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Social cohesion, Participation, and Inclusion through Cultural Engagement

D7.7 CASE STUDIES PROGRESS AND PLAN

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SPICE consortium

No.	Short name	Institution name	Country
1	UNIBO	ALMA MATER STUDIORUM - UNIVERSITÀ DI BOLOGNA	Italy
2	AALTO	AALTO KORKEAKOULUSAATIO SR	Finland
3	DMH	DESIGNMUSEON SAATIO - STIFTELSEN FOR DESIGNMUSEET SR	Finland
4	AAU	AALBORG UNIVERSITET	Denmark
5	OU	THE OPEN UNIVERSITY	United Kingdom
6	IMMA	IRISH MUSEUM OF MODERN ART COMPANY	Ireland
7	GVAM	GVAM GUIAS INTERACTIVAS SL	Spain
8	PG	PADAONE GAMES SL	Spain
9	UCM	UNIVERSIDAD COMPLUTENSE DE MADRID	Spain
10	UNITO	UNIVERSITA DEGLI STUDI DI TORINO	Italy
11	FTM	FONDAZIONE TORINO MUSEI	Italy
12	CELI	CELI SRL	Italy
13	UH	UNIVERSITY OF HAIFA	Israel
14	CNR	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy

Executive summary

This is the final deliverable report which describes the progress and plan of all the Case Studies in SPICE and their results. It elaborates on how co-design was used by each museum throughout the past three years. The final service blueprints of each Case Study are visualized in this report. In each Case, the status of the SPICE infrastructure is outlined and explained here. Drawing on the previous deliverables describing the Socio-technical systems in SPICE, the final maps of each Case Study are also visualized. In the end, the report reflects on the use of co-design, citizen curation, the ethical considerations, and potential improvements.

Document History

Version	Release date	Summary of changes	Author(s) -Institution
V0.1	03/04/2023	First draft released	AALTO, DMH, FTM, IMMA, PG, UCM, UH
V0.2	16/04/2023	Corrections included based on the internal review	AALTO, DMH, FTM, IMMA, OU, PG, UCM, UH
V1.0	24/04/2023	Final submission based on all the feedback from contributing partners	AALTO, IMMA

List of abbreviations and terms

- Attention-Deficit/Hyperactivity Disorder (ADHD)
- AI – Artificial Intelligence
- AR – Augmented Reality
- CoI – Communities of Interest
- CoP – Communities of Practice
- DMH – Design Museum Helsinki
- EuC – End-user Communities
- GAM – Galleria D'Arte Moderna
- GDPR – General Data Protection Regulation
- GUI – Graphical User Interface
- HCD – Human Centred Design
- HCI – Human Computer Interaction
- HECHT – Hecht Museum
- IMMA – Irish Museum of Modern Art
- IRL – Interpretation Reflection Loop
- LDH – Linked Data Hub
- MNCN – Museo Nacional De Ciencias Naturales
- PM tool – Project Management tool used by WP7 for communication between the Case Studies and WPs to keep track of tasks and requirements.
- SSA – SPICE Semantic Annotator
- STS – Sociotechnical systems
- URL – Uniform Resource Locator
- UX – User Experience
- VR – Virtual Reality
- WP – Work Package

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1 – INTRODUCTION TO THE CASE STUDIES

The sites of the SPICE H2020 project cover diverse landscapes including geographic, cultural, and linguistically distinct contexts. These are Finland in the Nordic region, Ireland and the United Kingdom in Northern Europe and Spain, Italy and Israel in Southern Europe and the Mediterranean respectively. There are five (5) Case Studies in the project and each one of them involves a museum in a different European or Associated country and they include:

- Design Museum, Helsinki (DMH), Finland
- Irish Museum of Modern Art (IMMA), Dublin, Ireland
- Hecht Museum (HECHT), Haifa, Israel
- Galleria D'arte Moderna (GAM), Turin, Italy
- Museo Nacional de Ciencias Naturales (MNCN), Madrid, Spain

In addition to heritage institutions, there are seven (7) research institutes located at universities of renown accompanied by three (3) business partners that play roles in the work being carried out.

Short name	Institution name	Country
DMH	DESIGNMUSEON SAATIO - STIFTELSEN FOR DESIGNMUSEET SR	Finland
GAM	GALLERIA D'ARTE MODERNA	Italy
HECHT	HECHT MUSEUM	Israel
IMMA	IRISH MUSEUM OF MODERN ART COMPANY	Ireland
MNCN	MUSEO NACIONAL DE CIENCIAS NATURALES	Spain

Table 1: Case studies with their short name.

WP7 is coordinating with the Case Studies the course of their development to integrate exploration, development, use and testing of tools and methods for citizen curation. The timeline in Table 2 below illustrates the deliverables of WP7 and the case study activities; the current (final) stage of the timeline is also highlighted in green.

DELIVERABLE (WP7)	DELIVERABLE	DUE DATE (IN MONTHS)
D7.1	Evaluation methods and protocols.	6
D7.2	Socio-technical (STS) roadmap with project management (PM) tool integrating the Case Studies with SPICE systems.	9
D7.3	Case studies progress and plan.	12
D7.4	Review of Socio-technical roadmap with project management tool.	24
D7.5	Case studies progress and plan.	24
D7.6	Case studies are fully operational.	30
D7.7	Case studies final progress and plan - final version.	36

Table 2: WP7 list of deliverables.

Bonding and bridging capital

Each Case Study is focused on researching how methods and tools for citizen curation can facilitate inclusion and social cohesion. This is carried out using co-design wherein an approach to inclusion is implemented so that excluded groups and other citizens can for example engage with artefacts, create stories, and express opinions. These types of contributions help to build so-called *bonding capital* within diverse groups (D7.1 – Evaluation Protocols). Similarly, the accumulated interpretations and reflections can be interconnected and shared to build the *bridging capital* which helps in promoting tolerance and thereby facilitating social cohesion. The bonding and bridging capital in each Case Study is described in Table 3 below.

Case Study	Bonding capital	Bridging capital
DMH	Enable senior citizens and other people living far from museum services to engage with culture and share their personal stories and interpretations of culture and Finnish design heritage with their communities.	Make artefacts and interpretations available and invite new contributions in virtual and touring galleries to generate dialogue and increase understanding across generations and geographical communities.
GAM	Enable Deaf people and other visitors to actively participate in cultural interpretation and storytelling and connect and share their interpretations through social media functions.	Enable the contributions of Deaf people to be digitally accessible to others in the museum and online. Interconnect contributions using story features such as characters and emotions.
HECHT	Enable members of religious and secular communities, in particular minority populations, to express and share their viewpoints and appreciate the variety of opinions even within a community.	Provide support in the museum for accessing and exploring opinions across different communities to find similarities as well as respect and understand differences.
IMMA	Support groups who are less able to visit the museum physically, such as asylum seekers and children with serious illnesses, to access collections and share their own perspectives.	Make their perspectives available online and in the museum. Encourage visitors to think about universal, personal themes such as family to make interconnections across groups.
MNCN	Actively engage children, including those from lower socio-economic groups who may not consider science interesting or a career option, through activities such as games and puzzles.	Make anonymized contributions available across groups to explore differences of opinion on biodiversity and what individuals can and should do to protect the environment.

Table 3: Bonding and bridging capital of the Case Studies.[1]

The current deliverable (D7.7) describes the final set of developments in the Case Studies and how co-design was applied. It also presents the final service blueprints of the Case Studies, the SPICE technological infrastructure in each case, and the final Socio-technical Systems (STS) map. All the Case Studies are currently fully operational and this has been explained in elaborate systematic detail in D7.6 – Case Studies Fully Operational. Other developments prior to this period have also

[1] These descriptions about the bonding and bridging capital have been derived from the project's grant agreement.

been reported in the other deliverables (D7.1 – Evaluation Protocols, D7.2 – Socio-technical Roadmap with Project Management Tool, D7.3 – Case Studies Progress and Plan, D7.4 – Socio-technical Roadmap with Project Management Tool, and D7.5 – Case Studies Progress and Plan, and D7.6 – Case Studies Fully Operational. The next chapter provides a summary of co-design throughout the project in each case study.

2 – CO-DESIGN IN EACH CASE

Co-design is a collaborative design process that involves all stakeholders in the design and creation of a product or service. In SPICE, co-design brings together different communities, museum professionals, developers, designers, educators, researchers, and other stakeholders to work together towards citizen curation. The aim of this process is to enable citizens to learn more about themselves, develop a better understanding of and empathy for, other communities, and to create digital solutions which can support these processes (https://spice-h2020.eu/)

In the Case Studies, co-design methods have been used to involve museum visitors, museum staff, and other stakeholders to create different kinds of activities, exhibitions, and other experiences together with the designers and digital developers. Visitors (citizens) and other participants have created content for the applications and provided feedback for further development. By involving all these groups in the design process, museums can ensure that their offerings are more relevant, engaging, and inclusive and thereby promote citizen curation. In the processes, designers and developers gain direct feedback from users of services and applications and learn about special needs and motivations.

Overall, co-design has been a powerful tool used by the Case Study museums to engage with their communities, create more meaningful and relevant experiences, and foster a sense of ownership and investment in the museum's offerings. Some of it has been explored in the previous deliverables (D7.3 – Case Studies Progress and Plan, D7.4 – Socio-technical Roadmap with Project Management Tool, D7.5 – Case Studies Progress and Plan, and D7.6 – Case Studies Fully Operational). The following sections outline aspects of co-design in each case and some of the recent workshop activities conducted. The communities described in these sections include End-user Communities (EuC), Communities of Interest (CoI) and Communities of Practice (D7.1 – Evaluation Protocols and D7.2 – Socio-technical Roadmap with Project Management Tool).

DMH

The Pop-up VR Museum is a Virtual Reality (VR) application co-designed by Aalto and DMH with various stakeholders, in which citizens can access, interact, and engage with a digitized/virtual artefact collection of DMH. It has been designed to function on portable VR HMDS and this ensures that it can be used easily without the requirement of complicated hardware setup. So far, the Pop-up VR Museum has been tested extensively in workshops in Helsinki and across Finland as well as during one-time events in Israel, Italy, and Ireland.

Communities
A list of the communities involved in the DMH Case Study include:

- Senior citizens
- Asylum seekers and immigrants
- Adult Finnish language learners
- Museum visitors
- Library visitors

- Museum curators and experts at DMH (collection team, education team, marketing & communication team)
- Experts from other museums
- Experts such as healthcare professionals in senior care centres, instructors in reception centre of the Finnish immigration office and event producer in municipal library
- Designers and developers of the Pop-up VR Museum and other services in the Case Study
- Researchers

Throughout the course of the SPICE project, more than 1000 people have been involved as contributors to the Pop-up VR Museum which includes:

- around 400 test-users
- estimated 200 observers, companions, and other visitors.
- 500 contributors of stories (many of these also tested the Pop-up VR Museum)
- around 50 individuals that include designers, researchers, museum professionals, and mediators.

Reasons behind the selection of these communities include:

- Increasing accessibility and inclusivity to Finnish design heritage: for i) people for whom visit to the Design Museum may be physically or culturally restricted, like senior citizens living in institutions or people living far from Helsinki ii) people who do not connect with Finnish design and cultural heritage, like the recently immigrated or asylum seekers or international visitors. For further explanation, see D7.6 – Case Studies Fully Operational (p.38 – 45).
- Capturing the diversity of interpretations and reflections of design and cultural heritage: for example, many senior citizens already possess extensive knowledge about the design objects in the Design Museum collection, and have personal memories of them whereas younger people or recently immigrated may not always have that knowledge but relate to the objects from other perspectives; through exposal to other people's stories, similar or differing form the person's using the Pop-up-VR Museum, we seek to promote understanding and empathy through, and social cohesion across communities.

Stories and narratives

More than 600 stories about design objects have been collected as contributions from communities and several individuals in 29 workshops. These include around 460 written stories and 140 audio-recorded stories, mostly in Finnish but also in English and some other languages. The written stories are of varying length, depending on the workshop method – many of them are short stories on post-it notes. The audio recordings were transcribed, and all the stories have been translated to Finnish, English, and Swedish. They are stored as JSON datasets in the LDH and analysed by most of the technological infrastructure (D7.6 – Case Studies Fully Operational, p.51 – 55). Most of the stories deal with everyday life, personal histories, and autoethnographic accounts connected to design objects from the museum's collection. There are various interpretations and reflections of the design objects. The devices and interaction used to support storytelling include:

- the Pop-up VR Museum installation including 3D objects and stories related to them, via VR HMD and controllers while users are seated on a chair by a table,
- paper printouts of design objects and "real" design objects from the DMH handling collection, similar to the design objects in the VR experience, organized on a separate table with image annotation devices such as post-it notes, pencils, and pens,
- cameras, iPhones, and other audio devices used for recording storytelling and other activities.

Contributions have been collected using a consent process considering several ethical aspects as well as following the ethos of co-design and citizen curation (D7.6 – Case Studies Fully Operational, p.35 – 39).

The museum space

Aside from the gallery space that is the most conspicuous space where the public encounters key tasks of the institution, a museum comprises a diversity of spaces which are utilised in many different activities including education, research laboratories, and more. Throughout the SPICE project, DMH has organised workshops and events in different premises at the museum: Studio workshop room, Auditorium, Conference room and in the exhibition galleries. The workshops open to all museum visitors have mainly taken place in the Studio and in the Auditorium and during the free evenings and free days, to enable widest accessibility. The invited workshops for different communities with a limited number of participants, have included guided visits to the exhibition galleries. During the pandemic, the museum back yard was used for one of the first meeting with senior citizens. Events for experts and museum professionals and partners in the project have taken place in hybrid form, in the Auditorium and online. In addition to this, the museum website includes a site for Pop-up-VR Museum, and it has been used for advertising announcements and for communicating about ongoing work in the project. https://www.designmuseum.fi/en/pop-up-vr-museum-2/

Other spaces used

Workshops and events have been organised outside the museum to meet communities and to learn about possibilities of pop-up activities. Some of the other spaces used to engage with senior citizens include senior-care centres and churches and activity centres in Helsinki. Senior communities have been met during separate workshops organised in Lahti, Orimattila, Tampere and Oulu. Two open workshops have been organised in libraries in Orimattila and Turku. Activities with asylum seekers and immigrants have been organized together with local reception centre, both at the museum and in the centre. Lastly, the virtual world in the Pop-up VR Museum has been a prominent space where participants have engaged with virtual design objects.

