For example, C2 – 13 even seemed cautious in moving around; C1 – 3 similarly was not moving the phone around too much and C1 – 4 for example, never lifted the phone up higher than the shoulders level. C1 – 23 would only do 90° of interaction in front of him, never turning around to see what the pharmacy had behind him.

We observed 4 participants holding back on the interaction movements (C2 – 8, 9,13, 21), while other 4 participants seemed to be immediately comfortable while interacting in the interactive 3D scene (C1 – 3, 10, 20; C2 – 7). Interesting to note that we observed that C1 – 16 and C1 – 17 were not moving too much at the beginning, but as they

felt more confident, they started to increase their range of movements.

The pharmacy MVR scene instigated walking among the participants in both versions. On the *C1Screen* condition, three participants started walking (C1 – 4, 6, 19), other three only gave a couple of steps (C1 – 23, 10, 17), and 1 participant asked if they were supposed to walk (C1 – 5). While in the *C2HMD* condition, six participants walked around 5m² and from these, two participants even walked backwards; C2 – 18 only gave a few steps and C2 – 15 was doing baby steps. As a consequence, we observed 5 participants (C2 – 9, 22, 24; C1 – 5, 19) bumping into elements of the surrounding environment.

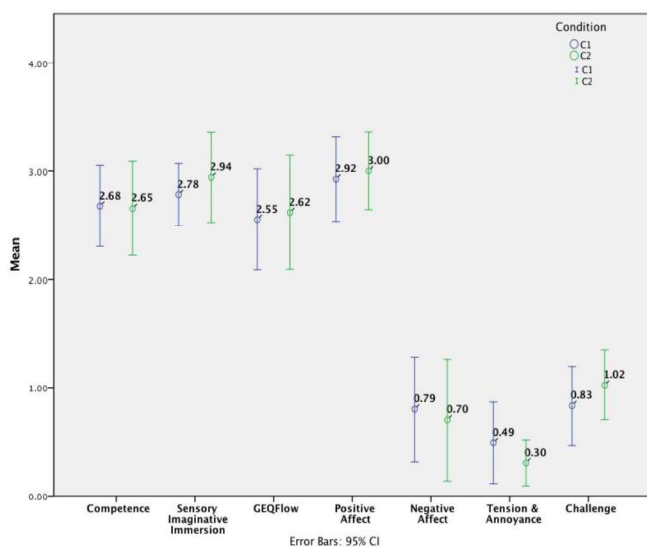


Figure 5. - Median Scores for the Game Questionnaire dimensions for each of the conditions.

We later followed up on this by asking the participants if they could explain why they felt the need to walk. For example, C1 – 5 said “Because I felt like I could walk; It was like walking enabled me to interact in the VR”; C2 – 15 had the illusion that walking in the real world was helping “I felt that it helps me reach my goal; Walking help to explore” and C2 – 22 said “I don’t know why I kept walking. It was intuition; felt the need to walk”.

It was observed that once participants started to interact with the pharmacy scene, they increased their focus on what they were doing; this was very evident in at least six of the participants (C2 – 2, 18; C1 – 6, 20, 10, 3).

Positive Aspects of MVR: When we asked participants in the interviews to highlight the positive and negative aspects while interacting with the *pharmacy scene*: “the ability to explore and walk within the pharmacy”, was the most mentioned aspect by the participants as ten participants expressed that their favourite thing in the interactive scene was the fact that they could walk and explore (C1 – 5, 3, 19, 20, 23; C2 – 9, 18, 12, 22, 24). Eight participants

specifically highlighted as their favourite aspect of the interactive scene getting to know more about all the traditional products existing there (C2 – 2, 12, 24; C1 – 6, 14, 20, 23). Other three participants mention the task of making and learning about the medicinal drink as their favourite aspect of the experience (C1 – 6, 11, 19). One participant praised the educational value of the interactive scene (C1 – 16).

Negative Aspects of MVR: However, six mentioned that the task was too long, taking a lot of time to complete (C1 – 4, 11, 17; C2 – 18, 21) leading to the frustration of two participants (C2 – 18, 21). Seven participants shared that the interactive scene was to some extent, a bit confusing at first (C1 – 1, 11, 20, 17, 23; C2 – 22, 24). However, after a couple of minutes of interaction, participants find it intuitive and enjoy it. Nine participants were pleased by the interaction and how intuitive it is (Intuitive: C1 – 1, 3, 4, 10, 17, 20; + Positive Interaction: C2 – 2; C1 – 5, 14). Four participants in *C2HMD* mention in the interviews like they felt that the VR/Interactive scene was too different from the other media; they mention that they would need some kind “preparation” beforehand (C2 – 18, 7, 15, 21) and five participants highlighted how unexpected the scene was and how that became a positive aspect of the experience (C2 – 7, 18, 21; C1 – 3, 17). Other three participants treasured the novelty of the experience (C2 – 13, 7; C1 – 3). Four participants described the fact that they were “immersed” in the task as their positive highlight of the experience (C2 – 9, 7, 21, 22), while other participants used the word “focused” (C2 – 9; C1 – 17, 16). Two participants also mention how they felt like there were too focused on the screen during the experience (C1 – 16, 23).

Location and social context of the experience

Most participants mention in the interviews that they were comfortable while doing the tour (C1 – 1, 4 10, 16, 20; C2 – 7, 2, 15, 22), while other 2 participants mention being uncomfortable (C1 – 19; C2 – 24 (arm + eyes)). Furthermore, seven participants mention that they weren’t uncomfortable in that specific context but if they were in another context, another public space they would be (C1 – 1, 14, 17, 23; C2 – 15, 18, 22 (uncomfortable with 360° interaction)). We also asked all the participants if they were worried about others observing them, nine participants did not demonstrate any worries in relation to that, eight mentioned that they would be self-conscious if it was in another context (C1 – 1, 11, 14, 17, 23; C2 – 18, 15); C2 – 18 said that he would even be worried about being robbed if it was in another context. Four participants (C2 – 8; C1 – 14, 16, 19) stated that they were worried about what others could think; C1 – 16 expressed that while in the pharmacy, he forgot about that fact. Two participants mentioned feeling pressured to achieve the task, as they didn’t want to look like “fools” (C1 – 5, C2 – 12). When we asked the participant to follow up on this, participants said that the interactive scene should be made available in a reserved location. For example, C1 – 4 said “Need for closed space

in 3D scene to be more focused”, another participant, C1 – 3, said “3D scene should be in a “paid” space”; Furthermore, we observed several passers-by looking at the participants. We noticed that this happened more often in *CIScreen* condition. In five of the participant sessions from the *CIScreen*, there were people looking and commenting about what they were seeing. In *C2HMD* condition, this only happened in three of the sessions.

DISCUSSION

The use of MVR within a location aware multimedia experience was in general, well perceived and enjoyed by the participants since we can see high score values in dimensions of the UX questionnaire such as *Attractiveness*, *Novelty*, and *Stimulation* for both of the conditions. The feedback received was very positive with most of the participants highlighting how much they enjoyed the overall experience of a LAMS coupled with mobile VR.

Finding the balance between Multimedia an immersive multimedia content

Participants emphasised how much they enjoyed the combination of media between the videos and the interactive scene. While the balance found was in general well perceived by the participants, it is a factor that needs to be pondered in future iterations as the interaction with the VR scene was something that absorbed a lot of attention from the participants and it should not become something mentally draining or exhaustive. Furthermore, the incorporation of media like audio that does not require the participants to actively focus on the screen could be beneficial as it maintains the variety of media enjoyed by the participants, while allowing participants to consider the locations they are in.

Participants in *C2HMD* scored slightly higher in terms of *Sensory and Imaginative Immersion*, a dimension of the game experience questionnaire; it is surprising that this value is not significantly higher in this condition due to immersive nature of the HMD, however, this shows that the VR environment and the task is immersive enough independently of the medium where is displayed. It could be of interest to study if the context of where it was being presented would play a role in increasing this. For example, if showing the pharmacy scene in the actual location where the pharmacy was, would, in fact, increase the *Sensory and Imaginative Immersion*.

Challenges in embracing Mobile VR

Despite the encouraging feedback from the participants, and the low scores in the parameters that evaluate the negative aspects of the experience, it is important to acknowledge that mobile VR is still not widely accepted socially. Some participants mentioned being uncomfortable during certain moments of public use. A suggestion received was that the interactive scene should be done in a reserved location. This suggestion should be taken into account every time that the location allows it, especially because of another behaviour that we observed: users physically walking while interacting in the VE, in both conditions. We did not

foresee this behaviour; in fact, it was quite worrying, as we feared for participant’s safety in the physical environment. We believe that the nature of the interaction required in the VE (walking and exploring) promoted this behaviour in the real world. In other words, we designed an exploration task that required the participants to virtually walk in VE and as a result, they also walked in the real world. This could indicate that this exploration task would not be indicated for a busy location (with a lot of people passing by), or tight spaces (where users could bump into walls) and suggests that it could be more indicated to have a passive story visualization, where the action is happening virtually around the participant but no interaction or exploration within the environment is required.

One of our main goals was to study the users experience while interacting with Mobile VR in a public context, and it was not surprising to discover that participants found *CIScreen* more familiar and easy to adapt to compare to *C2HMD*. C1 condition seems to have a broader reach and acceptance by audience since it relies on more common interactions present in current mobile computing interaction (e.g. touch to select objects and press buttons to move), while the interaction in C2 using HMD’s is still less common. Participants struggled more in *C2HMD* due to the fact that in order to view the content with the cardboard, participants had to learn how to put the phone inside the cardboard and learn how to use the cardboard button to move around in the VR environment, leading to a longer adaptation phase. We note that there is the possibility that this difficulty could be specific to Google cardboard HMD used, as a more robust HMD such as View-Master VR with a more reliable interaction input could mitigate these issues. Another option to consider for future design interactions is the use of a Mobile VR HMD such as Google Daydream that is equipped with external controllers that could improve the interaction within the virtual environment.

Provide “onboarding” time for a MVR experience

It is interesting to highlight that participants (namely those in *C2HMD*) felt the need to have some kind of “preparation” before the interactive scene. Therefore, they needed to be put in the right mind-set as the device that they were using, up until that point, takes a different interaction format. In a way, it seems like the use of the phone inside the cardboard disrupted their mental model of the mobile phone role in the context of the experience. This is very important in terms of reaching an overall smooth experience. Different approaches to the role of the HMD could be taken for future experiences of this kind. The HMD can be handed at the beginning of the experience (or users know that they need to take the HMD with them) allowing an “onboarding” with the HMD beforehand. Alternatively, if it is part of the experience to have a surprise effect (e.g. exploring to find the clue and finding the HMD), like in our case, the HMD used to interact and visualize the VE should have been portrayed and explained as part of the world building established by the LAMS (e.g.

as sort of “magical device” that allow the users to travel back an embody the character). In other words, the experience should be designed in a way that gives the users “onboarding time” in the transition between different types of mediums (videos vs VR). Despite this, it is also interesting to see that participants felt more *Competence* and *Challenge* in condition C2 - one reason for this could be the fact that since the task to use the cardboard revealed to be more challenging, participants also felt more empowered after being able to achieve the task, in the end becoming more rewarding.