List of all the co-design activities involving DMH throughout the SPICE project

Date	Activity	Description
29.10.2020	SPICE mini-conference 1	An online conference involving all partners in SPICE co-designed by WP7, WP2, and other partners and aimed at setting a direction for the Case Studies throughout the project (D7.3 – Case Studies Progress and Plan, p.13)
23.03.2021	SPICE mini-conference 2	An online conference involving all partners in SPICE co-designed by WP2, WP5, and WP7 aimed at establishing the "user-journey" loop (D2.1 – Initial Methods for Interpretation, p.71) and curators' interfaces in the Case Studies (D7.3 – Case Studies Progress and Plan, p.21)
17.06.2021	Workshop at Kustaankartano Senior Center, Helsinki	First visit to one of the biggest Senior Centres in Helsinki to understand how the care-centre uses technology with senior citizens and collecting ideas

		about VR and working with design objects from senior care experts and clients.
22.06.2021	Workshop with invited individual senior citizens at DMH	A workshop for non-institutionalized "free going" senior citizens was conducted with DMH's mediators in the backyard of the museum wherein artefact analysis was employed as an interpretation method by asking participants to bring along their "Everyday Hero Object" presenting it to each other and triggering conversations that included storytelling. This workshop is also described in greater detail in D7.3 – Case Studies Progress and Plan v2.0 (p.36).
15.12.2021	Workshop with focus group of senior citizens at DMH	Workshop with *Museum Ventilators*, DMH focus group with senior citizens conducted at DMH: using images of design objects interpretation in small groups and production of individual narratives that were documented using different media.
19.01.2022	Online workshop with focus group of senior citizens	Online workshop with *Museum Ventilators*, DMH focus group with senior citizens conducted via multimedia conferencing using Zoom and Miro: learning to use Miro, reflecting stories previously produced by other participants about specific design objects and re-interpreting objects.
02.03.2022	Workshop with focus group of senior citizens at DMH	Workshop with *Museum Ventilators*, DMH focus group with senior citizens conducted at DMH: discussion about VR and reflecting work with objects in previous workshops.
08.03.2022	Workshop with invited individual senior citizens in Orimattila	Workshop for a group of individually invited seniors in municipal library, Orimattila: using images of design objects interpretation as a group and production of individual narratives that were documented using different media; reflecting other people's stories using cards with stories from previous workshops.
08.03.2022 Open wrkshp, Orimattila library	Walk-in workshop in municipal library, Orimattila: Talk about the object! Using images of design objects participants were asked to tell their story or comment; annotations were written on post-it notes by mediators.	
15.3.2022	Workshop with invited group of senior citizens at DMH	Workshop for senior group from The Finnish Association for the Welfare of Older Adults (*Vanhustyön keskusliitto*): using images of design objects, interpretation in small groups and production of individual narratives that were documented using different media; reflecting other people's stories using cards with stories from previous workshops.
17.03.2022	Workshop with invited group of senior citizens in Lahti	Workshop with *Happy Paintbrushes*, art group for seniors in Mukkula, Lahti: using images of design objects, interpretation in small groups and production of individual narratives that were documented using different media; reflecting other people's stories using cards with stories from previous workshops; individual

			interpretations were also made using painting and drawing as medium.
22.03.2022		Workshop with invited group of senior citizens in Laajasalo, Helsinki	Workshop with group of seniors from *Neighborhood c*ircle (Naapurustopiiri) in Laajasalo, Helsinki: using images of design objects interpretation as a group and production of individual narratives that were documented using different media; reflecting other people's stories using cards with stories from previous workshops.
22.03.2022	Workshop with invited group of senior citizens in Maunula, Helsinki	Workshop with group of seniors from *Neighbourhood c*ircle (Naapurustopiiri) in Maunula, Helsinki: using images of design objects interpretation as a group and production of individual narratives that were documented using different media; reflecting other people's stories using cards with stories from previous workshops.	
29.3.2022		Online workshop with invited individual senior citizens	Online workshop wit*h* invited senior citizens conducted via multimedia conferencing using Zoom and Miro: learning to use Miro, reflecting stories previously produced by other participants about specific design objects and re-interpreting objects.
12.5.2022		Workshop with invited group of senior citizens in Tampere	During the A&DO Lab Senior Day a workshop for *Konkarit* group of Tampere City senior services was organized in The Labor Museum Werstas. The participants were encouraged to test the first prototype of the Pop-up VR Museum facilitated by museum educators. Using images of design objects interpretation as a group and production of individual narratives that were documented using different media; reflecting other people's stories using cards with stories from previous workshops.
17.05.– 22.05.2022		Open workshop for museum visitors during the Finnish Museum Week at DMH	During the Finnish Museum Week, The Pop-up VR Museum was set up in the Auditorium of DMH with another new media installation. The admission to this co-design event was free. The visitors were encouraged to test the first prototype of the Pop-up VR Museum facilitated by museum educators and researchers from the Aalto University team. Their experience in the simulation was broadcasted on screen to other visitors in the room. For more, see D7.6 – Case Studies Fully Operational, p.39.
19.5.2022		Hybrid seminar at DMH	Co-Designing Virtual Reality Experiences hybrid event for professionals featuring two EU projects: Beyond Matter and SPICE.
20.5.2022		Discussion event at DMH	Presentation of Pop-up-VR Museum process for Finnish museum professional with title How to design VR experience for seniors.
30.08.– 29.11.2022		Open workshops for museum visitors	The entry to DMH was free for all on the last Tuesday of every month (30.8., 27.9., 25.10., 29.11.). The Pop-

	during Design evenings at DMH	up VR Museum was tested by many visitors of varying backgrounds in an open walk-in workshop with also a possibility to interpretation and annotating of design objects and recording individual narratives using different media. For more, see D7.6 – Case Studies Fully Operational, p.45.
21.9.2022	Workshop with invited group of adult students with migrant background at DMH	Group of students from The Institute of Adult Education in Helsinki toured the collection exhibition, tested the Pop-up VR Museum and, using images of design objects, interpreted, and commented design objects and recorded individual narratives using different media assisted by museum educators and the course instructor.
07.10.2022	Workshop with invited group of customers of immigration services at DMH	Group of customers from the nearby Punavuori reception centre for asylum seekers and refugees toured the collection exhibition, tested the Pop-up VR Museum and, using images of design objects, interpreted and commented design objects and recorded individual narratives using different media assisted by museum educators and the instructors from the centre.
15.10.2022	Workshop with invited group of seniors at DMH	The *Happy Paintbrushes*, art group for seniors from Lahti which participated in a workshop in March, visited the museum, toured the exhibitions, and tested the Pop-up VR Museum in a short workshop.
15.11.2022	Workshop with staff members of DMH	The Pop-up-VR Museum was presented to DMH staff in a walk-in workshop where they could test the application and give feedback.
05.12.2022	Testing workshop at the Hecht Museum, University of Haifa, Israel	The Pop-up-VR Museum was presented to the SPICE project community in conjunction with a visit to the Hecht Museum. The participants could test the application and give feedback and even some museum visitors tested it.
25.01.2023	Open workshop at the Kontula Senior Centre, Helsinki	Testing the Pop-up VR Museum in a walk-in workshop in the lobby of Kontula Senior Centre with participants both from 24-hours-care and day activities and also some staff members; collecting feedback about VR experience as well as stories and comments about design objects in writing.
27.01.2023	Workshop for clients and staff of Kustaankartano Senior Centre, Helsinki	Testing the Pop-up VR Museum in a digital activity room of Kustaankartano Senior Centre with 24-hours-care clients, some with memory illnesses or physical challenges and some with previous experience of using VR; collecting feedback about VR experience as well as stories and comments about design objects in writing. Staff members participated in testing and facilitated the clients with museum educators.
30.01.2023	Workshop with invited group of	Testing the Pop-up VR Museum with the group Kyläkammari (The Finnish Association for the Welfare

	seniors in Oulunkylä, Helsinki	of Older Adults, *Vanhustyön keskusliitto*) at Oulunkylä church, collecting feedback about VR experience as well as stories and comments about design objects in writing.
17.02.2023	Open workshop at the Turku Central Library	Testing the Pop-up VR Museum with visitors of the Turku Central Library, collecting feedback about VR experience as well as stories and comments about design objects in writing and in audio.
23.02.2023	Hybrid workshop for professionals: Data visualization and community modelling	Workshop with presentations by UCM with DMH and Aalto professionals exploring the data structures of the Pop-up VR Museum and demonstrating development and use of visualizations based on community models.
03.03.2023	Open workshop at the Punavuori reception centre, Helsinki	Testing the Pop-up VR Museum in the Punavuori reception centre for asylum seekers and refugees, collecting feedback about VR experience.
14.03.2023	Open workshop at the Museum of Palazzo Poggi, Bologna, Italy	Testing the Pop-up VR Museum at the Museum of Palazzo Poggi in a walk-in open workshop with visitors and museum professionals, collecting feedback about VR experience as well as stories and comments about design objects in writing.
15.03.2023	ExICE conference, University of Bologna, Italy	General presentation about the work done and achievements in all the cases as part of the plenary session. Poster presentation and demo booth presenting and testing the Pop-up VR Museum at the ExICE conference organized by UNIBO and collecting feedback from testers about their experience.
05.04.2023	MELLIE workshop at IMMA, Dublin, Ireland	A workshop wherein MELLIE participants in pairs create sculptures of each other (duoethnography) after going through Deep Viewpoints (D2.1 – Initial Methods for Interpretation).
29.04.2023	Open workshop aimed at seniors in Oulu, Finland	Testing the Pop-up VR Museum in open walk-in workshop organised as part of A&DO Lab Senior Day in the premises of PROTO the Designers' association of Northern Finland, collecting feedback about VR experience as well as stories and comments about design objects in writing.

Table 4: All the co-design activities involving DMH throughout the SPICE project.

Fig.1: During the SPICE conference visit to Haifa in December 2022, some visitors of the Hecht Museum insisted on testing the Pop-up VR Museum although the session was mainly for project members. This was one of the many occasions where the Pop-up-VR Museum provided the possibility to try VR for the first time. (Photo credit: Nele Kadastik)

Fig.2: The Pop-up VR Museum was co-designed with participants at the Kontula senior center in a walk-in open workshop which was situated in the lobby of the building and people could pop by after their lunch and try themselves or watch others using the VR. (Photo credit: Gautam Vishwanath)

Fig.3: The Pop-up VR Museum visited the Turku Central Library where the voluntary participants tested the VR and commented design objects. In a typical workshop situation, museum educator Anna-Maija Karjalainen sits beside the user and facilitates the experience. (Photo credit: Linda Svarfvar)

Fig.4: Co-design workshops were organized in collaboration with institutions and museums, and they also provided a platform for reflection within the Communities of Interest (CoI). In conjunction with the SPICE conference in Bologna in March 2023, a Pop-up VR Museum workshop took place in the auditorium of Museum of Palazzo Poggi. Lily Diaz and Gautam Vishwanath discuss with curator Michela Contessi and the practician Yasmin. (Photo credit: Leena Svinhufvud)

Activity evaluation metrics

Adhering to the guidelines of GDPR, each user signed consent sheets that informed them of the data collected and processed for research at SPICE. No other personal information was collected except for users' generation identity (age-group). Most of the narrative material was collected anonymously.

A combination of usability testing and gameplay analysis were used to non-intrusively record the actions of users while they navigated through the experience. A silent approach made it more likely to maintain sense of presence. In the Pop-up VR Museum software application, trigger markers set as data points for each interaction variable outputted the following to an offline JSON file:

- age-group,
- artefacts selected,
- stories listened to,
- artefacts immersed in,
- artefacts collected,
- gameplay time from the beginning to the end

During subsequent iterations of the prototype, gameplay analysis helped designers identify and fix bugs based on faulty patterns of interaction and crashes. The results of all the test sessions conducted until March 15, 2023, are shown between Fig.5 – Fig12.

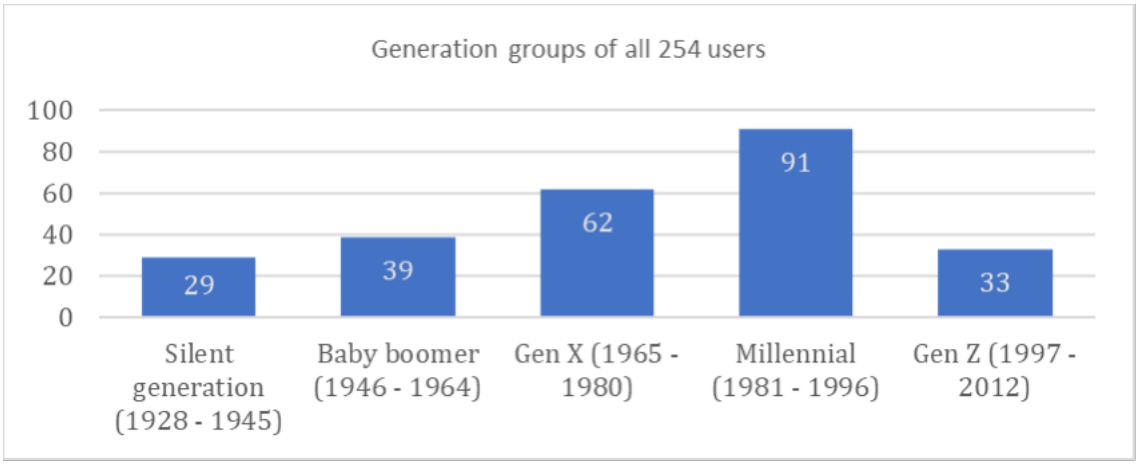

Fig.5: Generation groups of all 254 (68 seniors and 186 non-seniors) users who tested the Pop-up VR Museum.

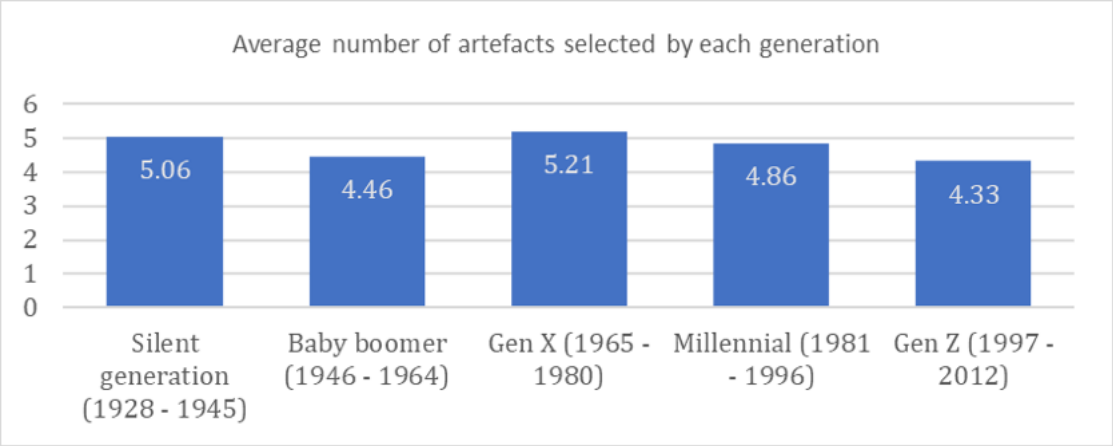

Fig.6: Each generation who tested the Pop-up VR Museum selected 4-5 artefacts.