Limitations

These initial results of the study encourage the pursuit of further investigation in LAMS combined with immersive Mobile VR technology, particularly using different types of tasks and interactions and eventually to test this kind of setup in other urban locations. The study presents in this way limitations. We decided to run the study in the university campus as we saw it as a public but yet contained space and in was seen, as a “safe setting” by the participants; a busier and diverse urban setting may not allow the “calm” experience as some participants highlighted during the interviews but on the other hand experience the stories in the location where they were envisage for might enrich the experience further in terms of immersion and engagement. Moreover, our end goal is to use such experiences within the tourism industry and this study was not done with the intended target audience because we were concerned that the experience design wasn’t mature enough to be provided to a tourist. However, from the findings that we uncovered, we are now confident that we are able to iterate on the prototype and conduct further user studies within the appropriate context.

CONCLUSION

This paper studies the pairing of immersive Mobile VR with Location Aware Multimedia Stories (LAMS). We designed an experience to study the user experience of a LAMS paired with Mobile VR. Furthermore, we analysed different viewing mediums for delivering the MVR content to understand how the much would that impact the experience in a real world setting. The quantitative and qualitative data analysis presents encouraging results despite the fact that we learned that the audience might not be quite ready to embark on MVR experiences in public spaces just yet. We believe that this first effort to understand more about the use of VR coupled with LAMS opens promising avenues for further research in order to understand how can we design this experiences to be widely adopted. Future directions of this work will include a redesign of certain aspects of the experience, such as reconsider the balance of type of the different types multimedia, and even push further on the amount of immersive content. Furthermore, an interesting approach would be to make the MVR “more aware”/reactive of its surroundings/location by for example matching the MVR 3D environment conditions with the real world weather conditions, it is without a doubt for us that MVR opens up a

whole panoply of exciting explorations between virtual reality and reality.

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REFERENCES

1. Joe Bardi on January 6 and 2017. 2017. Top Virtual Reality and Augmented Reality Technology Trends 2017. *Marxent | Top Augmented Reality Apps Developer*. Retrieved February 7, 2017 from <http://www.marxentlabs.com/5-top-virtual-reality-augmented-reality-technology-trends-2017/>
2. Andy O’Donnell. 8 Virtual Reality Travel Experiences That Will Blow Your Mind. *Lifewire*. Retrieved August 17, 2017 from <https://www.lifewire.com/virtual-reality-tourism-4129394>
3. Kamarulzaman Ab. Aziz and Tan Gek Siang. 2014. Virtual Reality and Augmented Reality Combination as a Holistic Application for Heritage Preservation in the UNESCO World Heritage Site of Melaka. *International Journal of Social Science and Humanity* 4, 5: 333–338. <https://doi.org/10.7763/IJSSH.2014.V4.374>
4. Paulo Bala, Mara Dionisio, Valentina Nisi, and Nuno Nunes. 2016. IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality. In *Interactive Storytelling: 9th International Conference on Interactive Digital Storytelling, ICIDS 2016*, Springer International Publishing, Cham, 3–11. https://doi.org/10.1007/978-3-319-48279-8_1
5. Steve Benford, Andy Crabtree, Martin Flintham, Adam Drozd, Rob Anastasi, Mark Paxton, Nick Tandavanitj, Matt Adams, and Ju Row-Farr. 2006. Can You See Me Now? *ACM Trans. Comput.-Hum. Interact.* 13, 1: 100–133. <https://doi.org/10.1145/1143518.1143522>
6. Lisa Blum, Richard Wetzel, Rod McCall, Leif Oppermann, and Wolfgang Broll. 2012. The final TimeWarp: using form and content to support player experience and presence when designing location-aware mobile augmented reality games. In *Proceedings of the designing interactive systems conference*, 711–720. <https://doi.org/10.1145/2317956.2318064>
7. Doug A. Bowman (ed.). 2005. *3D user interfaces: theory and practice*. Addison-Wesley, Boston, Mass.
8. Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research*

- in Psychology* 3, 2: 77–101.
<https://doi.org/10.1191/1478088706qp063oa>
9. Nuno Correia, Luís Alves, Helder Correia, Carmen Morgado, Luis Soares, Jose C. Cunha, Teresa Romão, A. Eduardo Dias, and Joaquim A. Jorge. 2005. InStory: A System for Mobile Information Access, Storytelling and Gaming Activities in Physical Spaces. In *ACE2005*, 102–110.
<https://doi.org/10.1145/1178477.1178491>
 10. Mara Dionisio, Mary Barreto, Valentina Nisi, Nuno Nunes, Julian Hanna, Bianca Herlo, and Jennifer Schubert. 2015. Evaluation of Yasmine’s Adventures: exploring the socio-cultural potential of location aware multimedia stories.
https://doi.org/10.1007/978-3-319-24589-8_26
 11. Mara Dionisio, Valentina Nisi, and Jos P. van Leeuwen. 2010. The iLand of Madeira Location Aware Multimedia Stories. In *Interactive Storytelling (Lecture Notes in Computer Science)*, 147–152.
https://doi.org/10.1007/978-3-642-16638-9_19
 12. Stefan Engeser and Falko Rheinberg. 2008. Flow, performance and moderators of challenge-skill balance. *Motivation and Emotion* 32, 3: 158–172.
<https://doi.org/10.1007/s11031-008-9102-4>
 13. Richard Ferraro and Murat Aktihanoglu. 2011. *Location-Aware Applications*. Manning Publications Co., Greenwich, CT, USA.
 14. F. Fritz, A. Susperregui, and Maria Teresa Linaza. 2005. Enhancing cultural tourism experiences with augmented reality technologies.
<https://doi.org/http://hdl.handle.net/123456789/653>
 15. Daniel A. Guttentag. 2010. Virtual reality: Applications and implications for tourism. *Tourism Management* 31, 5: 637–651.
<https://doi.org/10.1016/j.tourman.2009.07.003>
 16. Wijnand IJsselsteijn, Y. A. W. de Kort, and Karolien Poels. 2008. The game experience questionnaire. *Manuscript in preparation*. Retrieved May 3, 2017 from
<https://eclass.uoa.gr/modules/document/file.php/DI411/papers/Evaluation/Game%20Experience%20Questionnaire%20English.pdf>
 17. Carsten Magerkurth, Adrian David Cheok, Regan L. Mandryk, and Trond Nilsen. 2005. Pervasive games: bringing computer entertainment back to the real world. *Computers in Entertainment (CIE)* 3, 3: 4–4.
 18. Daniele Marini, Raffaella Folgieri, Davide Gadia, and Alessandro Rizzi. 2012. Virtual reality as a communication process. *Virtual Reality* 16, 3: 233–241. <https://doi.org/10.1007/s10055-011-0200-3>
 19. Paul Milgram and Herman Colquhoun. 1999. A taxonomy of real and virtual world display integration. *Mixed reality: Merging real and virtual worlds*: 5–30.
 20. Paul Milgram, Haruo Takemura, Akira Utsumi, and Fumio Kishino. 1995. Augmented reality: a class of displays on the reality-virtuality continuum. 282–292.
<https://doi.org/10.1117/12.197321>
 21. Shailey Minocha, Ana-Despina Tudor, and Steve Tilling. 2017. Affordances of Mobile Virtual Reality and their Role in Learning and Teaching. Retrieved August 18, 2017 from <http://hci2017.bcs.org/wp-content/uploads/Paper-52-Minocha-BCS-HCI-Final-Submission-16May2017-reduced-size.pdf>
 22. Barbara Elizabeth Neuhofer. 2014. An Exploration of the technology enhanced tourist experience. Bournemouth University. Retrieved May 3, 2017 from <http://eprints.bournemouth.ac.uk/22032/>
 23. Valentina Nisi, Enrico Costanza, and Mara Dionisio. 2016. Placing Location-Based Narratives in Context Through a Narrator and Visual Markers. *Interacting with Computers*. <https://doi.org/10.1093/iwc/iww020>
 24. Valentina Nisi, Ian Oakley, and Mads Haahr. 2006. Inner City Locative Media: Design and Experience of a Location-Aware Mobile Narrative for the Dublin Liberties Neighborhood. In *Intelligent Agent*. Retrieved July 3, 2015 from <http://mf.media.mit.edu/pubs/journal/InnerCity.pdf>
 25. Valentina Nisi, Alison Wood, Glorianna Davenport, and Ian Oakley. 2004. Hopstory: An Interactive, Location-Based Narrative Distributed in Space and Time. In *Technologies for Interactive Digital Storytelling and Entertainment*, Stefan Göbel, Ulrike Spierling, Anja Hoffmann, Ido Iurgel, Oliver Schneider, Johanna Dechau and Axel Feix (eds.). Springer Berlin Heidelberg, 132–141. Retrieved July 3, 2015 from http://link.springer.com/chapter/10.1007/978-3-540-27797-2_18
 26. Jeni Paay, Jesper Kjeldskov, Anders Christensen, Andreas Ibsen, Dan Jensen, Glen Nielsen, and René Vutborg. 2008. Location-based storytelling in the urban environment. 122.
<https://doi.org/10.1145/1517744.1517786>
 27. N. de la Peña, P. Weil, J. Llobera, B. Spanlang, D. Friedman, M. V. Sanchez-Vives, and M. Slater. 2010. Immersive Journalism: Immersive Virtual Reality for the First-Person Experience of News. *Presence* 19, 4: 291–301. https://doi.org/10.1162/PRES_a_00005
 28. Erik Poppe, Désirée Gilgen, and Niz Safrudin. 2017. Virtual Reality Goes Mobile in the Digital Age. In *Shaping the Digital Enterprise*, 309–330.
https://doi.org/https://doi.org/10.1007/978-3-319-40967-2_15
 29. Mel Slater and Maria V. Sanchez-Vives. 2016. Enhancing Our Lives with Immersive Virtual Reality. *Frontiers in Robotics and AI* 3.
<https://doi.org/10.3389/frobt.2016.00074>