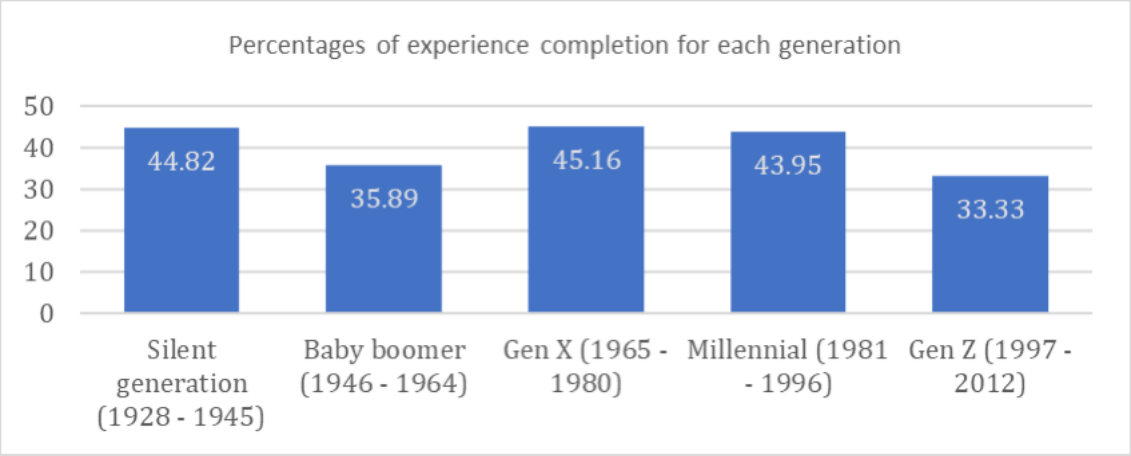

Fig.7: Senior citizens were as likely as the non-seniors to complete the experience by selecting 7 different artefacts.

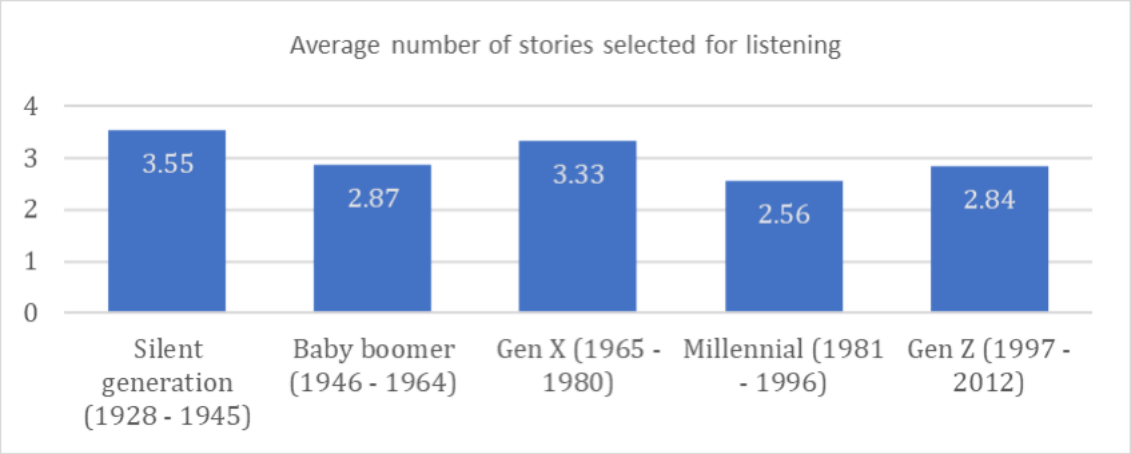

Fig.8: Each generation selected 2-4 stories for listening.

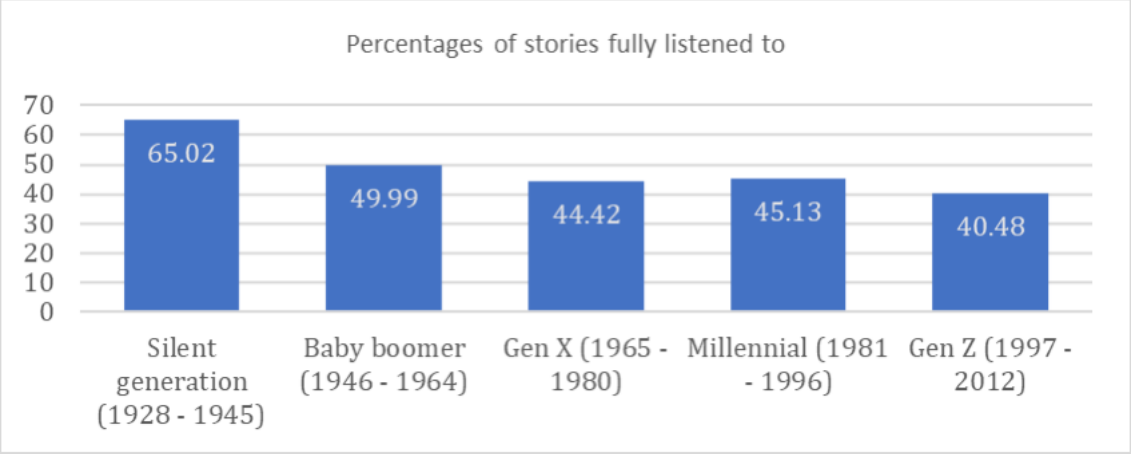

Fig.9: Seniors were far more likely to listen to stories without skipping them in-between.

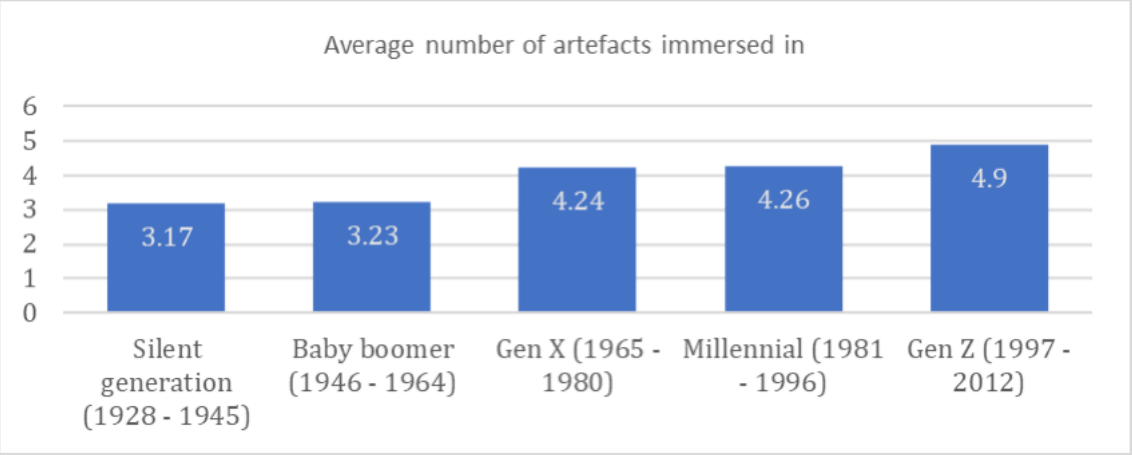

Fig.10: The younger the generation, the more likely they were to immerse inside virtual artefacts.

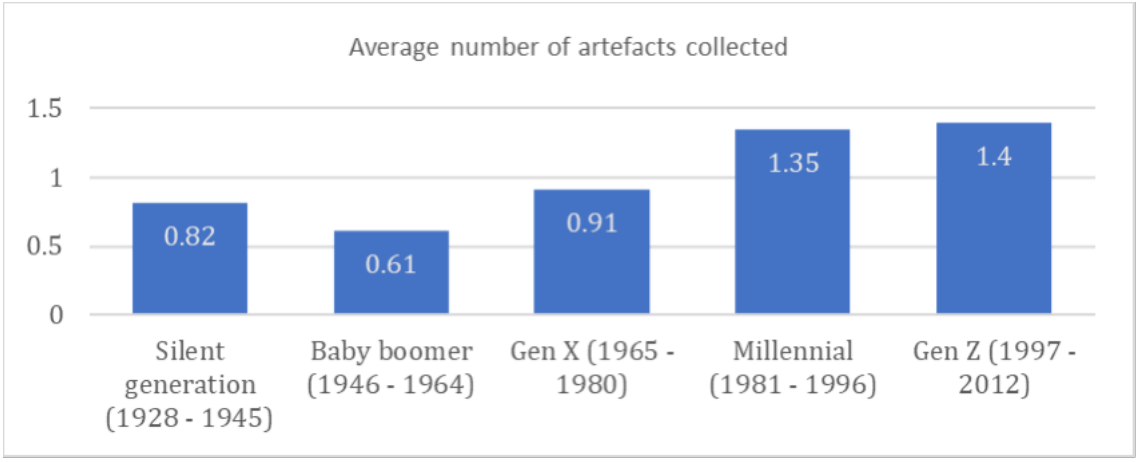

Fig.11: Seniors collected fewer artefacts when compared to younger generations.

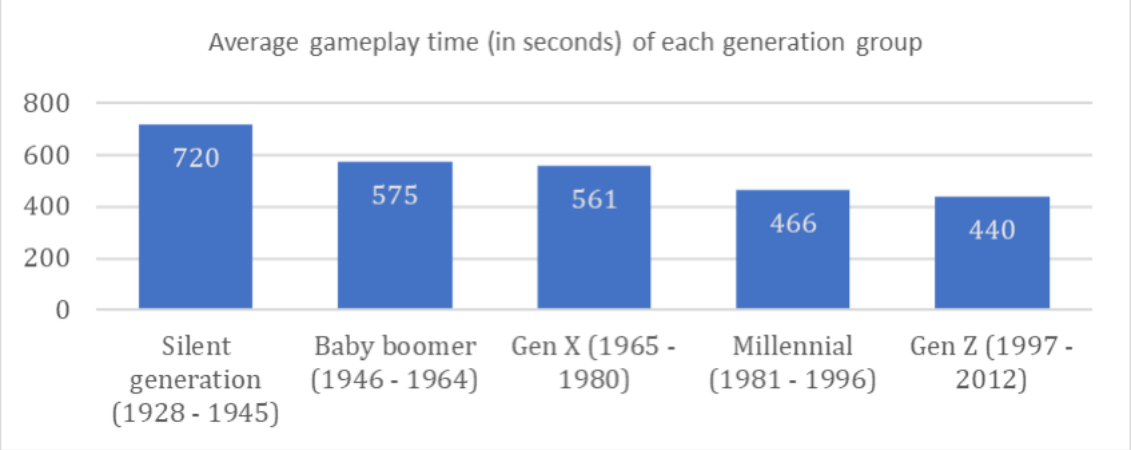

Fig.12: The older the generation, the more time they spent with the Pop-up VR Museum.

After their experience, users were provided the option of anonymously filling unstructured questionnaires and it assisted the researchers in gathering more qualitative feedback. Specific questions and their research aims are outlined below in Table 5. In addition to the questionnaire, many of the users also described their individual experiences and provided design suggestions to the mediators assisting them.

Question	Research aim
Prior to experiencing the Travelling Museum, have you ever tried using Virtual Reality - VR to experience any film or game or other content?	The aim here is to ascertain digital literacy and specifically familiarity with VR as a medium.
Which artefact was the most interesting to you and why?	To understand the level of engagement with cultural heritage, description about users' interests, familiarity, and relation with the artefacts and stories is beneficial.
Which story was the most striking/memorable to you and why?	
While engaged, did you ever feel a "sense of presence" / "immersed" / "that you were there"? If yes, how strong (between 1-5).	Engagement with the experience is also bound to be affected by the degree of presence in VR.
Did you find the experience challenging or uncomfortable at any point?	Analysing the difficulties and make improvements to newer iterations of the VR prototype.
Anything else you would like to let us know.	Other comments were also welcome.

Table 5: Post-experience questions presented to users and their research aims.

Question	Research aim
Prior to experiencing the Travelling Museum, have you ever tried using Virtual Reality - VR to experience any film or game or other content?	Out of all 68 respondents, 21 were first-time VR users amongst which 10 of them were senior citizens.
Which artefact was the most interesting to you and why?	A variety of artefacts were of interest to users of all age-groups. Some comments regarding why include: - "a dear object", - "my grandmother had it at home", - "because it was of a funny shape", - "tasty looking soup steaming inside", - "you can pile any number of them on top of each other", - "the Nokia phone reminds me of my youth". These responses seem to indicate that the artefacts in the Pop-up VR Museum triggered personal memories amongst many users. Some comments from senior citizens about the stories include: - "The scissors: what kind of a wedding gift is that?", - "because I was surrounded by the sea", - "I can't believe that some visitor had once owned that expensive objects… Or had it been in the family, etc?",
Which story was the most striking/memorable to you and why?	

	- "I myself have had one when the children were little", - "it brought back a lot of memories for me". These responses indicated that participants related in some way to the stories provided by the contributors.
While engaged, did you ever feel a "sense of presence" / "immersed" / "that you were there"? If yes, how strong (between 1-5).	60 out of the 68 respondents reported the feeling, the average degree being 3.72. Varying comments from some of the seniors include: - "Yes, it felt very real. On the scale, 5", - "Interesting, 4", - "I did, once, about 2.5", - "I didn't. I was disturbed by the background landscape/image, which did not find the products at all". We acknowledge the semantic difficulties in wording and understanding this question especially when it was translated to two other languages. Therefore, we used the three different terms in the question to allow more room for interpretation.
Did you find the experience challenging or uncomfortable at any point?	32 out of all 68 respondents reported experiencing challenges or discomfort. - Some of whom found the VR HMD uncomfortable at some point such as "the virtual glasses put pressure on my glasses and without glasses the image is very unclear", "…device was too tight", and "…made me sweat". - Others regarding the contents of the experience such as "…it was challenging to see the text above the objects", "Being stuck inside was frustrating", and "The sound was maybe a little too loud". - Few included "It was challenging but good", "Not challenging, but uncomfortable", while another one was unclear. Therefore, there is further room for improvement to make the experience of the Pop-up VR Museum more accessible and user-friendly for all.

Table 6: Summary of the results from the post-experience questionnaire as of April 12th 2023.

The Pop-up-VR Museum is the only case study in the SPICE project using VR technology. Amongst the workshop participants many used VR for the first time. Especially for seniors, this provided an important opportunity to participate in digital technologies which sometimes may seem "not for seniors". The workshops organised by a museum were a reliable and safe environment for testing new things. Younger test users, and especially those representing digital native generation, enjoyed the playful and funny experience and compared it to game playing.

GAM

The GAM Game invites museum visitors to provide their interpretation of their artworks. As a responsive web application co-designed by GAM and UNITO, it encourages the Deaf community (primary end-user community of GAM) and other museum visitors to interpret the artworks using mostly non-verbal communication such as annotating emotions. The citizen curation goal here is to create a more welcoming, accessible, and inclusive environment in the museum and consolidating the presence of the deaf community in the institution.

Communities
GAM has a long history of working with the Turin Institute for the Deaf and the communities involved in the Case Study include:

- Teenage students from the Deaf Association
- Mediators from the Deaf Association
- Museum curators and educators
- Researchers

The prototype has been thoroughly tested with 78 users throughout the course over the course of the SPICE project.

Museum narratives
A total of 198 stories have been collected from the 78 users who have been testing iterations of the prototype. These have taken place in the GAM Game on personal devices such as mobile phones and tablets provided by the museum wherein users select and collect museum items as well as comment on artworks. They can also explore the collection through other visitors' stories and receive recommendations on artworks and stories based on affective similarity and dissimilarity. Based on the recorded responses to artworks, researchers and museum professionals were able to discern the patterns of interaction from the choices made by the users of GAM Game.