30. 2017. 20 Top Virtual Reality Apps that are Changing Education. *The Tech Advocate*. Retrieved August 18, 2017 from <http://www.thetechadvocate.org/20-top-virtual-reality-apps-that-are-changing-education/>
31. Tango. *Tango*. Retrieved August 18, 2017 from <https://get.google.com/tango/>
32. Daydream. Retrieved August 18, 2017 from <https://vr.google.com/daydream/>
33. 2016 Augmented and Virtual Reality Survey Results. *Perkins Coie*. Retrieved August 25, 2017 from <https://www.perkinscoie.com/en/21626/ar-vr-survey-results.html>
34. Gartner's 2016 Hype Cycle for Emerging Technologies Identifies Three Key Trends That Organizations Must Track to Gain Competitive Advantage. Retrieved August 18, 2017 from <http://www.gartner.com/newsroom/id/3412017>
35. Uncle Roy All Around You: Implicating the City in a Location-Based Performance | Steve Benford, Martin Flintham, Adam Drozd, Rob Anastasi, Duncan Rowland, Nick Tandavanitj, Matt Adams, Ju Row-Farr, Amanda Oldroyd, Jon Sutton. *Europeana*. Retrieved July 3, 2015 from http://www.europeana.eu/portal/record/2022113/urn_a_xmedis_00000_obj_a5e61424_e3f1_46ea_b471_99a9536a5a73.html
36. Catch Pokémon in the Real World with Pokémon GO! Retrieved August 18, 2017 from <http://www.pokemongo.com/en-us/pokemon/>
37. Official Site | Second Life - Virtual Worlds, Virtual Reality, VR, Avatars, Free 3D Chat. Retrieved August 18, 2017 from http://secondlife.com/?campaignid=290832390&adgroupid=29238425070&loc_physical_ms=1011781&placement=&keyword=%252Bsecond%2520%252Blife%2520online&matchtype=b&creative=194148972203&utm_source=Google&creativeid=T011094&gclid=CjwKC_AjwoNrMBRB4EiwA_ODYvzukj1mFUN4FxPVWdgJxvqi4vxDc_pyY90grIUy-6e1lXw5fZTyf7RoC3XEQA_VD_BwE
38. 3D Virtual Geology Field Trip | The OpenScience Laboratory The OpenScience Laboratory- Projects- 3D Virtual Geology Field Trip. Retrieved August 18, 2017 from <http://www.open.ac.uk/researchprojects/open-science/3d-virtual-geology-field-trip>
39. Google Expeditions. Retrieved August 18, 2017 from <https://www.google.com/expeditions/>
40. User Experience Questionnaire Handbook Version 2. Retrieved October 21, 2016 from https://www.researchgate.net/publication/303880829_User_Experience_Questionnaire_Handbook_Version_2

**Appendix E. A Participatory Platform
Supporting Awareness and Empathy
Building Between Tourists and Locals:
the Há-Vita, a Case Study**

A Participatory platform supporting awareness and empathy building between tourists and locals: the Há-Vita a case study

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Figure 1: The Há-Vita Interactive Participatory Platform

ABSTRACT

In this paper, we describe the conceptualization, design and preliminary evaluation of *Há-Vita*, a participatory platform populated with video interviews about nature and biodiversity preservation, designed primarily for tourists and visitors of a popular Touristic Island destination. The content was selected to raise awareness towards environmental sustainability related. As a strategy to engage the public with the local biodiversity, we envisioned to foster interaction between tourists and locals. Evaluating our strategy with tourists' revealed itself to be a research challenge on its own. Nevertheless, our results shed light on content creation and design choices of the platform, as well as reflecting on

*Article Title Footnote needs to be captured as Title Note

†Author Footnote to be captured as Author Note

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the methodological challenges of conducting HCI research with real tourists in situ.

CCS CONCEPTS

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

KEYWORDS

Storytelling; tourism, authenticity, participatory media; environmental awareness; HCI and sustainability, artistic design, biodiversity preservation, local residents.

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1 INTRODUCTION

Socio-economic constraints of islands include isolation, lack of scale and economic dependence on few products and services, often coupled with a challenging topography and climate. In many Islands, tourism is often the prime source of economic welfare and job creation. Our case study concerns one of the outermost regions of Europe in which Tourism accounts for 24 % of the GDP and 15% of the employment. These insular regions account for 80% of the biodiversity of Europe [10] with their unique environmental attributes offering a variety of endemic species, including plants and animals, many of them threatened and endangered. While this could be considered as wealth for the islands' population, islanders have often to face many challenges in order to preserve the underlying biodiversity. Tourism pressures can endanger endemic species as well as generate frictions with the local community, as visitors may adopt behaviors perceived contrary to the island culture or traditional values [16]. These frictions may lead locals to dislike tourism and to develop coping mechanisms to avoid contact with visitors, generating unexpected consequences on the long run. Há-Vita emerged from this interesting, and potentially contradictory political and social context. Há-Vita was developed as a web-based platform (<https://havita.m-iti.org/>) which functions as an information touch point between visitors and locals, opening up dialogue about the rich natural capital, traditions and folklore of the islands [19][8] [7]. In order to create opportunities for this dialogue, the project delivers two main points of interaction. Firstly, it functions as a repository of locally collected video interviews highlighting many aspects of the island's natural capital and local culture [18]. Secondly, it encourages contact and exchange among locals and visitors, by means of providing tourists with the information and channels that locals themselves propose as preferred contact modes between them and the visitors.

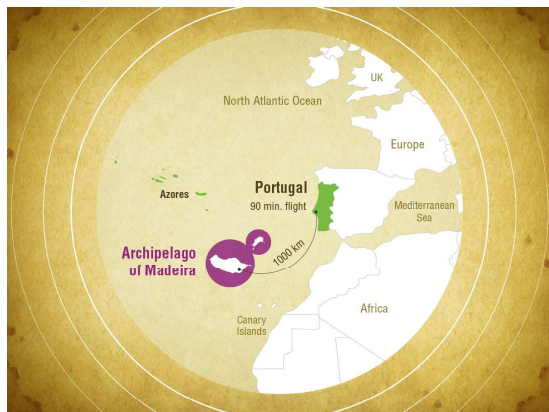


Figure 2: Map of the archipelago of Madeira, Portuguese ultra-peripheral region

Há-Vita was specifically designed for the region of Madeira Island, situated in the North Atlantic, nearly 1000 Km away of the mainland of Portugal and continental Europe (Figure 2). More than 1.3 million people visit Madeira every year, mostly from the UK, Germany, and the Scandinavian countries[1, 6]. Along with

Guadalupe, Guiana, Martinica, Reunion, Canary Islands, and Azores, the archipelago of Madeira is deemed an “ultraperipheral region” by the European Commission. These European territories have very geo-economics particularities and extraordinary natural conditions [10].

Há-Vita takes a research through design approach [23] focusing on storytelling and journalistic style interviews as a mean to foster interest, empathy and dialogue between locals and tourists. In this paper, we reflect on the design and preliminary evaluation of Há-Vita, with an eye on the implications, and dimensions of designing such platform in the outlined specific context of a touristic region. We also account for the methodological challenges of gathering meaningful evaluation from tourists. By tourists, we mean visitors who are staying on the island for at least one week and have a scheduled itinerary for leisure purpose.

To tackle the aforementioned issues, the authors have anchored their work on Authenticity Theory [15] and Latent Ties Theory [12] and reflect on the implications of such theories regarding the interactive digital platform. In the next sections, the paper unfolds describing the background and design rationale of Há-Vita followed by methods, results, discussion, methodological challenges, and conclusions.

2. BACKGROUND

In the recent years, the World Wide Web has become an increasingly valuable tool to the tourism industry. It currently relies immensely on ICT, from booking platforms to content sharing on social media. Although tourism has entered a phase of profound change, one of the trends in the tourism business is the “search for authenticity” a concept that has been around ever since the 1970s and the seminal writings of MacCannell [15,16]. Authenticity is connected with what Van Nuenen [21] presents as “the modern discourse of anti-tourism, which consists of a desire of travellers to reach beyond superficial experiences that tourism industry fosters”. Van Nuenen himself, is drawing from theories dating back to 1959 [11], in which Goffman provides an analysis of social interactions framed through the metaphor of *front and back regions* of a theatre. The *front* is the meeting place of hosts and guests or customers (e.g., reception offices, parlours, dining room in a restaurant) and the *back* is “where members of the home team retire between performances to relax and to prepare” (e.g., Kitchens, boiler rooms). Building on this division of *front and back regions*, MacCannell [16] argues that touristic experiences are underlined by the same structural tendencies. Increasingly, tourists' ambitions move towards experiencing the local life, being like locals; there is a desire to experience *back regions* and being “one of them”, in this case being one of the locals, or at least having access to the intimacy of locals.

The close relationship between tourism and innovations in ICT yielded several studies investigating how social media provide opportunities for sharing and connecting, among tourists and more recently across tourists and locals as well (e.g., Couch surfing, see

[6], see *vayable.com*¹, *Urban Buddy*², *Spotted by Locals*³), either online or offline [17].

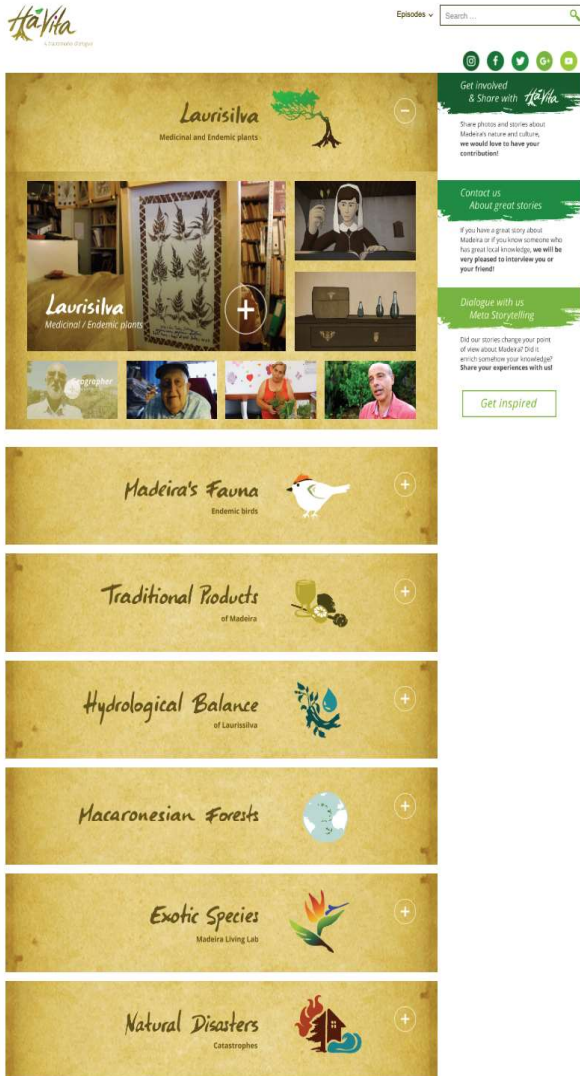


Figure 3: Screenshot of the main Há-Vita web page showcasing the representative themes and icons. On the right side we can see the 3 different encouragement levels for user participation