Museum space
The gallery space has been used to test the application with users and curators during their visits to the museum. Laboratory rooms have been used for focus group sessions with target users and museum curators/educators.

Other spaces used
Online spaces such as Google Meet and UNITO web servers were used heavily during the pandemic-era and later to collect initial requirements from schools (November 2020) and for questionnaires to receive feedback from the Deaf community on interface elements and recommendations. Rooms and facilities of the Turin Institute for the Deaf were also used for testing prototypes the GAM Game and specific functions such as story creation, artwork selections, and story recommendations.

List of all the co-design activities involving GAM throughout the SPICE project

Date	Activity	Description
29.10.2020	SPICE mini-conference 1	An online conference involving all partners in SPICE co-designed by WP7, WP2, and other partners and aimed at setting a direction for the Case Studies throughout the project (D7.3 – Case Studies Progress and Plan, p.13).

23.03.2021	SPICE mini-conference 2	An online conference involving all partners in SPICE co-designed by WP2, WP5, and WP7 aimed at establishing the "user-journey" loop (D2.1 – Initial Methods for Interpretation, p.71) and curators' interfaces in the Case Studies (D7.3 – Case Studies Progress and Plan, p.21).
23.09.2022	Meeting in GAM with researchers and curators	Agenda: collecting stories • Number of researchers/curators: 10 • Stories created by researchers/curators: 99
01.10.2022	Researchers' night	• Number of users: 34 • Number of created stories: 43
22.12.2022	Focus group session 1 at Turin Institute for the Deaf	• Number of deaf/non deaf users: 20 (9 males, 11 females) • Number of created stories: 36
23.01.2023	Focus group session 2 at Turin Institute for the Deaf	• Number of deaf/non deaf users: 9 (5 females, 4 males) • Number of created stories: 18
15.03.2023	ExICE 2023	Demo booth at the SPICE conference in UNIBO • Number of users: 5 • Number of created stories: 2

Table 7: All the co-design activities involving GAM throughout the SPICE project.

Fig.13: Launch event of the first prototype of the GAM Game. (Photo credit: Anna Follo)

Activity evaluation metrics

For collecting requirements, co-design, and testing the application, online surveys, focus group sessions, and ethnographic observations have been used. In addition, to evaluate the prototype sessions, post-experience questionnaires containing System Usability Scale were provided to participants. (D7.6 – Case Studies Fully Operational, p.55-56)

HECHT

The HECHT Case Study makes use of the notion of dilemma as a rhetorical device in relation to the Galilee rebellion for high-school students to learn about diversity of opinions regarding historical and national issues. This usually takes place during and after a museum school trip. Students learn to interpret museum artefacts according to their own personal views, reflect on other students' opinions, and perform citizen curation activities.

Communities

The communities involved in the HECHT Case Study include:

- High-school students
- School teachers
- Museum curators
- Developers
- Educational researchers

Through collaboration with education researchers and teachers, a total of 200 students were involved as participants over the course of the SPICE project.

Museum narratives

Around 200 written autoethnographies reflecting on the Galilee rebellion were obtained from the students. They also took photographs on their own mobile phones and used them to compliment these autoethnographic accounts. After their visit, using digital images and 3D models of artefacts from the HECHT museum, students also designed virtual exhibitions reflection on their opinions. Overall, the dilemma was used as a rhetorical device for depolarization by understanding and engaging with other opinions and perspectives.

Museum space

In the galleries of HECHT, guided tours were provided to students. They then examined the premises looking for artefacts that support their opinions on the rebellion. After this activity, students in groups also discussed each other's opinions. Therefore, the museum space was used for introduction to the exhibits, exploration, and discussion.

Other spaces used

The other prominent spaces were the classrooms and auditoriums in schools. Pre-visits wherein teachers introduced the topic of the rebellion took place in these classrooms. Other post-visit activities such as reflections on their visits and curation of the virtual exhibitions took place in these classrooms as well.

Activity evaluation metrics

Researchers involved with the HECHT Case Study carried out statistical and qualitative analysis of the responses collected from the students. They analysed the effect on historical relevance with a state hypothesis that the activity in the museum would increase historical relevance obtaining:

- no significant effect of time ($F(1,109)=1.54$, $p=.22$, $Eta2= .01$), with a small decrease from pre-museum questionnaire measure ($M(SD)=4.31(.92)$), to in post-museum questionnaire measure ($M(SD)=4.23(.84)$).

However, when the separate components or subscales of relevance such as historical relevance for **identity** were analysed, the researchers at HECHT noticed:

- a significant effect of time (F(1,109)=16.20, p< .001, Eta2= .13), increase from pre-museum questionnaire measure (M(SD)=4.13(1.04)), to in post-museum questionnaire measure (M(SD)=4.47(.98)) was significant.

It was observed that an opposite effect occurred for relevance to citizenship and current affairs:

- a significant effect of time (F(1,107)=18.42, p< .001, Eta2= .15). Decrease from pre-museum questionnaire measure (M(SD)=4.38(1.05)), to in post-museum questionnaire measure (M(SD)=4.02(.89)), was significant.

As a converging measure of AOT, researchers used the assessment of a second, opposing, opinion. They performed Analysis of Variance which showed:

- a significant effect of exposure opposite opinion versus self-confirming opinion (F(1,70)=5.24, p< .05, Eta2= .7).

Participants who were previously exposed to an opinion opposing their own, showed higher appreciation of a second opposing opinion, than their peers who were previously exposed to a self-confirming opinion (M(SD)=4.72(1.31) vs. M(SD)=3.97(1.42)). The researchers concluded that in accord with our hypothesis, exposure to an opposed opinion increases openness. However, contrary to their hypotheses, argumentative evidence-based museum activity reduced openness.

List of all the co-design activities involving HECHT throughout the SPICE project

Date	Activity	Description
29.10.2020	SPICE mini-conference 1	An online conference involving all partners in SPICE co-designed by WP7, WP2, and other partners and aimed at setting a direction for the Case Studies throughout the project (D7.3 – Case Studies Progress and Plan, p.13).
23.03.2021	SPICE mini-conference 2	An online conference involving all partners in SPICE co-designed by WP2, WP5, and WP7 aimed at establishing the "user-journey" loop (D2.1 – Initial Methods for Interpretation, p.71) and curators' interfaces in the Case Studies (D7.3 – Case Studies Progress and Plan, p.21).
(21.09.2020 – 11.10.2022)	Bi-weekly meetings with CoIs and CoPs	• Meetings with educators at schools throughout the project • Meetings with museum curators and staff throughout the project • Meetings with philosopher concerning what is ethical in depolarization and what are worthy goals • Meeting with education academic concerning storytelling
18.05.2022	Workshop on technology for Cultural Heritage	Remote workshop conducted with students from UH and the team at UNITO.
19.05.2022	Digital Humanities Hackathon	Remote workshop conducted with students from UH and the team at UNITO.

Table 8: All the co-design activities involving HECHT throughout the SPICE project.

Fig.14: Students participating in a Rebellion activity at the HECHT museum. (Photo credit: Joel Lanir)

Fig.15: An exhibition curated by a student about the Galilee rebellion. (Photo credit: Joel Lanir)

IMMA

The IMMA Case Study supports visitors in using the museum's collections to develop their own perspectives and share them with others to help citizens examine different perspectives or alternative points of view. This is carried out via Slow-looking method in the Deep Viewpoints application (D7.6 – Case Studies Fully Operational, p.76). To improve accessibility and advance

inclusiveness, IMMA supports groups who are not always able to visit the museum premises and these communities are listed below.

Communities
Communities that are often marginalized or under-served and have special emphasis in the IMMA Case Study include:

- Asylum seekers
- Migrants / new communities
- Black activist groups
- Healthcare workers
- Marginalized young people
- Irish Travellers

In addition, the CoIs and CoPs that have been involved include:

- Museum educators
- Artists
- Researchers

Around 185 participants took part in different workshop activities and user-testing sessions carried out by IMMA.

Museum narratives
A total of 73 autoethnographic accounts of visitor's reflections were collected via the Slow-Looking method. These were largely obtained through the Deep Viewpoints web application designed in the IMMA Case Study (D7.6 – Case Studies Fully Operational, p.76). In some of the workshops, tablets, computers, and projectors were also used as devices to support storytelling.

Museum space
Workshop activities and other specially programmed ones with EuCs and the public were conducted at the gallery space, workshop/studio space, museum grounds and gardens, front-lawn pavilion. Events with community groups also took place in different parts of the museum. Lastly, the museum website and social media was used for advertising announcements and communications about ongoing work in the project.

Other spaces used
The other spaces used by IMMA include the Oberstown Children Detention Campus during their workshops with children in detention and Zoom videoconferencing platform especially during the pandemic era. Some of the devices used in these spaces were:

- Image annotation devices such as post-it notes, pencils and pens.
- Deep Viewpoints web application
- Tablet computers
- Projectors
- Wooden model of gallery space and miniature canvases
- Virtual exhibitions
- IMMA online collection

List of all the co-design activities involving IMMA throughout the SPICE project

Date	Activity	Description
29.10.2020	SPICE mini-conference 1	An online conference involving all partners in SPICE co-designed by WP7, WP2, and other partners and aimed at setting a direction for the Case Studies throughout the project (D7.3 – Case Studies Progress and Plan, p.13)
23.03.2021	SPICE mini-conference 2	An online conference involving all partners in SPICE co-designed by WP2, WP5, and WP7 aimed at establishing the "user-journey" loop (D2.1 – Initial Methods for Interpretation, p.71) and curators' interfaces in the Case Studies (D7.3 – Case Studies Progress and Plan, p.21)
24.11.2021	New Communities partnership	Authoring their own script in Deep Viewpoints. For more, see D7.6 – Case Studies Fully Operational.
27.11.2021	Black and Irish group	Authoring their own script in Deep Viewpoints. For more, see D7.6 – Case Studies Fully Operational.
02.02.2022	Chinedum Muotto (artist)	A resident artist who created two scripts related to his own exhibition works.
12.02.2022	Black Queer Book Club	IMMA workshop with the Black Queer Book Club wherein artworks that are not part of IMMA are added to IMMA Viewpoints and this process would be used to develop an exhibition. An activity was conducted by Black Queer Book Club called Queer Reflection which provided an institutional critique of IMMA based on the portrayal of certain artworks.
23.02.2022	MELLIE (Migrant English Language & Literacy through Intercultural Education)	Pre-workshop visit from participants in the MELLIE (Migrant English Language, Literacy, and Intercultural Education) Programme via Dublin City University. This Programme brings together staff and students from the university and people seeking asylum in Ireland. The pre-workshop involved young Afghan women going through the gallery and choosing images to interpret through different perspectives.
26.03.2022	HELIUM Arts Youth Advisory Group	Workshop with the Youth Advisory Group of HELIUM Arts, an organization providing creative opportunities to young people with life-long illnesses. After discussion with the group, this workshop was delivered entirely remotely to maximize participation for the young people, many of whom are particularly vulnerable to Covid-19.
11.03.2022 – 01.04.2022	Oberstown Children Detention Campus	Series of four workshops with young people in Oberstown Children's Detention Campus. In these workshops, participants used the Deep Viewpoints web app to mediate their own paintings and develop connections between their work and works in the IMMA Collection. The scripts authored by this group were integrated into a physical exhibition of their work at IMMA in April-May 2022, as well as being accessible to other groups in future workshops.
12.05.2022	Royal College of Physicians	Responded to scripts from HELIUM group.
21.05.2022	St James's Hospital Workshop 1	Authoring their own script in Deep Viewpoints. For more, see D7.6 – Case Studies Fully Operational.

12.12.2022	St James's Hospital Workshop 2	Authoring their own script in Deep Viewpoints. For more, see D7.6 – Case Studies Fully Operational.
24.02.2023	Uillinn Youth Group	Responded to the collection artistically, to be added to Deep Viewpoints by museum professionals.
03.03.2023	Apollo Youth Group	Authoring their own script in Deep Viewpoints using music for artworks, working with Naomi Barker. For more, see D7.6 – Case Studies Fully Operational.
08.03.2023	MELLIE group	Slow-looking activity with participants from MELLIE.
21.03.2023	Irish Traveller Group	Authoring their own script in Deep Viewpoints. For more, see D7.6 – Case Studies Fully Operational.
05.04.2023	MELLIE group	A workshop wherein MELLIE participants in pairs create sculptures of each other (duoethnography) after going through Deep Viewpoints (D2.1 – Initial Methods for Interpretation).
22.04.2023	EPIC - Empowering People in Care	A workshop in which young people who have experienced the care system authored their own scripts in Deep Viewpoints. For more, see D7.6 – Case Studies Fully Operational.

Table 9: All the co-design activities involving IMMA throughout the SPICE project.

Fig.16: MELLIE workshop conducted on the premises of IMMA. (Photo credit: Gautam Vishwanath)

Fig.17: Members of Black and Irish take part in a workshop at IMMA (Photo credit: Kyle Tunney)

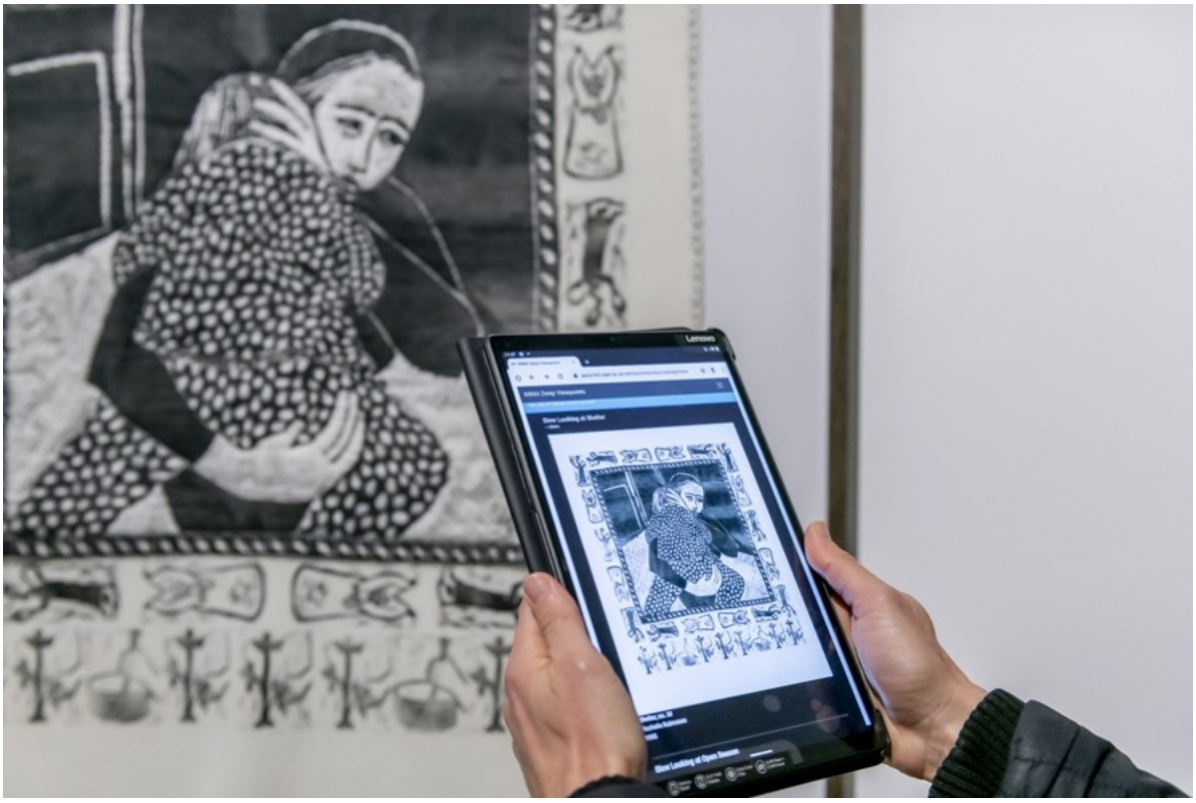

Fig.18: Members of New Communities Partnership use Deep Viewpoints at IMMA (Photo credit: Louis Haugh)

Activity evaluation metrics
These metrics include qualitative feedback provided by the participants during workshops, analysis of the scripts in Deep Viewpoints, and several other semi-structured interviews.

On 3rd March 2023 visitors to the convivial space were asked whether they would like to spend some time looking at Deep Viewpoints and give their feedback. For the session Deep Viewpoints contained the scripts created by the community groups in 2022 (e.g. Black & Irish) and also the artist curated scripts by Chinedum Muotto and Art Nomads. Volunteer participants spent about 10 to 15 minutes exploring the app before responding to a set of questions.

The first questions were about the experience of looking through the scripts:

- *Did carrying out a script change how you look at or think about the artworks? If so, how?*
- *Did carrying out a script help you to notice things about the artwork, If so, what?*
- *Did carrying out a script help you to connect the artwork to other ideas or personal experiences? If so, can you give an example?*

Two further questions were related to how the app could be used and improved:

- *Can you imagine how you or others might use this technology either in the museum or at home?*
- *Do you have any suggestions for how Deep Viewpoints could be improved?*

For the first set of questions, the following themes emerge:

1) The value of having access to other viewpoints
"Gives you different interpretations of the artworks from someone with a different culture or upbringing".
"My reaction was different to the observer, so it was learning about someone else's culture or story. I love that."

2) Reading different viewpoints helps you to think about the artwork
"Knowing what someone else thinks about the artwork helps you to find your own interpretation".
"Reading someone's description of other people's work helps you to think about them".

3) Additional information helps to provide a way to approach to artwork
"The text is helpful if you don't know what to be thinking"?
"Unless you are knowledgeable it is useful to have a bit more information about what the artist is trying to say".

4) The prompts help you to think about the artwork for yourself
"I liked the option of being able to comment. It changed how I looked at the art".
"I like that there are no wrong answers. So, it's not like school. It is about what do you feel, does it touch you, how does it connect to humanity".

5) The scripts help to guide looking at the artwork
"I saw things I wouldn't have known by being guided to specific areas of the artwork to focus on".
"Draws your attention to things you might miss".

The question on how the technology could be used prompted suggestions related to:

- A side-gallery with a physical exhibition of a curated script
- Scripts on a touch screen or kiosk near the artwork
- A digital guide or Explorers Programme for adults
- A tool for schools where young people can give their own interpretations.

The question on how to improve Deep Viewpoints prompted suggestions related to:

- Giving more context to the scripts rather than jumping straight in (e.g., profile information about who authored the script)
- Using it to capture information related to past exhibitions.
- Improved navigation from the scripts back to the home page

MNCN

The MNCN Case Study engaged with school children and provoked more interest in science through interactive gamified activities such as treasure hunts. In these activities, students share anonymized contributions about biodiversity by exploring fossils in the museum. The aim is to examine differences in opinion and what individuals can and should do to protect the environment.

Communities

The Case Study and the Treasure Hunt application designed in it is targeted to middle school students. CoPs and CoIs involved in it include:

- Museum educators
- School teachers
- Game designers

The museum educators selected different schools based on an age-criteria proposed by the game designers as well as diverse backgrounds of the students. Around 200 members of all these communities have participated in the Treasure Hunt activities over the course of the SPICE project.

Museum narratives

A total of 57 documentary essays were written by the students that included drawn images emerging from the content delivered to the workshops about conserving nature. During the workshop activities, students moved around the gallery space, scanned artefacts, and wrote these essays.

Museum narratives

The gallery space of the museum was used to test the treasure hunts during school children's visits. Teachers and museum educators assisted the students on these occasions. Laboratory rooms were used to conduct co-design activities between the game designers, teachers, and museum educators.

Other spaces used

Google Meet was used as a remote-collaboration platform for focus group sessions with schoolteachers. Pre and post activities were conducted at schools such as the presentation about biodiversity, and post-experience questionnaires provided to students.

List of all the co-design activities involving MNCN throughout the SPICE project

Date	Activity	Description
29.10.2020	SPICE mini-conference 1	An online conference involving all partners in SPICE co-designed by WP7, WP2, and other partners and aimed at setting a direction for the Case Studies throughout the project (D7.3 – Case Studies Progress and Plan, p.13)
23.03.2021	SPICE mini-conference 2	An online conference involving all partners in SPICE co-designed by WP2, WP5, and WP7 aimed at establishing the "user-journey" loop (D2.1 – Initial Methods for Interpretation, p.71) and curators' interfaces in the Case Studies (D7.3 – Case Studies Progress and Plan, p.21)
06.09.2021 – 05.10.2021	Design workshops	Conducted with game designers and museum educators to plan the treasure hunts at the museum.
03.11.2021	Colegio Arcangel Madrid	Treasure Hunt with 5th and 6th grade students during the Madrid Science Week.
04.11.2021	Colegio Nuestra Señora del Val, Alcalá de Henares	Treasure Hunt with 6th grade students during the Madrid Science Week.
05.11.2021	Colegio San Francisco de Asis, Madrid	Treasure Hunt with 2nd year of secondary education during the Madrid Science Week.
05.11.2021	CEPA Aluche, adult educator center	Treasure Hunt activities with students at the museum.
02.03.2022 – 21.09.2022	Focus groups with schoolteachers	Discussions with schoolteachers about designing the Treasure Hunt activities.
10.11.2022	Co-design with school teachers from CEIP Bachiller Alonso López, Alcobendas	Discussing the Treasure Hunt activities with schoolteachers.
22.11.2022	CEIP Bachiller Alonso López, Alcobendas, fifth grade	Treasure Hunt activities with students at the museum.
14.02.2023	IES María de Molina, Madrid, first year of secondary education	Treasure Hunt activities with students at the museum.
15.02.2023	IES María de Molina, Madrid, first year of secondary education	Treasure Hunt activities with students at the museum.
17.02.2023	IES Menéndez Pelayo, Madrid, third year of secondary education	Treasure Hunt activities with students at the museum.
01.02.2023 – 14.03.2023	Co-design with SPICE researchers	Discussing the Treasure Hunt activities with SPICE researchers for the ExICE 2023 event.
15.03.2023	Testing with ExICE attendants	Testing the Treasure Hunt framework using other artworks at the ExICE 2023 conference in UNIBO.

Table 10: All the co-design activities involving MNCN throughout the SPICE project.

Fig.19: Extinct specimen (Tilacino) example used as part of the closing narrative in the MNCN museum Treasure Hunt. (Photo credit: Lily Diaz-Kommonen)

Fig.20: Museum educator at MNCN provides summary narrative. (Photo credit: Lily Diaz-Kommonen)

Fig.21: School children using Augmented Reality in the Treasure Hunt application to scan some of the museum artefacts. (Photo credit: Lily Diaz-Kommonen)

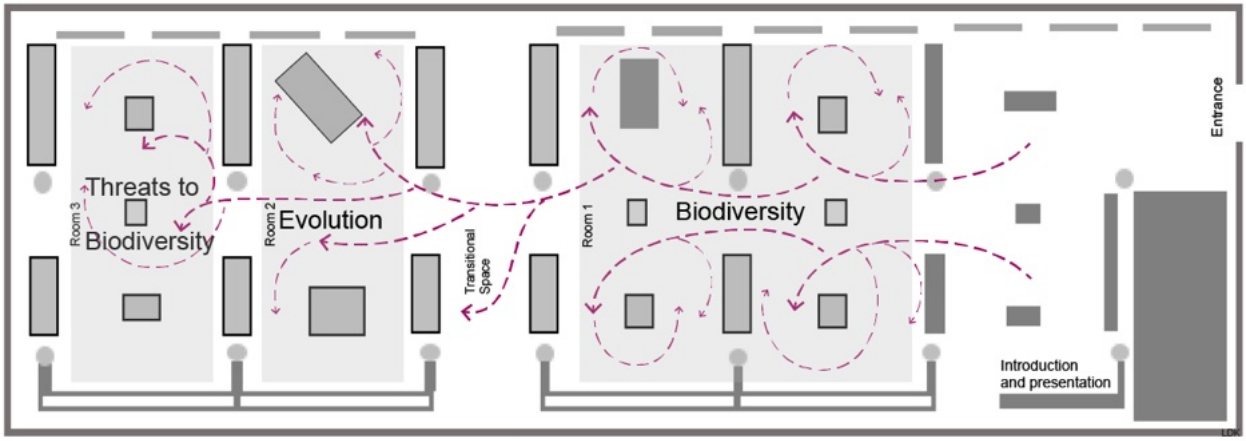

Fig.22: Floorplan of the MNCN Case Study, indicating the contents of the exhibition in each of the room spaces as well as the activity flows

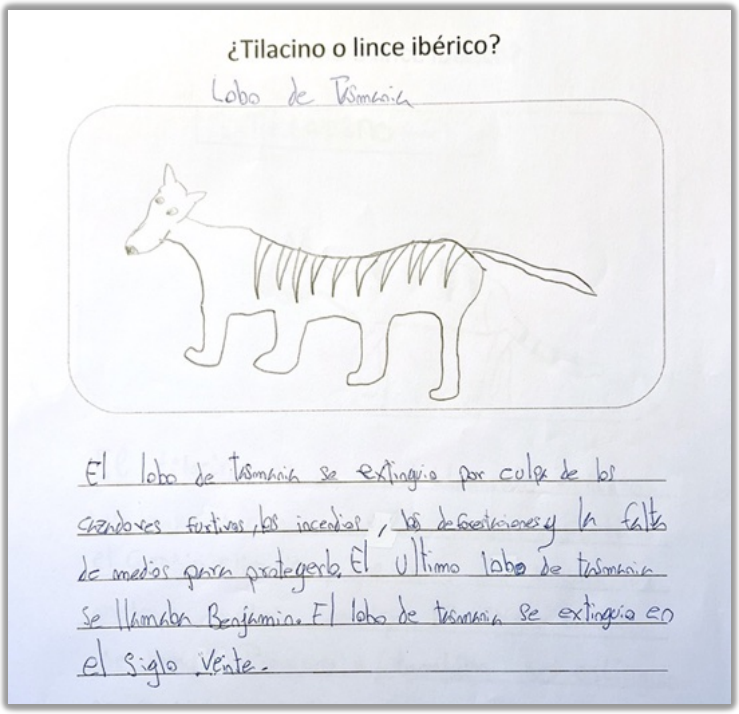

Fig.23: A student's essay on the Tasmanian wolf (Thilacyne) mentioning "The Tasmanian wolf (tilacino) became extinct because of hunting, fires, deforestation, and the lack of resources to protect him. The last Tasmanian wolf was named 'Benjamin'. He became extinct in the early 20th century". (Photo credit: Pedro González)

Activity evaluation metrics

As explained earlier, some of these include:

- Semi-structured interviews
- Focus groups
- Questionnaires

The activity in MNCN Madrid presents an example of a community sprouted when using place-specific digital application simultaneously in a group. During the activity in the museum space the digital treasure hunt task was facilitated by a museum educator, encouraging the use of digital methods to engage participants with museum content.

Results

All the Case Studies thoroughly made use of co-design by engaging with different stakeholders and communities involved with their museums. As seen in the activity evaluation metrics, co-design has significantly enriched the results of each case and led towards the SPICE goal of citizen curation. Each Case Study also made use of the SPICE technological infrastructure in unique ways and more of these will be described in the upcoming chapters of this deliverable report.

3 – FINAL SERVICE BLUEPRINTS

Service blueprints are diagrams that map out the steps involved in delivering a service, including the people, processes, and SPICE infrastructure involved (D7.6 – Case Studies Fully Operational, p.28; Bettiol et. al, 2014; Chan et.al, 2009; McFarland, 2008; Yeh & Lee, 2011). They provide a detailed overview of the entire service experience, from the citizen's perspective, as well as some of the internal processes and resources required to deliver that service. In SPICE, the Case Study museums have been co-designing personas and UX maps to identify the interests and needs of citizens as well as tackle gaps in the services provided (D7.5 – Case Studies Progress and Plan and D7.6 – Case Studies Fully Operational, p.28). The deliverable report D7.5 also highlights how the UX mapping and service blueprints designed in WP7 is different from the user-journey scripts developed in WP2 (D7.5 – Case Studies Progress and Plan, p.28).

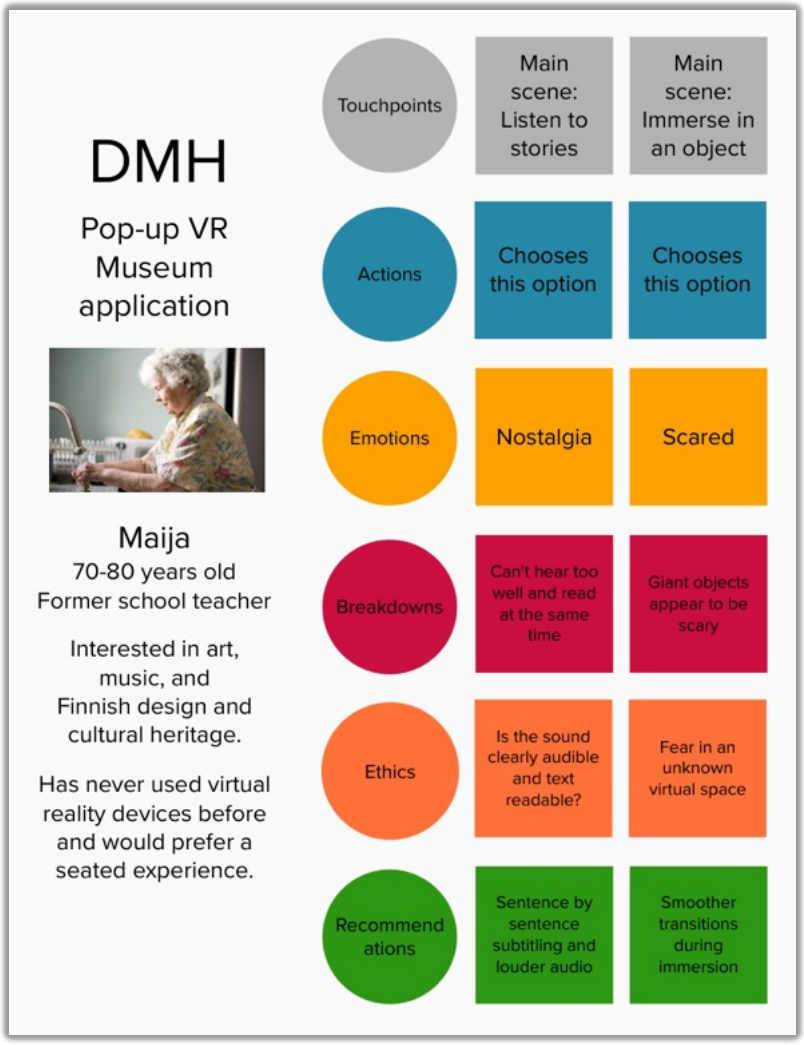

Fig.24: A user experience (UX) map based on a persona's hypothetical interaction with the Pop-Up VR Museum.