In summary, Authenticity Theory highlights the visitors' desire for authentic experiences involving a pursuit of truthful interactions with locals [16]. This theory warns us about staged authenticity and supports the enabling of visitors' engagement with local life through developing ties with local residents. On this note, Latent Tie Theory argues that individuals have latent ties – “technically

possible but not yet activated socially” in online settings [12]. Latent ties can be converted to weak or strong ties by reinforcing relationships with others. For instance, members of CouchSurfing.com have only latent ties via viewing others' profiles or chatting with them, which can develop into strong friendships after attending an offline meeting or being couched [4]. Chung and colleagues [3,4] look at online communities, and the role of an offline meeting in building online friendships: locals and tourists build online friendships through offline events; they may start their acquaintance through an online travel community, but they develop friendships after offline meetings. This theory helps us to frame Há-Vita as a participatory and interactive interface, as we may envision elaborating on the notion of latent ties between locals and visitors in Madeira We connect the latent theory to the authenticity theory, by envisioning an authentic experience through the fostering of relationships between locals and visitors. To develop Há-Vita we used a Research through Design approach [23]; from observations emerging from the locals accounts of their own values and traditions, our goals were to capture locals thinking and talking about what is familiar to them and how it could be authentically accessed by tourists. Há-Vita was conceived as means to expose authentic *back regions* to visitors. The stories featuring in Há-Vita are captured through journalistic style interviews and crafted so to be as authentic as possible, by means of minimum set up and capturing of spontaneous performances. The content is edited so to maintain focus on several themes, which emerged from the interviews content itself.

3. CONCEPTUAL DESIGN

The design foundation of the Há-Vita platform sits on the presentation of content highlighted from the interviews with local community members. Several topics emerged during the interviews, which encompass natural and cultural heritage, and local products and crafts. The content consolidated into seven main topics: i) Laurisilva of Madeira (UNESCO World Heritage site) ii) Madeirans' fauna, iii) Traditional Products, iv) Hydrological Balance, v) Macaronesian Forests, vi) Invasive Species and vii) Natural Disasters.

Seven respective icons were designed to visually represent each theme. Such icons are items in a drop-down menu that expands until the end of the page (Figure 3). The seven topics guided the editing of the 7 videos with around 3 minutes each as well as the design of the Web interface. For the latter a customized template on Wordpress was created.

3.1. Content Creation

To populate the Há-Vita platform we interviewed 19 local community members. The interviewees were chosen according to their availability, expertise and local knowledge. The participants represented two different groups of journalistic sources: i)

¹ <https://www.vayable.com/>

² <https://www.citylab.com/life/2013/08/urban-buddy-turns-tourists-locals/6513/>

³ <http://www.spottedbylocals.com>

Scientists and ii) Local residents. For scientists, we asked open-ended questions regarding technical distinctions of terms such as native and endemic plants, or the causes of wildfires or floods on the island. For local residents, we posed general questions about their knowledge of, and experience with, the flora, fauna, and traditional products of Madeira. All interviewees were informed about the general project goal of instilling curiosity and empathy towards the local community values. Our questions were open-ended and reflected the journalistic style of having multiple views on the same subject.

3.2. Conceptualization of the interface

The Há-vita graphical elements for the Web and mobile interfaces were designed to highlight the connection with the seven emerging themes, several of which reflected on specific concerns related to Madeira's nature. In fact, the Há-Vita logo itself is a visual synthesis of one of the island most typical trees. Inspired by Bernoff and Li's discussion about the different levels of participation [24], we sketched three different possibilities for engagement, from more active to quite passive represented by the metaphorical "leaves" of the tree in the graphical interface (see Figure 3, top right). Those "leaves" were designed in three different shades of green. Each shade illustrates one level of participation which are as follows: 1) Dark green: Active (Get involved & Share with Há-Vita) – send us content - Share photos and stories about Madeira's nature and culture, we would love to have your contribution. 2) Mid green: Passive (Contact us about great stories) – Contact us if you have a great story about Madeira, or if you know someone who has great local knowledge. We will be very pleased to interview you or your friend. 3) Light green: Meta-storytelling (Dialogue with us) - Send us stories about our stories - Did our stories change your point of view about Madeira? Did it somehow enrich your knowledge? Share your experiences with us. These three participatory layers constitute an attempt to compose a door to the back stage acclaimed by MacCannel [15,16], opening up the possibility of tourists meeting locals and participating in their activities, fostering face to face meetings and call for actions. In fact, during the interviews, locals manifested interest in using the platform to advertise their own activities and open them up to tourists' participation. The activities mentioned by the locals ranged from planting trees to reforest the local mountains recovering from and prevent wildfires [20], learning how to make traditional drinks (poncha) with a local, or even the possibility of contacting artisans who live in rural areas around the island, such as one of our interviewees who make wicker baskets.

Moreover, specific icons were designed for each of the seven topics that emerged during the interviews (see Figure 3). The icons were carefully sketched and conceptualized from the beginning as small affordances for the nature and culture of Madeira. Icon 1 depicts the iconic tree, mentioned earlier, found in Fanal. Icon 2 depicts an endemic bird that exists only on Maderia, the well-known 'Bis-bis'. Icon 3 depicts a glass of *poncha*, a traditional Madeiran drink made of orange, lemon, honey, and rum that used to be used as a medicinal beverage. Icon 4 depicts the natural characteristic of Laurisilva to absorb water. Icon 5 shows the set of archipelagos,

which consist of what is called "Macaronesia". Icon 6 depicts how the insertion of plants from other continents may be dangerous for Madeiran ecosystem. Finally, icon 7, depicts the intimate and destructive relationship between wildfires and flashfloods, which endangers not only animal and plants species, but also put human lives at risk on the island. All icons were designed initially by hand and were improved throughout an iterative process.

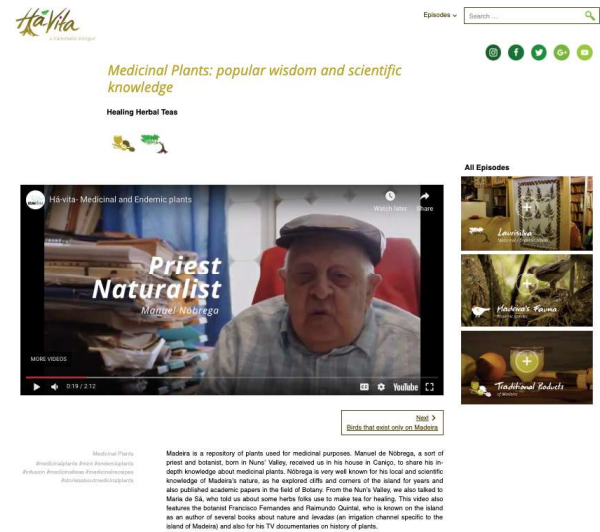


Figure 4: Screenshot of the Laurisilva web page showcasing the video interview with one of the locals.

4. METHODS

The development of Há-Vita followed a research through design approach [23] which included initial contact with the locals to draw inspiration for the design of the platform and its content, and subsequently the evaluation of the overall concept and specific design refinements and insight. As briefly mentioned in the Conceptual Design section, the design of the website and its content was drawn from the interviews of 19 local sources, collecting around 20 hours of video. Among the locals interviewed there were: handcraft artisans (4), biologists of different fields (6), geographers (1), farmers (3), tourists guides (2), historians (2) and a priest. The youngest local interviewed was 23 years old and the oldest 88. the average age of the locals was around 48 years old. After the first design iteration was completed, in order to validate the concept, we showcased the Há-Vita working prototype in well-known hotel venues. We adopted a qualitative approach by drawing on field notes, observations, questionnaires and interviews conducted with tourists visiting the island for one week or more. For this preliminary study we decided not to pre recruit users but to approach them in the natural habitat, in their habitus, in their field [25]. We are aware that this is one of the possible approaches, as, for example, Bødker & Browning [2], pre recruited users and studied tourists prior to their arrival at destination. Our choice was dictated by timing and ease of contact with local Hotels. Nevertheless Bødker & Browning approach should be considered for follow up studies.

4.1. Há-Vita study

The Há-Vita's study was conducted during the winter season of 2017/18 which corresponds to a popular touristic season in the Island. For the research we selected two hotels, one situated in the main capital and another on a smaller village in the Eastern coast of the Island. An initial pilot study prior to the study, was held in a hotel venue utilizing the setting and attendees of the Sustain IT 2017 Conference, where the project was presented as a demonstration [22]. The pilot helped us refine the evaluation protocol.

Overall the study took place over a period of one week, during the evening time from 7pm to 10 pm, as it seems the best moment to capture the tourists' attention, as they are leaving the hotel for dinner or resting in the lounge, not interfering with their daily holiday activities. The researchers were able to involve 12 participants in total, 11 from the hotel in Funchal and 1 from the eastern coast hotel. Guests of these hotels were mainly northern Europeans. The research protocol aimed to evaluate the effectiveness of the content in stimulating the user's interests, curiosity and empathy with locals and their culture. The set up was the following:

1. A table with flyers and a poster describing the project was set up at the entrance of the hotel. Two local products also feature on the table: A bottle of Madeira wine and a set of Luffa sponges. The Madeira wine and luffa sponges' producers were among the Há-Vita website interviewees.
2. As guests approached the set-up desk, two researchers introduced themselves, presented the project inviting the hotel guests to participate in the study and sign consent forms explaining principles of privacy, including anonymity of the reported data, the right to refuse, withdraw, or stop interviews, as well as security and confidentiality of the data.
3. Guests agreeing to participate in the study filled in a questionnaire about demographics (e.g., age, nationality, gender, occupation) and questions related to traveling and travel information (e.g., how many times do you usually travel abroad per year?). Then participants were offered a glass of Madeira wine and asked to browse Há-Vita website and pay attention to the content and participatory features elements.
4. Finally, participants were interviewed about content and interaction. The interview was divided into three sections: i) General content; ii) Interface and interaction; iii) Participatory features, and lasted in average about 15 minutes. Guiding questions included: a) Was there something new that you discovered about Madeira by browsing Há-Vita? Which piece of content did you find most interesting? And why? b) Notable website design issues c) Did you ever feel prompted to learn more about the content or the person featuring in the site? Did you notice any features that invite you to get involved?