The Case Study applications are envisioned to continue existing after the end of the SPICE project. Therefore, new stakeholders and others working with the museums who would get involved later should be able to see the service blueprint and understand the estimated users' experiences as well as the nature of integrated SPICE infrastructures.

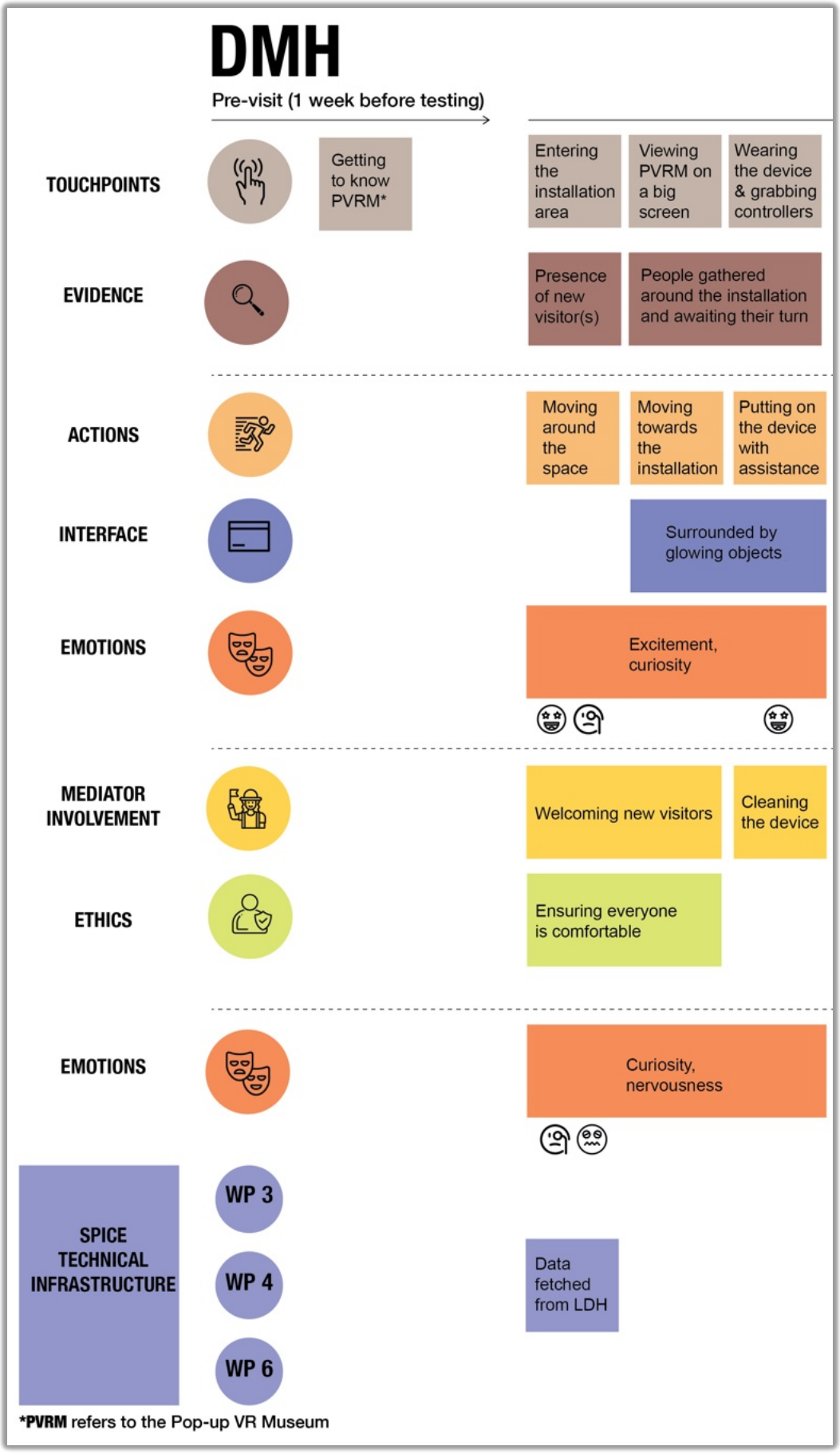

Fig.25: First half of the final service blueprint of the DMH Case Study.

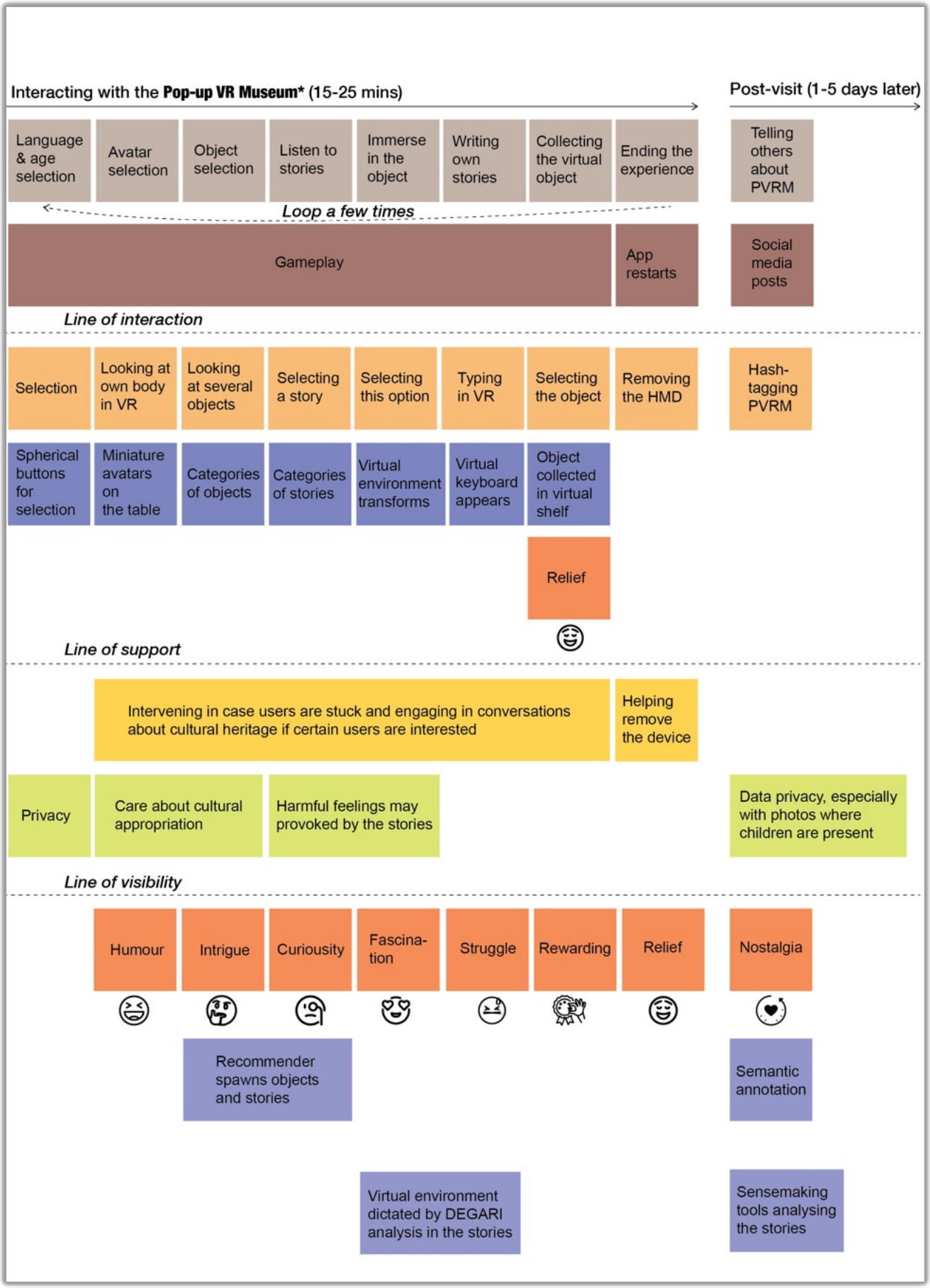

Fig.26: Second half of the final service blueprint of the DMH Case Study.

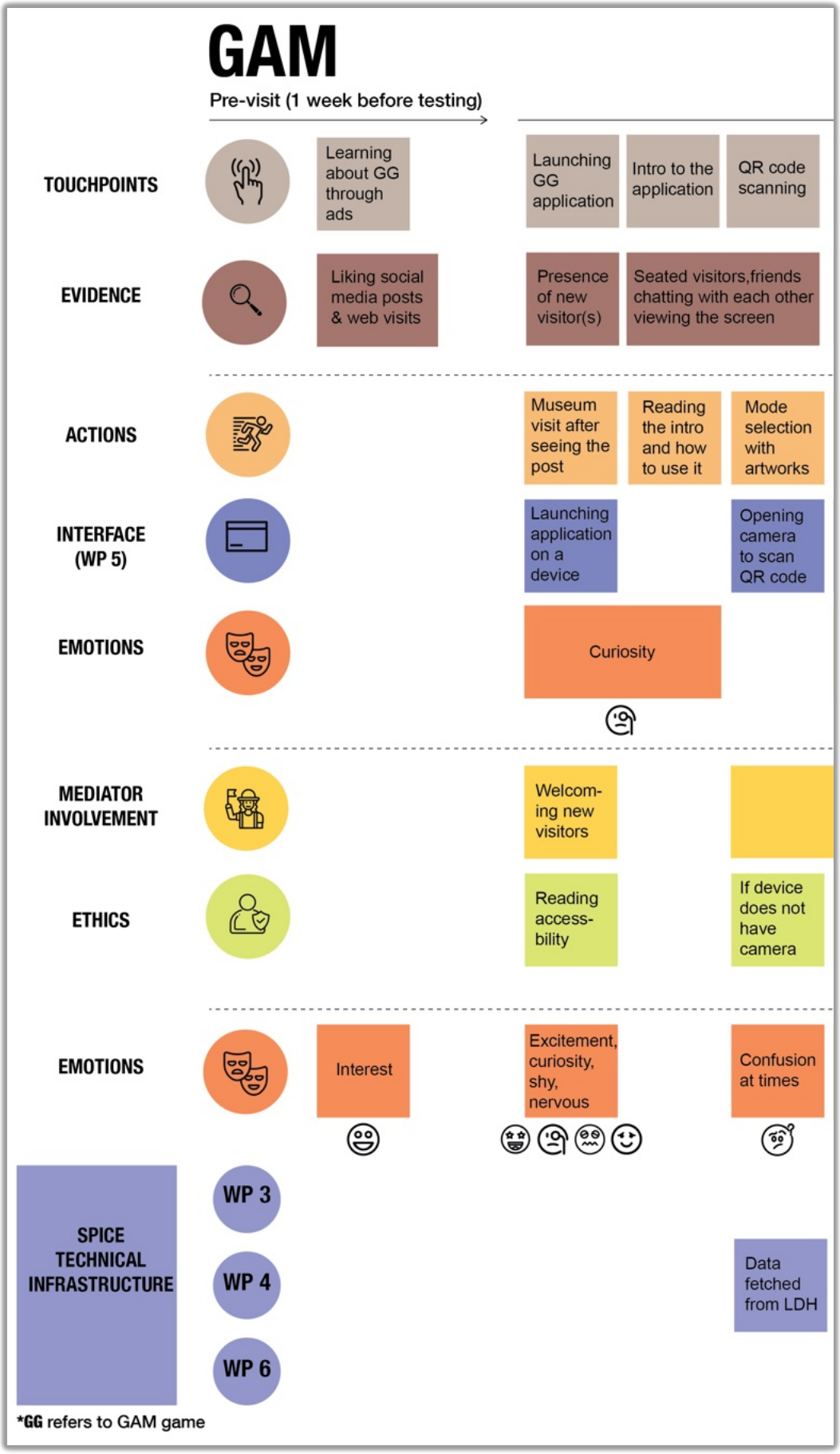

Fig.27: First half of the final service blueprint of the GAM Case Study.

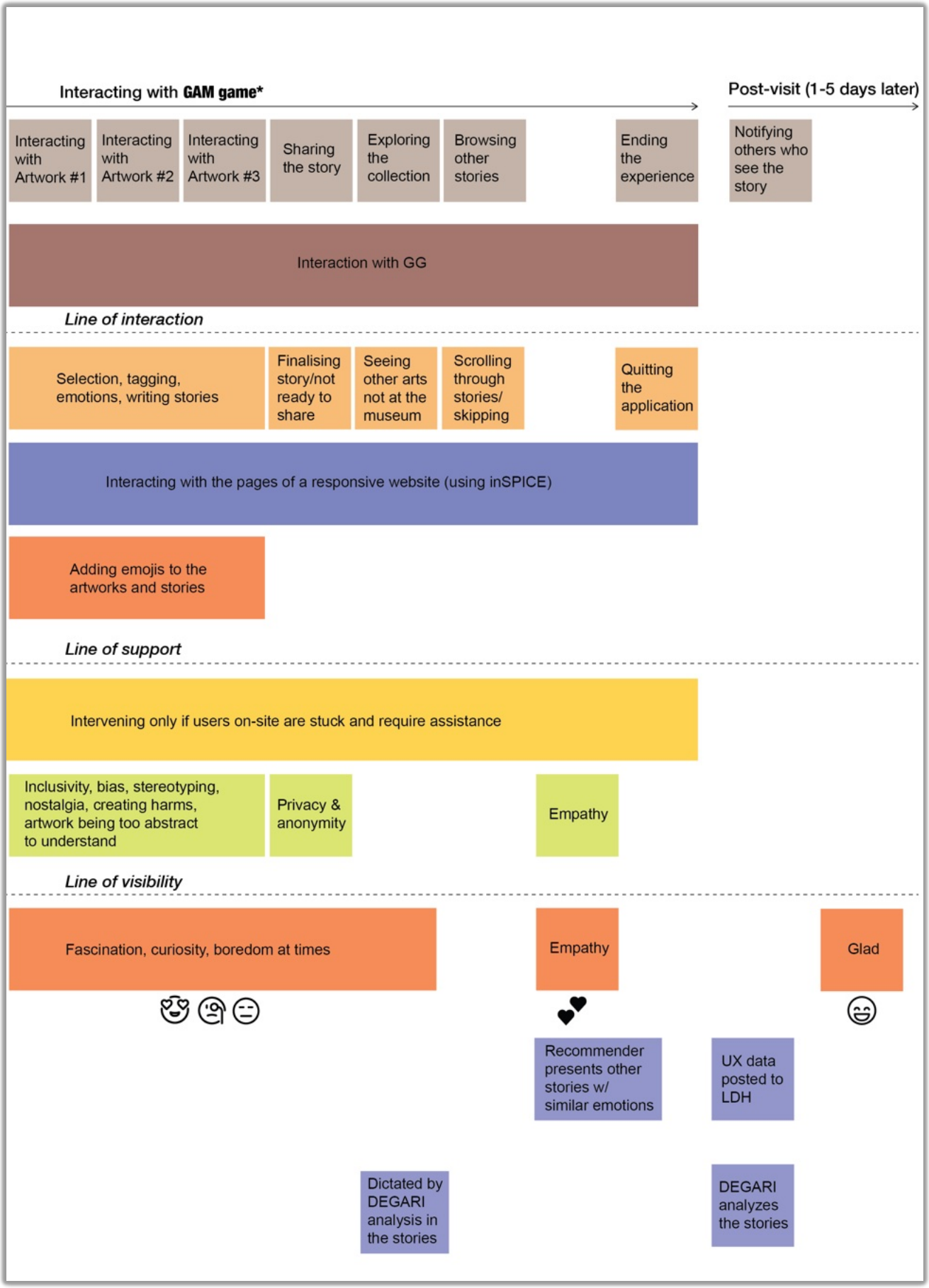

Fig.28: Second half of the final service blueprint of the GAM Case Study.

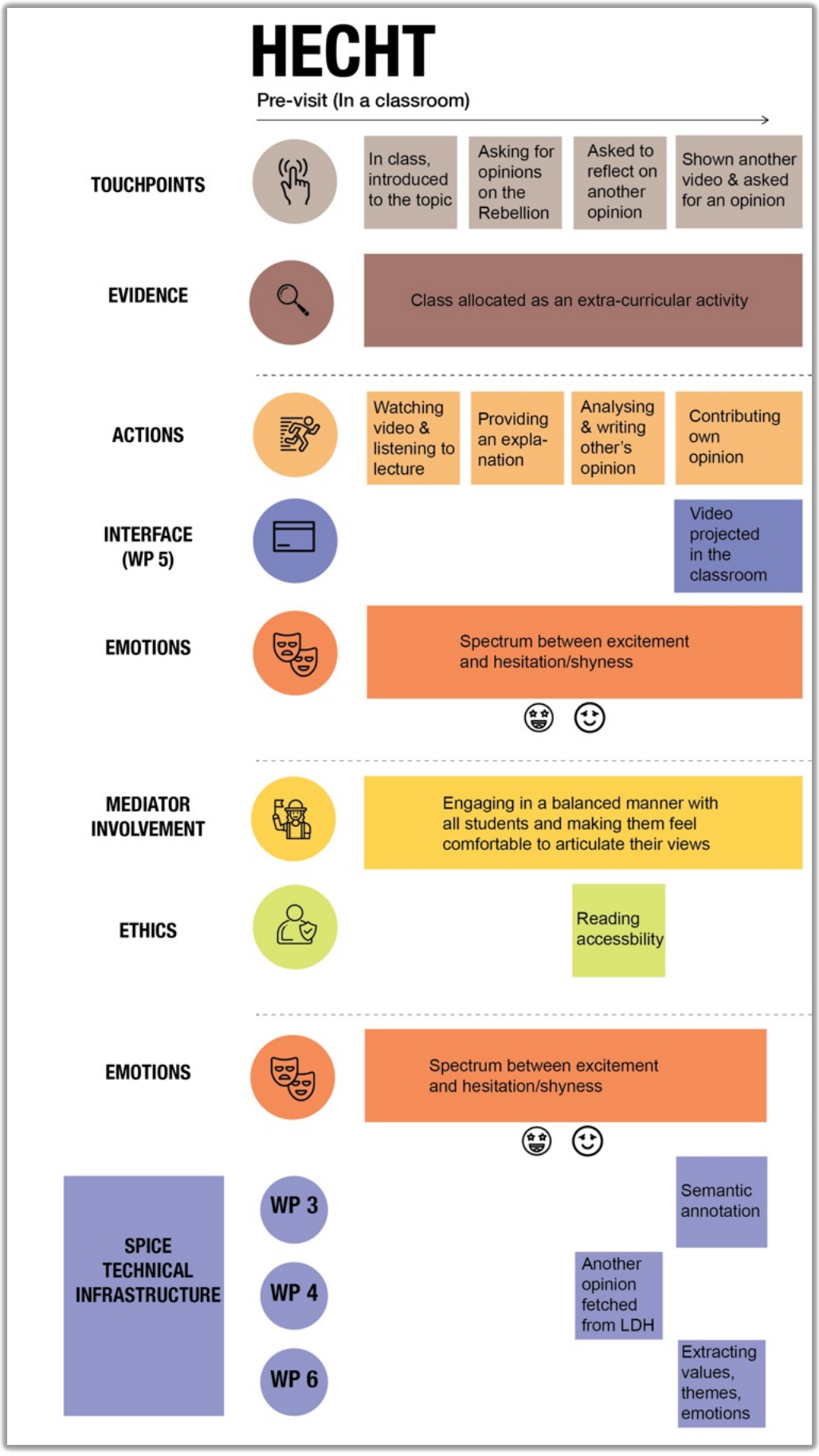

Fig.29: First half of the final service blueprint of the HECHT Case Study.

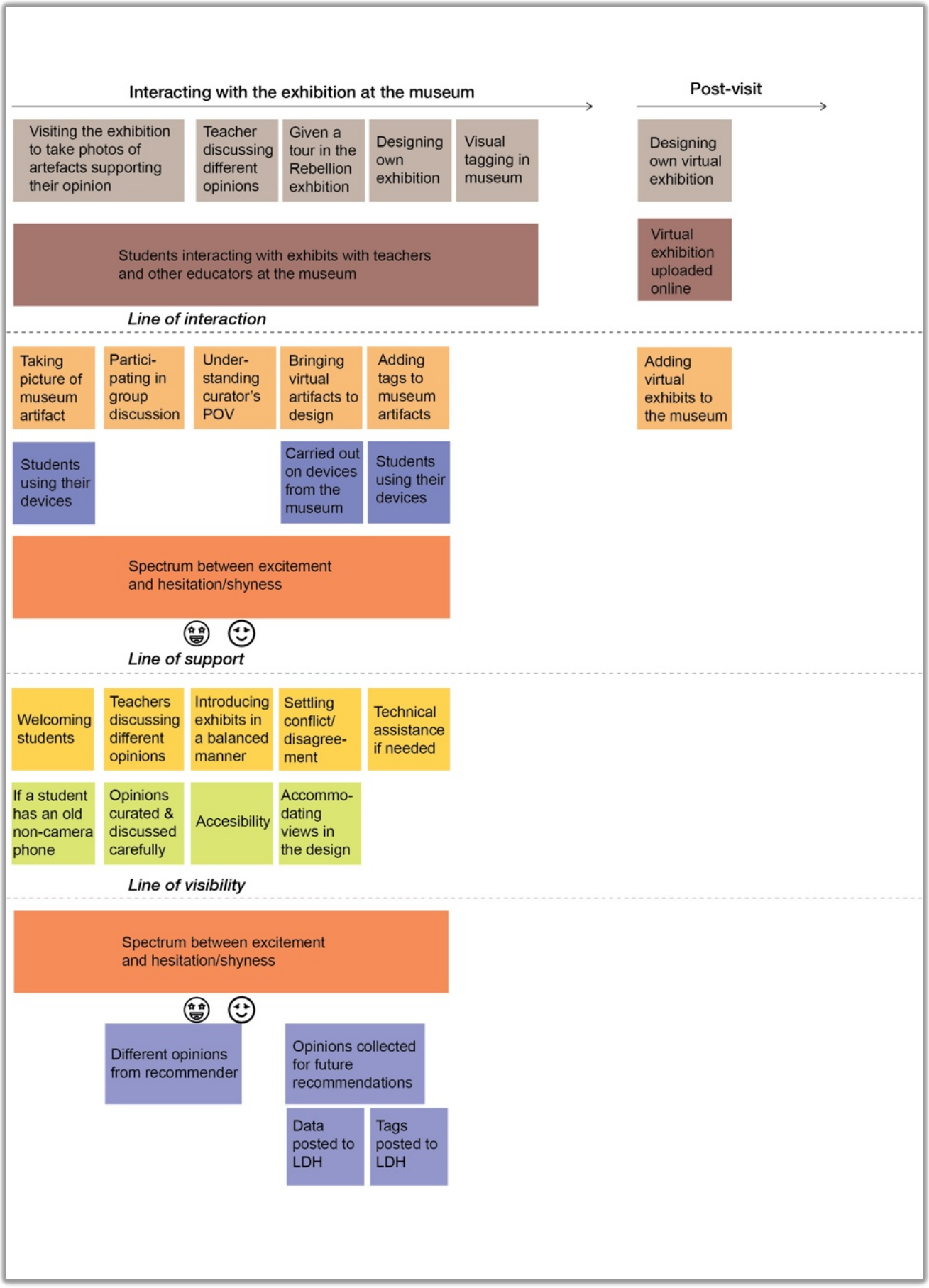

Fig.30: Second half of the final service blueprint of the HECHT Case Study.

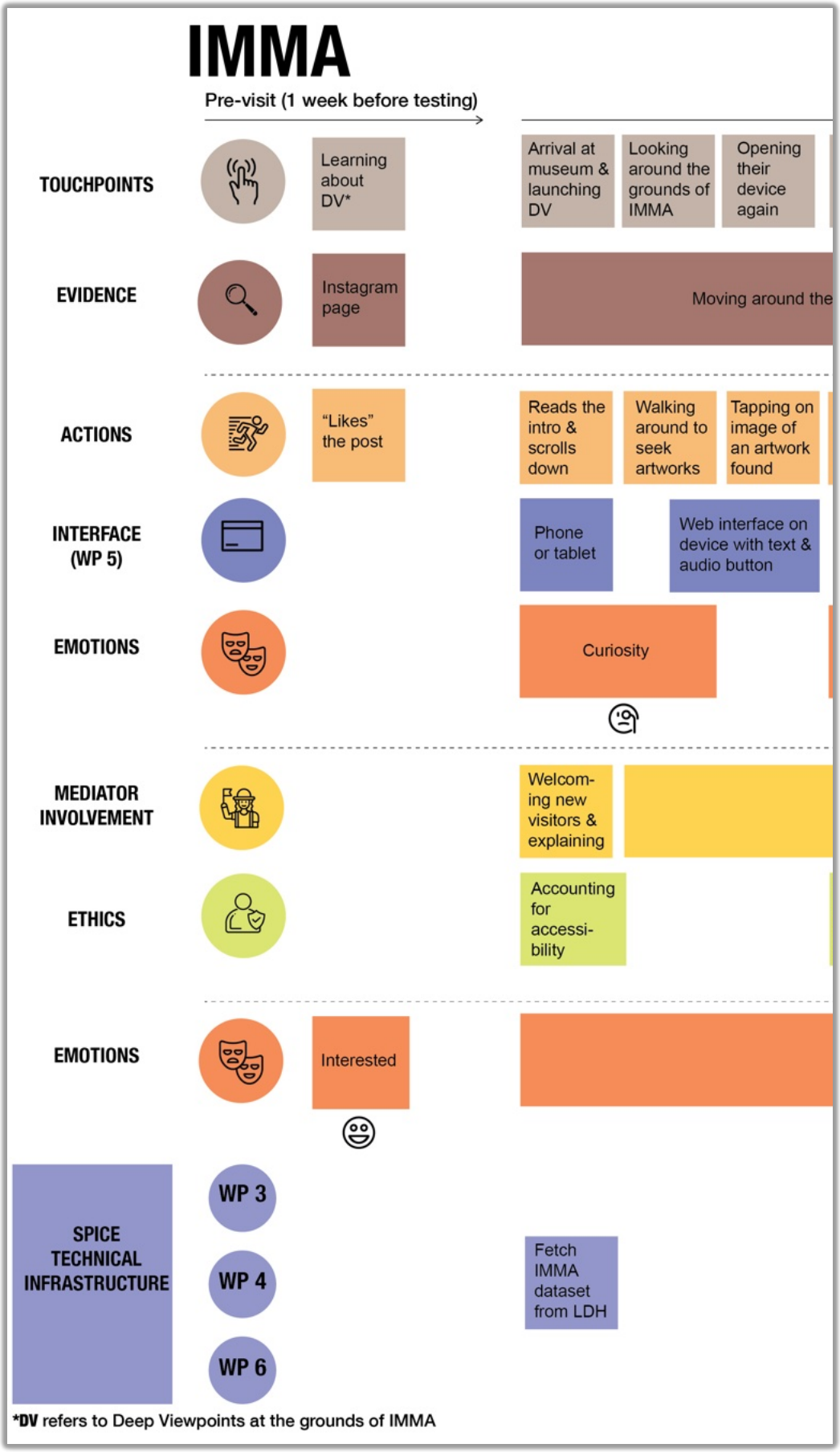

Fig.31: First half of the final service blueprint of the IMMA Case Study.