We analyzed the interviews data via inductive thematic analysis which is a process of coding the data without trying to fit it into a pre-existing coding frame[5]. Transcripts were read several times to find patterns within the data. It is also worth noting that the highlighted themes and findings do not express necessarily

prevalence in the data. Rather, we follow who suggest that the centrality of a theme is not necessarily dependent on quantifiable measures but rather on whether it captures something important in relation to the overall research question [13]. Finally, we highlight and discuss data that we found relevant to our main research issues, which related to the interactive platform and its content as means to create interest and empathy, connecting tourists with locals and their issues. Findings are presented and discussed in the next section.

5. FINDINGS

In the following section we describe the findings resulting from the thematic analysis of the data collected from all three sources: observations, interviews and questionnaires. From the data we derived categories which are reflected in the subsections titles.

5.1. Participants and travel behavior

Six participants responded the questionnaire, from which there were two couples (husband and wife) and two males participants. Except one participant, who was from Germany, the rest were from England (Darlington, Wigan, Liverpool, Hereford, and Hereford). The participants age averaged 66.2 (s=10.3). Regarding their travel behavior, in general, four people travel three times a year, one person travels two times a year, and another one just once per year. Most of the participants have one main source of information that they utilize before travelling and that serves for tourism purposes. Their main source is an official website of the place of destination, followed by newspapers, friends/relatives, and travel guide books. None of the interviewees consult travel blogs to access this sort of information. Regarding interaction with locals, four said they try to interact with locals to learn more about the place they are visiting, while two said that they try to do it "only sometimes". All respondents said they try to contact locals during the traveling. Most respondents said that when interacting with locals, they look for recommendations (n=5), or practical information (n=4), nature topics (n=1), and other (the participant added fishing). At the time of the study, half of the participants had already interacted with locals while the other half did not. Most said they would like to learn something specific from locals, several mentioned that they would like to learn about culture/traditions (n=6), others about nature (n=2) and history (n=4). Out of six, five people said they would not mind being contacted about further questions after returning home, and thus they left email contact or telephone.

Authenticity (tourist vs a traveler)

Three participants were aware about the difference of being a traveler and a tourist, while the other two were not. Interestingly enough, out of those three who were aware, two said they are tourists rather than travelers. In their words: "1: a tourist comes to holiday, as a relaxing journey, obviously you are tourist, but we would like to be a traveler if we had more time, you understand... nothing, it is interesting, sometimes you just need holidays to rest, if you are working... 2: No, we are tourists, I'd like to be a traveler (laughing out loud), Yes, no. I am tourist among other tourists..."

However, a British female profusely reacted to the question by saying: “I don’t like tourists (laughing)”, and then explained why she thinks she is a traveler: “... *(I think of myself as a) visitor rather than tourist... I think a tourist comes in, don’t add anything to where they are going... just do their own thing, just don’t add anything whatsoever... just eat the local food in the hotel, they don’t participate, go the beach and then go home... to me that is a tourist, but a visitor has a taste of where they are going, and a traveler, and you are going, you speak to the locals, you go to local areas, you don’t buy all the knick-knack things, a tourist and a traveler are completely different things, a visitor is much nicer... they speak to locals, they try the local language, they try to get a flavor...*”

This participant said she tries to escape being a tourist by using local transport and to do what locals do as much as possible.

5.2. Reactions to the Há-Vita platform

Learning about Madeira: Before and During traveling

Users highlighted different modalities of consuming Há-Vita story content. A participant found impactful to access Há-Vita after having been out in the field. She found Há-Vita useful in accessing in-depth knowledge about things that she had tried or seen first-hand, but not captured in full depth or complexity during the field trip. The Danish female participant had been on a Levada walk and had tried the poncha local drink during the day. However, she explains, she did not understand what the drink was made of and how. By browsing Há-Vita she had the chance to see a local explaining the composition and history of the drink. She also enjoyed learning about the endemic birds as a way to “catch up” with information after having been out in the field. On the other hand, a British male participant, suggested he’d like to access this kind of information before traveling to Madeira, as it is hard, to rely only on tour guides’ information. He said: “*if anybody who comes to Madeira and who are interested in the place, I am sure, the hotel, if they got this on the website, have that, people could actually see before they come, they would realize what this is about, something like this, if placed on the tourism website...*”

In this participant’s opinion, Há-Vita may serve as an introductory digital venue for Madeira’s tourists. He suggested: “it would be interesting if you could put this channel in the internal televisions [of hotels] ... so people [hotel guests] could watch [it]”. When asked if they (him and his wife) think people would really watch it, he said: “*they would, a lot of people have been to Madeira, and they come for the same reason we have come for, to see the sea, to see different foods, this is quite unique sort of place, I am sure people will be interested in that sort of thing, and look at that TV instead of watching all these channels they put in, like Sky news... when they put the TV on, because there are no English channels...*”

Overall, participants highlighted two main ways of accessing Há-Vita, before and during the traveling, bringing up to relevance Bødker & Browning approach of probing tourists before reaching the destination [2]. Interesting to note that the need of reflecting, remembering or satisfying curiosities and eventually accessing Há-Vita after returning home, was not brought up by any participants. However, all participants found that in order to have a

comprehensive understanding of the website they would need to spend more time with it (more than what was spent during the evaluation protocol) and preferably access it on their own devices. In summary, participants appreciated consulting Há-Vita before and /or after their outings in the city and through the island. Both modalities contributed to satisfying some of their needs, weather lack or clarification of conflicting information or curiosities. Users even suggested having the site as an internal channel for the hotel guests, but no one spontaneously mentioned the use of Há-Vita after the trip, to remember things, reflect or satisfy curiosities.

New knowledge, discovery and empathy building

Há-Vita generated new knowledge in several participants, in particular on the theme of nature and “Natural disasters”. While a few participants skipped the subject, specifically choosing not to watch the related video interview, others were surprised by the existence of such issues in Madeira. These natural calamities are not mentioned by the marketing and travel destination agents. When asked about what he learned from Há-Vita that he would share with somebody else, a 70-year-old British male returning to Madeira for the fifth time mentioned: “*...probably about the natural disasters, yes, because that was new to me. I just assumed that Madeira was an island where everything was more or less perfect. That’s what it seems from the outside. Ah yes, but you don’t realize, I mean (in) a small island like this, natural disasters do happen and then people do suffer because of it. Yes, so yeah, most definitely.*”

This respondent added that he felt empathy toward those who had suffered through those disasters, either three years ago or hundred years. A British female participant, a returning visitor to the island, was not aware about the Laurisilva forest and was quite astonished about it. She was also keen about the idea of learning about medicinal remedies directly from locals. Overall, she realized that there is more to see on the island, “*there is more to it than Funchal (laughing)*”, “*there is more in the middle*” as she puts it. Along with this participant, another British female found the use of medicinal plants quite striking. As she said: “*some of the items, the plants I did not realize, there was such a diversity on the island of very much like we have in England, they have been used for centuries, you know they have been registered they can be used for antibiotics, things like that because it is such a remote island, you don’t expect that... so yes...*”

Along these lines, several other participants found new knowledge in learning about the vast variety of endemic birds, which they were not aware of.

In summary, Há-Vita was successful in providing new knowledge even for returning visitors, creating empathy through exposing natural features of the island, from the Laurisilva UNESCO protected heritage, its endemic plants, and rare birds, as well as the natural calamities which can cause harm to the island environment and its inhabitants. For some visitors the image of Madeira as a perfect place was lost, against the efforts of the tourists’ agents; on the other hand, empathy towards the locals reality was found, to the benefit of local residents and community. Moreover, empathy towards the local inhabitants was expressed across time: for recent natural disasters as well as for events that troubled the local

community centuries ago. Overall Há-Vita succeeded in promoting interest and curiosity beyond the already known facts: *“There is more in the middle”*, a visitor mentioned after browsing Há-Vita platform, as the middle being an undistinguished region, outside the known and safe, none the less worth adventuring.

Local tacit knowledge vs scientific knowledge

Participants found the Há-Vita platform and its content relevant for different reasons. Some users mostly appreciated the scientific content directly narrated from the local scientists, others enjoyed content coming from ordinary local community members, embedded with local knowledge and traditions. A British male and his wife, visiting Madeira for the fourth time, mentioned that tour guides sometimes provide contradictory explanations about the same phenomena, such as the origin of the Levadas (channels of irrigations that in time became hiking trails). In this regard, he said, the website is fulfilling because it enables them to access information coming directly from expert sources. A Danish female enjoyed listening to locals talking about their own culture and daily life. This one participant found more authentic and engaging to have content and interviews like the video about “traditional products”, in which a middle age woman from “Curral das Freiras” (Nun’s Valley) talks about the origin of the poncha regional drink. In her words: *“Actually, I really like her (referring to a local talking about the traditional Poncha drink), she is really authentic, she is not a Professor, she is like cooking mom, or whatever, so I like, that is what you asked before, authentic, I think, she was like, I could meet her out in the street, and she would just talk to me like this... so I think it is her...”*

In summary, the preference expressed by the users through the distinction between content provided by ordinary local residents and expert scientists point out at how visitors can be drawn to authenticity in different ways, through the reliability of scientific information on one had but also through the connection to real authentic people they can recognize as familiar or mundane. This finding supports our initial varied choice of topics and kinds of content and encourages us to continue to populate the platform with a wide variety of stories, as visitors have different values and motives to browse the site, and different types of content stimulate curiosity and empathy in different people.

We also asked the participants to pinpoint gaps in the content we had collected, and if there was anything they would like to know more about. Some participants said that missed more information about traditional products. One of them, while she was watching the video under the theme “Traditional products”, she cried spontaneously: traditional products “implied wide range” of products, while the video “was just about poncha!” This participant in the study wanted to know more about other local products and how they evolved through time.

There was also a general interest in learning more about the history of Madeira, and the impact of tourism on the island’ economy and its inhabitants. In the words of one of the participants: *“Eh, yeah, I think that I like to know more about the history of the island, I mean we’ve been coming here quite a lot, nine or ten years, umm and, you come on holiday and you leave two/three weeks later.”*

A German participant and his spouse lamented that the lack of clarity of Há-Vita’s message: *“As a tourist I can see there are some interesting videos, but it doesn’t become clear what it is the sense of it, what you want to tell me...”*

When asked to explain better what he was missing he said: *“if I go to the webpage it must be clear in two seconds what the webpage wants to say to me, yeah... What information I can get there, that was missing for me...”*

Summarizing the findings in relation to the shortcomings of the Há-Vita platform, we may say that some participants lamented lack of specific and in-depth information about some topics. Several participants would have like to know more, about local products, local history and economy. From a positive side, this reaction could be interpreted as Há-Vita being able to generate curiosity and sustained interested towards local issues. Moreover, some participants complained about the lack of an operational presentation of that content. What should they do with the information acquired through the site? Why should they know those things? These comments invite us to consider how to further foster action and interaction through the platform. Moreover, some non-Portuguese speaking participant considered “Há-Vita” a difficult name to engage and remember.

Participatory media (prospects of willingness to interact with locals)

Regarding the potential to interact with locals through the platforms (Details of the interface in Figure 3), participants found the idea innovative and relevant to their stay in Madeira, and thus had a positive reaction to the idea presented for them.

When asked if they could imagine any sort of activity or interaction, a few respondents outlined some scenarios as quoted below: *“Something could be about the weather, the best places to go during the time of the year, it is not so much about the tourism, about to finding about locals, what they are doing, maybe there are traditional festival going on, you know maybe in little they have something very special...”*

Similarly, in the words of another user: *“...rather than a tour guide, somebody who knows it, the world is not perfect, the city where I live, to get more hopefully you have people who are good at it...”*

In the words of these participants we find resonance with MacCannell Authenticity framework (19). Tourists are looking forward to connecting with locals to ensure a more authentic and satisfactory experience of the place. The desire of the visitors to connect to locals is met by the locals and manifested through the intention of using the platform to advertise their own activities and open them up to tourists’ participation.

6. DISCUSSION

In relation to our goal of raising awareness about local values and issues, our findings suggest that the content provided in Há-Vita does bring some level of awareness and newness about what the island has to offers. Along with this, our questionnaire data also shows that tourists mostly access official websites and thus are not aware about certain problems and local issues, as usually official tourism website portray tourism destinations as pristine places. One

participant said that he thought Madeira was somewhat perfect. The Ha-Vita content about the island's natural disasters, provoked surprise and empathy towards the local community in this participant. On the other hand, we have noticed that another participant skipped the theme "Natural disasters" on purpose, saying out loud: "Oh, natural disasters! Not this one". This dual outcome of avoidance and surprise is quite complex to unpack without further in-depth user studies. But in general, we do argue that having this type of content is important for bringing awareness and popping the tourist bubble, building up a tunnel for the authentic back region [15,16]. However, changing the tourist fantasy of being in a paradisiac place close to heaven and thus perfection may be seen by some local stakeholders a mean to scare away visitors from the island. This issue does bring us the question: do local stakeholders in the business of tourism prefer staged authenticity rather than involving tourists with local issues? This is a question that researchers could explore in future studies. We have noticed in our ongoing research that this question is a relevant one that needs further exploration. On the other hand, as MacCannel [15,16] points out, not all tourists are in pursuit of authenticity. Nevertheless, making them care and empathise with the locality they are visiting is an ethical concern that should be always at the forefront of any touristic activity or industry.

Referring to gaps in the website content, our findings also suggest that participants of this study, returning to the island, are willing to delve into the traditions and history of Madeira. Here, it is relevant to refer to the fact that Madeira is a tourism destination favored by visitors over 55-years old [9] and the age range of our participants is quite high. Some of them come to Madeira looking to rest and relax rather than expecting active outings or climbing the hiking trails of the island. On this note, while we see a challenge to instill awareness in this group age, we see an opportunity to invest in authenticity and provide them with activities that are tailored for their needs and desires, possibly avoiding peak and rush hours for their activities, proposing more relaxed activities, like for example storytelling sessions and exchanges with locals. The participatory aspect of the website in fact was well received and thus our strategy of fostering interaction with locals make sense to them.

6.1. Methodological Challenges

Moyle et al. [17] call for the inclusion of the visitors' perspective in studies about interaction between locals and visitors in touristic islands. In trying to address this gap, we have encountered several challenges in finding strategies to reach tourists and engage them in evaluation and interviews processes. Tourists are transient individuals, visiting destinations for limited time which they use wisely. Reflecting on our study, we highlight some of the barriers we have found in applying our methodology: a) Time - the visitors are on holiday or tourist's mode; hence time is wisely spent, participating in a research study is not a priority. Pressure to get through the study is often an issue; b) Space (and the people it hosts) - What is the most suitable and strategic space to conduct user studies with tourists? Informed by urban theories, we are aware that the space where this research protocol is eventually applied may affect the results of our study due to the social

production of space. While partnering with hotels seems a logic step, the kind of hotel and types of guests it attracts needs to be carefully considered. A hostel will have different minded people than a 5 stars resort. The typology of visitors involved will affect the results of the study; c) Partnering with hotels and the suitable content to showcase - Informed by urban theories [14], we are aware that the space may affect the results of our study due to the social production of space. On this note, one of the entities which accepted to host our research team for a day or two have warned us about the content of our website, namely the natural disasters, by implying that could be damage for the touristic image of Madeira. On the other hand, by going to hotels, we have seen also an opportunity to provide them with fresh content and a novel digital platform. In one of the hotels where we have run the user study, we noticed the guests spent more than an hour watching an outdated documentary. Based on that observation, we were left wondering if the hotel plays a role in conducting the guests through these channels of information. In this sense, one of the lessons we have learned is that in order to disseminate this type of interactive platform (such as Ha-Vita), it is key to partner with hotels, local tourism board and agencies and conduct longitudinal studies, which requires a great amount of time and human endeavor. However, an interesting approach, is Bødker & Browning [2] which used a single case study, staging an encounter between a young American visiting Denmark and a group of four locals in Copenhagen. Participants were equipped with an egocentric point of view (EgoPOV) camera and collected video data to analyze while visiting the city.

6.2. Future Work

In general, this preliminary study highlighted how the Há-Vita platform was overall well-received, successful in supporting connection and empathy building across locals and visitors, curiosity and knowledge even for returning visitors. Moreover, visitors to the island have a variety of interests and preferred approaches to the local culture and nature, encouraging us to continue to collect and present a wide variety of stories about the cultural and natural heritage of the island. Participatory features were well accepted, confirming Há-Vita design as a valid mean of sharing and encouraging further connections with locals. More information about history of the island, its local products, facts about its economy and impact of tourism on the archipelago were desired topics that could be further explored in the website. Observations from one visitor in particular made us reflect on the clarity of the Há-Vita intent and choice of local language for the title of the site. Further studies and concept validation session will be necessary to disambiguate some of the issues raised in this fruitful initial exploratory study. Finally, the study highlighted the methodological challenges of studying tourists while on holiday. This was a main challenge with the project which could benefit from a larger sample of participants that we are planning to deploy in the next months. Nevertheless, we believe that reporting our challenges could help other researchers develop quantitative studies with tourists in other contexts.

7. Conclusions

In this paper, we provided a description and reflections on the preliminary design and evaluation of Há-Vita, an online digital platform aimed at fostering connection and empathy among visitors and locals of a touristic island. Although the sample of users is small, this work makes specific contributions. First, it provides initial encouraging signs that Há-Vita can be a successful tool in connecting visitors of Madeira to their local community and issues. Secondly, attending Moyle et al' call [17], our study adds the perspective of visitors in the interaction between locals and visitors. The study highlights initial barriers and strategies of undertaking user studies with tourists, a discussion that may inform future studies concerned with tourism. Regarding future developments, at the time of writing, we have been conducting further studies in the form of focus groups with locals' holders of local knowledge, as well as tourism operators. Our goal is to evolve the platform according to the locals needs and developed further prototypes incorporating more highly participatory features.

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REFERENCES

1. C. P. Barros and L. P. Machado. 2010. The length of stay in tourism. *Annals of Tourism Research* 37, 3: 692–706.
2. Mads Bodker and David Browning. Tourism Sociabilities and Place: Challenges and Opportunities for Design. *International Journal of Design*. Retrieved April 15, 2019 from <http://www.ijdesign.org/index.php/IJDesign/article/view/1181/580>
3. Jin Young Chung. 2017. Online friendships in a hospitality exchange network: a sharing economy perspective. *International Journal of Contemporary Hospitality Management* 29, 12: 3177–3190. <https://doi.org/10.1108/IJCHM-08-2016-0475>
4. Jin Young Chung, Dimitrios Buhalis, and James F Petrick. The Use of Social Network Analysis to Examine the Interactions between Locals and Tourists in an Online Community. 9.
5. Victoria Clarke and Virginia Braun. 2013. Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The psychologist* 26, 2: 120–123.
6. Alain Decrop, Giacomo Del Chiappa, Jérôme Mallargé, and Pietro Zidda. 2018. " Couchsurfing has made me a better person and the world a better place": the transformative power of collaborative tourism experiences. *Journal of Travel & Tourism Marketing* 35, 1: 57–72. <https://doi.org/10.1080/10548408.2017.1307159>
7. Mara Dionisio, Valentina Nisi, Nuno Jardim Nunes, and Paulo Bala. 2016. Transmedia Storytelling for Exposing Natural Capital and Promoting Ecotourism. In *Interactive Storytelling: 9th International Conference on Interactive Digital Storytelling, ICIDS 2016, Los Angeles, CA, USA, November 15–18, 2016, Proceedings*, 351–362. https://doi.org/10.1007/978-3-319-48279-8_31
8. Mara Dionisio, Valentina Nisi, and Jos P Van Leeuwen. 2010. The iLand of Madeira location aware multimedia stories. In *Joint International Conference on Interactive Digital Storytelling*, 147–152.
9. Direção Regional de and Estatística da Madeira.- Funchal: D.R.E.M., 2003. 2016. *ESTATÍSTICAS DO TURISMO DA REGIÃO AUTÓNOMA DA MADEIRA*. Retrieved May 11, 2017 from <https://estatistica.madeira.gov.pt/download-now-3/economic/turismo-gb/turismo-publicacoes-gb/finish/270-publicacoes/5962-turismo-2015.html>
10. Europäische Kommission (ed.). 2012. *The outermost regions: European regions of assets and opportunities*. Publ. Off. of the Europ. Union, Luxembourg.
11. Erving Goffman. 2002. The presentation of self in everyday life. 1959. *Garden City, NY*.
12. Caroline Haythornthwaite. 2002. Strong, Weak, and Latent Ties and the Impact of New Media. *The Information Society* 18, 5: 385–401. <https://doi.org/10.1080/01972240290108195>
13. Mostafa Javadi and Koroush Zarea. 2016. Understanding thematic analysis and its pitfall. *Journal of Client Care* 1, 1: 33–39.
14. Henri Lefebvre and Donald Nicholson-Smith. 2011. *The production of space*. Blackwell, Malden, Mass.
15. Dean MacCannell. 1973. Staged authenticity: Arrangements of social space in tourist settings. *American journal of Sociology* 79, 3: 589–603.
16. Dean MacCannell. 1976. *The Tourist: A New Theory of the Leisure Class*. University of California Press.
17. Brent Moyle, Betty Weiler, and Glen Croy. 2010. Tourism interaction on islands: the community and visitor social exchange. *International Journal of Culture, Tourism and Hospitality Research* 4, 2: 96–107. <https://doi.org/10.1108/17506181011045172>
18. Valentina Nisi, Mara Dionisio, Claudia Silva, Deborah Castro, Dina Dionisio, Marko Radeta, Paulo Bala, and Nuno Jardim Nunes. 2016. "Echoes of Nature": a transmedia project to foster dialogue about the natural capital of Madeira island. In *Workshop on Exploring New Approaches to Narrative Modeling and Authoring, ICIDS 2016, Los Angeles, CA, USA, November 15–18, 2016, Proceedings*, 3–11.
19. Valentina Nisi and Mads Haahr. 2006. Weird view: interactive multilinear narratives and real-life community stories. *Crossings* 2: 27.
20. Valentina Nisi, Nuno Jardim Nunes, Filipe Quintal, and Mary Barreto. 2013. *SINAIAS from Fanal: design and evaluation of an art-inspired eco-feedback system*. ACM, New York, NY, USA. <https://doi.org/10.1145/2499149.2499151>
21. Tom van Nuenen. 2016. The production of locality on peer-to-peer platforms. *Cogent Social Sciences* 2, 1: 1215780. <https://doi.org/10.1080/23311886.2016.1215780>
22. C. Silva, A. Bettencourt, M. Dionisio, D. Castro, D. Dionisio, D. Teixeira, and V. Nisi. 2017. Há-Vita: A transmedia platform about Madeira's nature and culture. In *2017 Sustainable Internet and ICT for Sustainability (SustainIT)*, 1–2. <https://doi.org/10.23919/SustainIT.2017.8379813>
23. John Zimmerman, Jodi Forlizzi, and Shelley Evenson. 2007. Research through design as a method for interaction design research in HCI. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, 493–502. Retrieved July 26, 2017 from <http://dl.acm.org/citation.cfm?id=1240704>
24. Groundswell – Winning in a World Transformed by Social Technologies. Charlene Li and Josh Bernoff, Harvard Business Press, 2009. ISBN-13: 978-1422125007. - Butler - 2012 - Psychology & Marketing - Wiley Online Library. Retrieved April 15, 2019 from <https://onlinelibrary.wiley.com/doi/abs/10.1002/mar.20503>
25. Bourdieu, Epistemology and Research Practice. Retrieved April 15, 2019 from <http://www.leeds.ac.uk/educol/documents/000000135.htm>

Appendix F. FoL Posters

Have an unique Experience
& see the difference!

Fragments of Laura
A transmedia experience
about Madeira's Nature and Heritage!

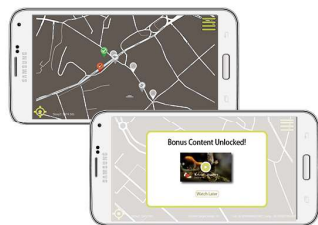


@ Funchal City Center



Are you up to have fun while gaining knowledge about Madeira?

Embark on a transmedia experience that mixes history, fiction, video interviews, and real world locations!



Mobile Tour



Website



Hey! Visiting Madeira?

Want to have fun while
gaining knowledge about Madeira?

Bring a friend and explore
the hidden secrets of Funchal!!



Fragments of Laura

A transmedia experience
about Madeira's
Nature & Heritage



7 locations



1 hour

@ Funchal City Center

Embark on a transmedia experience that mixes history,
fiction, video interviews, and real world locations!



Scan here and sign up!

Questions? or more info?

fragmentsoflaura@m-iti.org



4 Simple Steps



1. Schedule

Book your urban adventure online & receive an email with all the details. Don't Forget to check your spam or promotions folder.



2. Meet Us

One element of our team will meet you at the starting point to kick off the tour.



3. Enjoy the Tour

Go around the historical area of Funchal and uncover the hidden traces of Laura's Story.



4. Re-connect

Come back to the website and discover more about Madeira and it's hidden local values!

With **Fragments of Laura**, you will have a chance to satisfy your curiosity about **hidden stories** in the architecture of Funchal, the capital of Madeira. You will be guided by the fictional tale of **Laura Silva**, an adventurous Madeiran girl who discovered many secrets of Madeira's natural heritage.

How can I schedule my tour?

Visit: <https://form.jotformeu.com/90853695858376>

Or

Send mail to: fragmentsoflaura@m iti.org

Or



Scan the code!!



A Transmedia Experience

Fragments of Laura is a mobile app that gives users a chance to learn about seven specific locations through **location-based storytelling**.

Each location is embedded with digital content that unlocks pieces about Laura Silva's life! These fragments can be multimedia videos, gossips or interactive virtual reality scenes!



✉ fragmentsoflaura@m-iti.org



Appendix G. FoL Evaluation Questionnaires

Fragments Of Laura Tour

Thank you for taking part in this study. Your opinion is very important to us!
Could you please fill in this questionnaire based on the tour you have just completed.

***Required**

1. Name&SessionID *

The Session ID is on the back of the phone that you just used for the tour; If you shared a phone, each of you should pick a different ID :)

Overall Fragments of Laura (FOL) Experience

Reflect on the overall experience (story and walking tour)

2. Compared to other experiences which I participated in, this one was *

Mark only one oval.

	1	2	3	4	5	6	7	
Easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Difficult

3. For me personally the demands of this experience were *

Mark only one oval.

	1	2	3	4	5	6	7	
Too low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Too high

4. The experience enabled me to learn about the Madeira Heritage *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	A lot

5. I lost myself in this experience *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

6. The time I spend in FOL tour just slipped away *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

7. I was absorbed in this experience *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

8. I felt frustrated while doing this tour *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

9. I found FOL application confusing to me *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

10. Using this application was demanding *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

11. This FOL application was attractive *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

12. The FOL application was aesthetically appealing *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

13. The FOL application appealed to my senses *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

14. Using FOL application was worthwhile *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

15. My experience was rewarding *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

16. I felt interested in this experience *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

17. In general would you say the duration of the experience was: *

Mark only one oval.

	1	2	3	4	5	6	7	
Too long	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Too short

18. How aware were you of the real world surrounding while using the application (i.e. sounds, other people, etc.)? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not aware at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremely aware

Fragments of Laura Story

As you answer please reflect on the story that you just saw.

19. While watching the video narratives I had a sense of "being there". *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

20. While I was using the application, I could easily picture the events in it taking place. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

21. While I was using the application, activity going on in the space around me was on my mind. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

22. I could picture myself in the scene of the events described in application. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

23. I was mentally involved in the story while watching it.

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

24. After the story ended, I found it easy to put it out of my mind. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

25. I wanted to learn how the narrative ended. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

26. The video narrative affected me emotionally. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

27. I found myself thinking of ways the video narrative could have turned out differently.

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

28. I found my mind wandering while watching the video narrative. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

29. The events in the video narrative are relevant to my everyday life.

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

30. The events in the video narrative have changed my life. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

Madeira
Island

You are going to read several statements about Madeira Island and Culture. Not everyone heard about some of these. If you haven't heard about them, feel free to tell us so.

31. Madeira is of volcanic origin. *

Mark only one oval.

- True
- False
- Don't know for sure.

32. Cabo Girão is the highest cliff in the world. *

Mark only one oval.

- True
 False
 Don't know for sure.

33. The most common elements that can harm Madeira's environment are volcanic eruptions and wildfires. *

Mark only one oval.

- True
 False
 Don't know for sure.

34. Laurisilva is a forest that only exist in Madeira island. *

Mark only one oval.

- True
 False
 Don't know for sure.

35. Coalmen ("carvoeiros") had an important role preserving endemic trees. *

Mark only one oval.

- True
 False
 Don't know for sure.

36. Laurisilva refers to plant communities that only resembles the bay laurel. *

Mark only one oval.

- True
 False
 Don't know for sure.

37. The existence of invasive species increase the risk of wildfires. *

Mark only one oval.

- True
 False
 Don't know for sure.

38. To reduce the destructive effects of floods, it is necessary to reforest the primitive flora. *

Mark only one oval.

- True
 False
 Don't know for sure.

39. All exotic species become invasive. *

Mark only one oval.

- True
 False
 Don't know for sure.

40. When fishermen went for long fishing trips they used to make poncha. *

Mark only one oval.

- True
 False
 Don't know for sure.

41. "Aguardente" is made from Sugarcane. *

Mark only one oval.

- True
 False
 Don't know for sure.

42. The Botanical Garden is full of invasive species. *

Mark only one oval.

- True
 False
 Don't know for sure.

43. Wildfires happen mainly in the Laurisilva forest. *

Mark only one oval.

- True
 False
 Don't know for sure.

44. Laurisilva performs an important role by collecting the water from the mists. *

Mark only one oval.

- True
- False
- Don't know for sure.

45. The Firecrest (Bis-bis) is an endemic bird that only lives near the city. *

Mark only one oval.

- True
- False
- Don't know for sure.

46. We can find healing properties in endemic flora from Laurisilva. *

Mark only one oval.

- True
- False
- Don't know for sure.

47. Thank you! Please leave your email in case we need to clarify some information:

*

This content is neither created nor endorsed by Google.

Google Forms

Questionnaire Fragments of Laura

Thank you for accepting to take part in this study.

Please fill in this questionnaire with some data about yourself.

*** Required**

1. Name/ID *

The Session ID is on the back of the phone that you just used for the tour; If you shared a phone, each of you should pick a different ID :)

2. Gender *

Check all that apply.

Female

Male

3. Please indicate your age range: *

Mark only one oval.

18-24

25-34

35-44

45-54

55-64

65-74

75 years or older

4. Where do you currently live? (city, country) *

5. Which is your native language? *

6. Please indicate your experience with smartphones: *

Mark only one oval.

- Low
- Average
- High

7. Experience with applications of this kind (location based tour) : *

Mark only one oval.

- Low
- Average
- High

8. When you travel, do you try to interact with locals to learn more about the place you are visiting? *

Mark only one oval.

- Yes
- No
- Only sometimes

9. Would you consider yourself a : *

Mark only one oval.

- Tourist
- Traveler
- Is there in difference?

10. For how long have you been in Madeira? *

Mark only one oval.

- Less than 2 days
- 2-3 days
- 4- 5 days
- 1 week
- 2-3 weeks
- More than 1 month

11. What is the full duration of your stay in Madeira? *

Mark only one oval.

- Less than 2 days
- 2-3 days
- 4- 5 days
- 1 week
- 2-3 weeks
- More than 1 month

**Madeira
Island**

You are going to read several statements about Madeira Island and Culture. Not everyone heard about some of these. If you haven't heard about them, feel free to tell us so.

12. Madeira is of volcanic origin. *

Mark only one oval.

- True
- False
- Don't know for sure

13. Cabo Girão is the highest cliff in the world. *

Mark only one oval.

- True
 False
 Don't know for sure

14. The most common elements that can harm Madeira's environment are volcanic eruptions and wildfires. *

Mark only one oval.

- True
 False
 Don't know for sure

15. Laurisilva is a forest that only exist in Madeira island. *

Mark only one oval.

- True
 False
 Don't know for sure

16. Coalmen ("carvoeiros") had an important role preserving endemic trees. *

Mark only one oval.

- True
 False
 Don't know for sure

17. Laurisilva refer to plant communities that only resembles the bay laurel. *

Mark only one oval.

- True
 False
 Don't know for sure

18. The existence of invasive species increase the risk of wildfires. *

Mark only one oval.

- True
 False
 Don't know for sure

19. To reduce the destructive effects of floods, it is necessary to reforest the primitive flora. *

Mark only one oval.

- True
 False
 Don't know for sure

20. All exotic species become invasive. *

Mark only one oval.

- True
 False
 Don't know for sure

21. The Botanical Garden is full of invasive species. *

Mark only one oval.

- True
 False
 Don't know for sure

22. Wildfires happen mainly in the Laurisilva forest. *

Mark only one oval.

- True
 False
 Don't know for sure

23. Laurisilva performs an important role by collecting the water from the mists. *

Mark only one oval.

- True
 False
 Don't know for sure

24. The Firecrest (Bis-bis) is an endemic bird that only lives near the city. *

Mark only one oval.

- True
 False
 Don't know for sure

25. We can find healing properties in endemic flora from Laurisilva. *

Mark only one oval.

- True
- False
- Don't know for sure

26. When fishermen went for long fishing trips they used to make poncha. *

Mark only one oval.

- True
- False
- Don't know for sure

27. "Aguardente" is made from Sugarcane. *

Mark only one oval.

- True
- False
- Don't know for sure

This content is neither created nor endorsed by Google.

Google Forms

PostWeb-Questionnaire: Fragments Of Laura Overall

Thank you for taking part in this study.

This questionnaire has a first section based on the web platform you just watched.

And a section that asks you to reflect on the overall experience (Mobile + Website)

*** Required**

1. Name&SessionID *

The session ID is on the received email that invited you to visit the website

2. Can you please identify the videos that you just visualize on the Website *

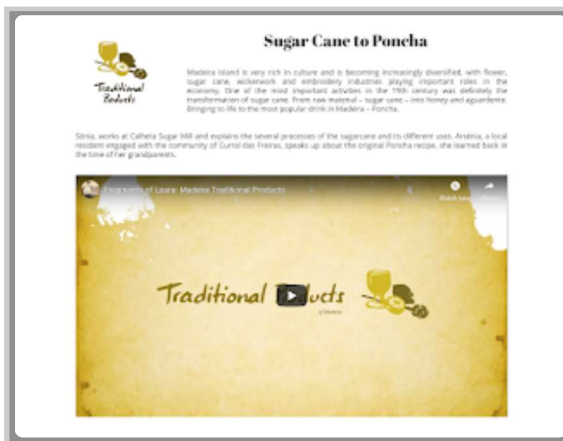
Check all that apply.



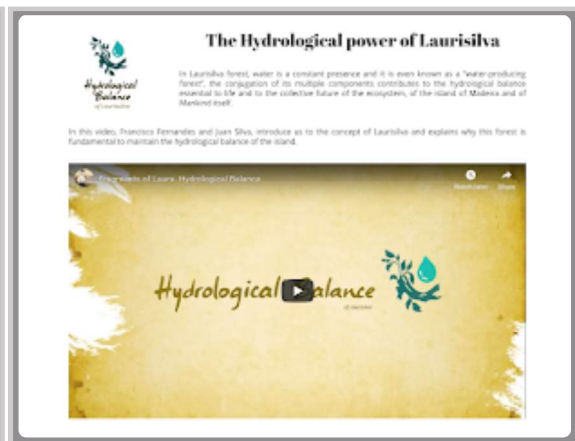
Medicinal Plants: popular wisdom and scientific knowledge



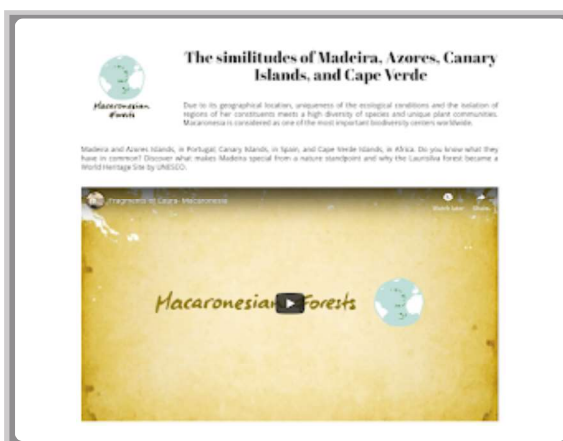
Birds that exist only on Madeira



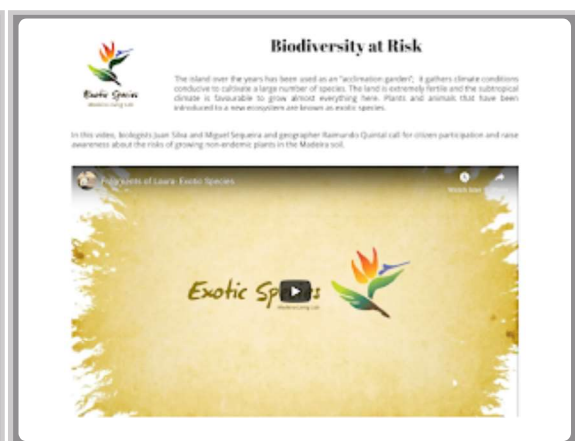
Sugar Cane to Poncha



The hydrological power of Laurisilva Forest



The similitudes of Madeira, Azores, Canary Islands and Cape Verde



Biodiversity is at risk with invasive plants

Other: _____





Wildfires and Floods: Two Sides of the Same Coin

Fragments of Laura Website experience

On this section reflect on the Fragments of Laura website experience

3. I felt involved while interacting in the website *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

4. It was rewarding *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

5. This was fun *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

6. The Fragments of Laura website was visually pleasing *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

7. The visualization of the web platform was worthwhile *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

8. The web platform was aesthetically appealing *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

9. I will continue to explore the topics of Fragments of Laura out of curiosity *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Overall Experience

Reflect on the overall experience (Mobile + Website)

10. I was thrilled about having this new experience *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

11. I really enjoyed the Fragments of Laura Experience *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

12. I had an exciting experience with Fragments of Laura *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

13. With Fragments of Laura I had a good impression about the local culture *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

14. With Fragments of Laura I had a chance to closely experience the local culture *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

15. The locals in Fragments of Laura were friendly to me *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

16. I had a refreshing experience *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

17. I felt that I did something meaningful *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

18. I felt that I did something important *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

19. I visited a place that I really wanted to visit *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

20. I was interested in the main activities offered *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

21. I gained a lot of information during the experience *

Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

22. I experienced a new culture *

Mark only one oval.

1 2 3 4 5 6 7

Strongly Disagree Strongly Agree

23. 1-The content of the Fragments of Laura experience incited my curiosity. *

Mark only one oval.

1 2 3 4 5

Strongly Disagree Strongly Agree

24. I will recommend Fragments of Laura Transmedia experience to my family and friends if they visit the island. *

Mark only one oval.

1 2 3 4 5

Strongly Disagree Strongly Agree

User Experience

On this section please reflect on the overall experience, the mobile tour in combination with the website.

25. Compared to other experiences which I participated in, this one was *

Mark only one oval.

1 2 3 4 5 6 7

Easy Difficult

26. For me personally, the demands of this experience were *

Mark only one oval.

	1	2	3	4	5	6	7	
Too low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Too high

27. The experience enabled me to learn about the Madeira Local Values (nature, culture, traditions) *

Mark only one oval.

	1	2	3	4	5	6	7	
Completely Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely Agree

28. With the help of word-pairs please enter what you consider the most appropriate description for Fragments of Laura. *

Mark only one oval.

	1	2	3	4	5	6	7	
Clear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Confusing

29. *

Mark only one oval.

	1	2	3	4	5	6	7	
Inefficient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Efficient

30. *

Mark only one oval.

	1	2	3	4	5	6	7	
Complicated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Easy

31. *

Mark only one oval.

	1	2	3	4	5	6	7	
Obstructive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Supportive

32. *

Mark only one oval.

	1	2	3	4	5	6	7	
Boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Exiting

33. *

Mark only one oval.

	1	2	3	4	5	6	7	
Not interesting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Interesting

34. *

Mark only one oval.

	1	2	3	4	5	6	7	
Conventional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Inventive

35. *

Mark only one oval.

	1	2	3	4	5	6	7	
Usual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Leading edge

Madeira Questions

You are going to read several statements about Madeira Island and Culture. Tell us if they are true or false based on what you learn in Fragments of Laura

36. Madeira is of volcanic origin. *

Mark only one oval. True False

37. The most common elements that can harm Madeira's environment are volcanic eruptions and wildfires. *

Mark only one oval. True False

38. Laurisilva is a forest that only exists in Madeira island. *

Mark only one oval.

True

False

39. Coalmen ("carvoeiros") had an important role in preserving endemic trees. *

Mark only one oval.

True

False

40. Laurisilva refers to plant communities that only resembles the bay laurel. *

Mark only one oval.

True

False

41. The existence of invasive species increases the risk of wildfires. *

Mark only one oval.

True

False

42. To reduce the destructive effects of floods, it is necessary to reforest the primitive flora. *

Mark only one oval.

True

False

43. All exotic species become invasive. *

Mark only one oval.

True

False

44. "Aguardente" is made from Sugarcane. *

Mark only one oval.

True

False

45. When fishermen went for long fishing trips they used to make poncha. *

Mark only one oval.

True

False

46. The Botanical Garden is full of invasive species. *

Mark only one oval.

True

False

47. Wildfires happen mainly in the Laurisilva forest. *

Mark only one oval.

True

False

48. Laurisilva performs an important role by collecting the water from the mists. *

Mark only one oval.

True

False

49. The Firecrest (Bis-bis) is an endemic bird that only lives near the city. *

Mark only one oval.

True

False

50. We can find healing properties in endemic flora from Laurisilva. *

Mark only one oval.

True

False

Comments

51. Please add any comments or feedback about the experience that are in your mind that we should take into account

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