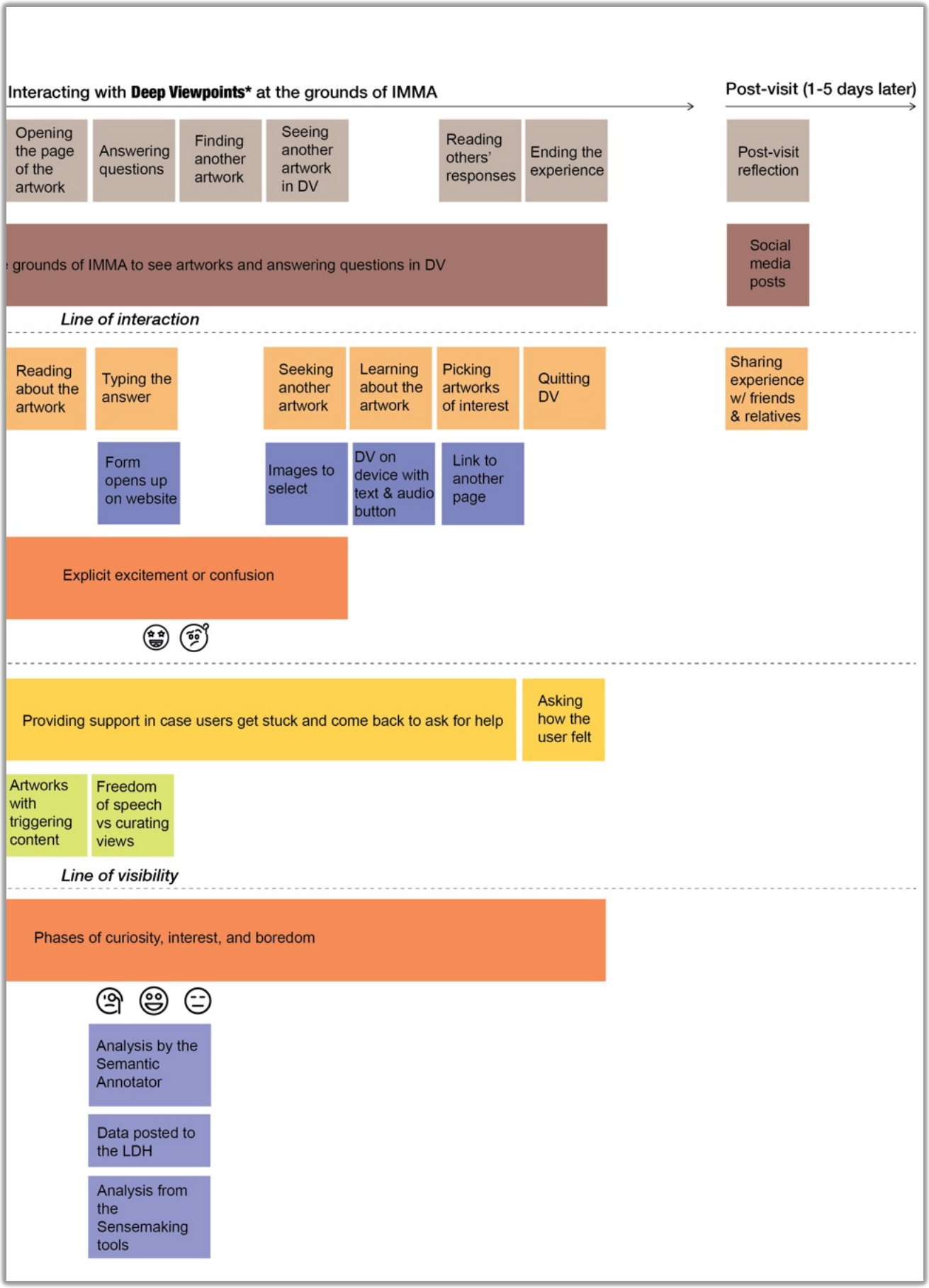

Fig.32: Second half of the final service blueprint of the IMMA Case Study.

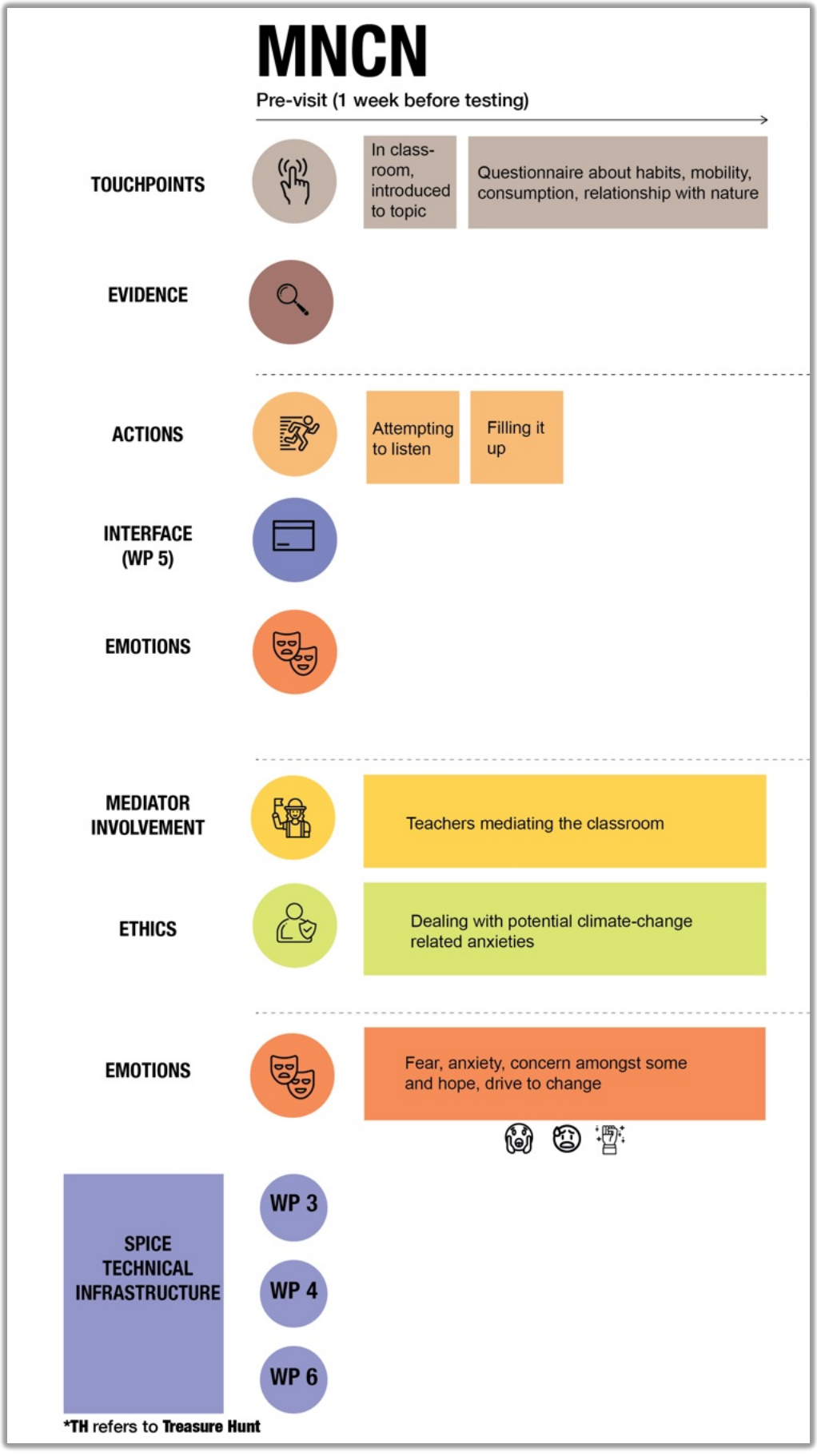

Fig.33: First half of the final service blueprint of the MNCN Case Study.

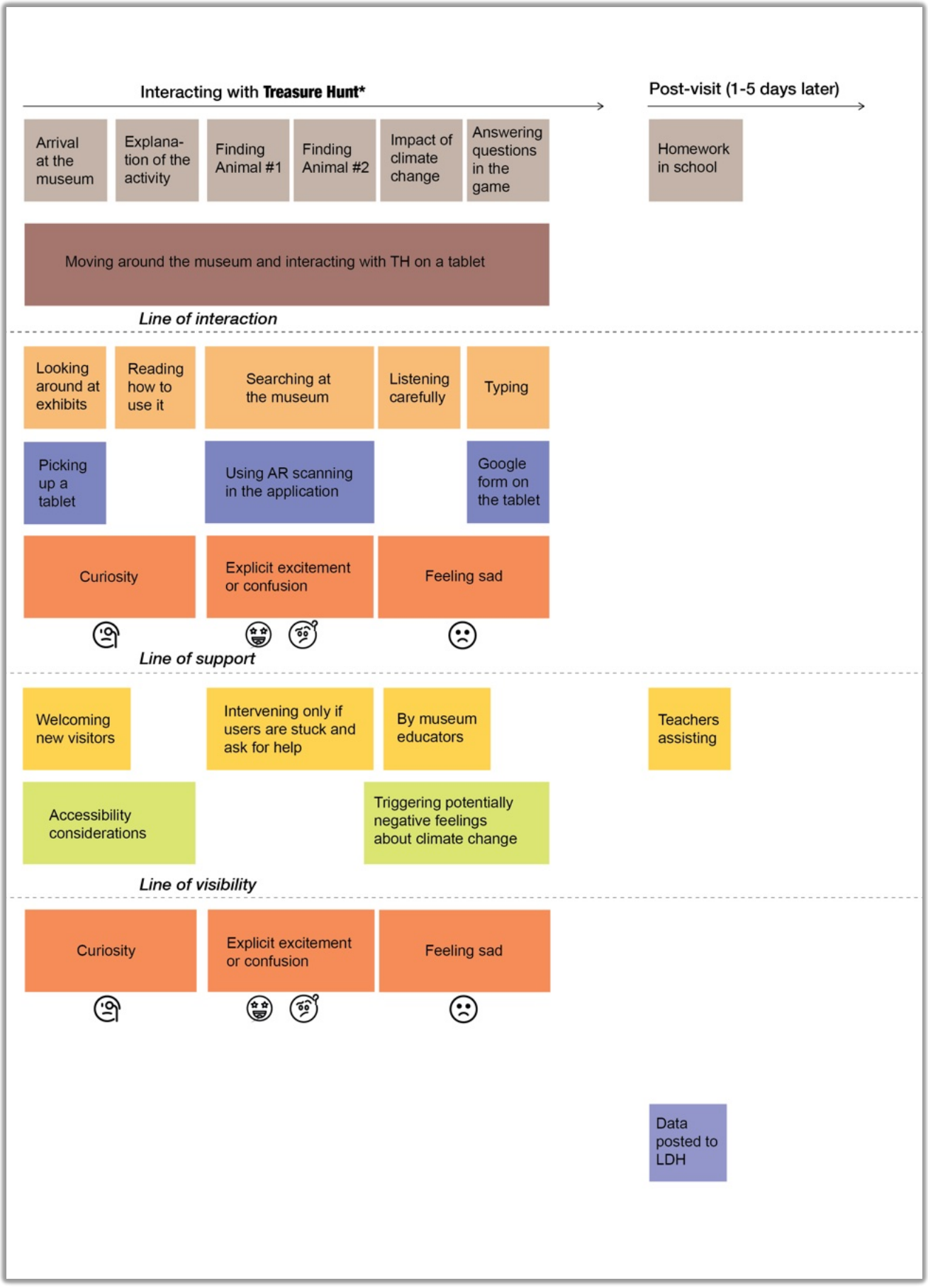

Fig.34: Second half of the final service blueprint of the MNCN Case Study.

4 – SPICE INFRASTRUCTURE IN EACH CASE

WP	Infrastructure	DMH	GAM	HECHT	IMMA	MNCN
WP2	Interpretation methods					
	Reflection methods					
WP3	User model					
	Community Modeller					
	Semantic Annotator					
	Recommender					
WP4	Linked Data Hub					
WP5	Pilot application interface					
	Curators' interface					
WP6	Value Reasoner					
	Thematic Reasoner					
	DEGARI					
	Scripting services					
WP7	User experience design					
	Service blueprints					
	Sociotechnical systems maps					
	Ethical considerations					

LEGEND

Green – Implemented or being implemented
Yellow – Ongoing finalization
Grey – No contribution required from WP

Table 11: Status of development of the SPICE infrastructure in each Case Study.

WP2

Interpretation and reflection loop (IRL)

WP2 has developed an integrated methodological toolkit to support interpretation and reflection in the Case Studies. Drawing on their previous workshops conducted with each Case Study, this toolkit provides methods and best practices that can be used by museums and cultural heritage institutions to engage with citizens and communities in sharing interpretations and perspectives. Overall, the aim of the toolkit is to promote mutual understanding across individual and communities thereby leading to social cohesion.

WP3

User Model

In SPICE, user models that represent the individuals interacting with the system are key elements used to guide the process of recommendation by taking into consideration their individual and community interests. The final user models along with descriptions of them in the Case Studies are provided to the consortium members and heritage institutions in Deliverable 3.3 – Final User and Community Models.

Community Modeller

Earlier in this report and previous deliverables, communities were categorized as EuCs, CoIs, and CoPs and this has been done from the perspective of engagement between museums and citizens. On the other hand, WP3 describes communities as "key elements to search and browse contents of interests, to identify similarities and differences across users and their contributions, to provide alternative interpretations of objects, to promote the social contagion among users and to emphasize the similarities and differences within and across communities" (p.7, Deliverable 3.3 – Final User and Community Models). Based on the data collected through user contributions, using clustering techniques, communities have been developed in DMH, GAM, HECHT, and MNCN Case Studies using UCM's VISIR (Visualization for Interpretation and Reflection) tool that enables museum curators to detect, visualize, and explain communities needed in the SPICE IRL model. Examples of community clusters are provided below in Fig.33 and Fig.34.

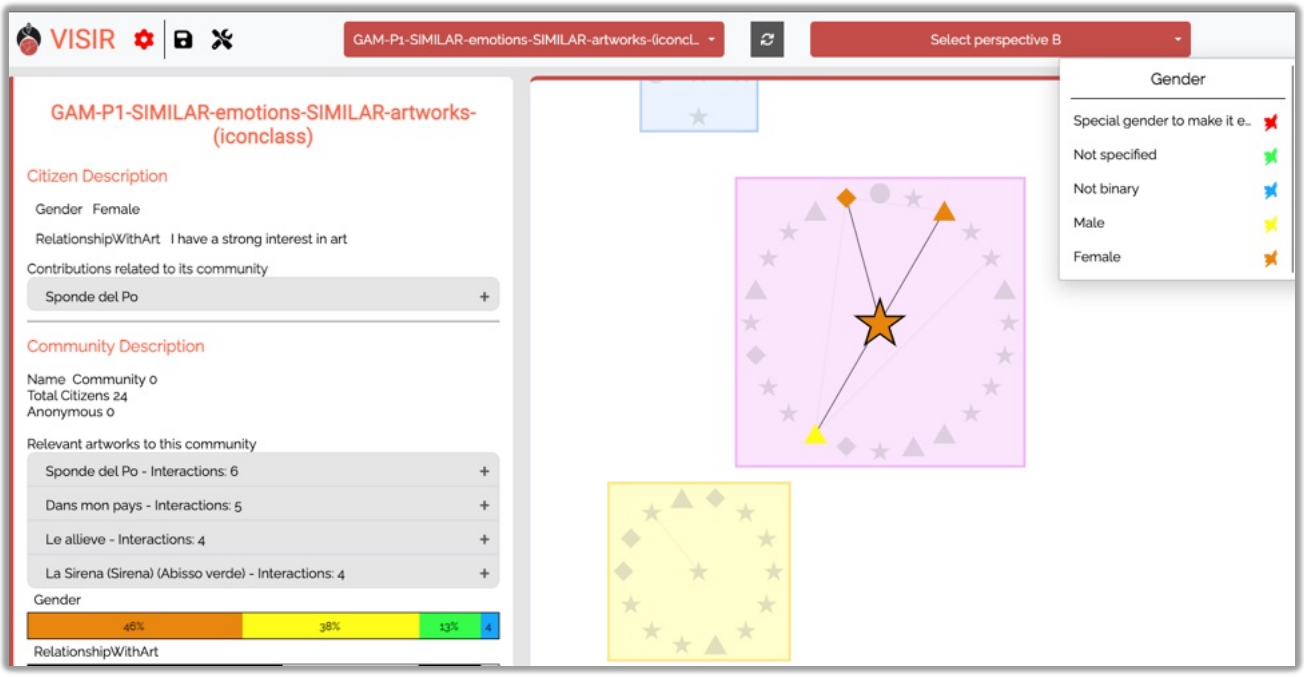

Fig.35: Community clusters based on similar emotions for similar artworks in the GAM Case Study. (Credit: UCM)

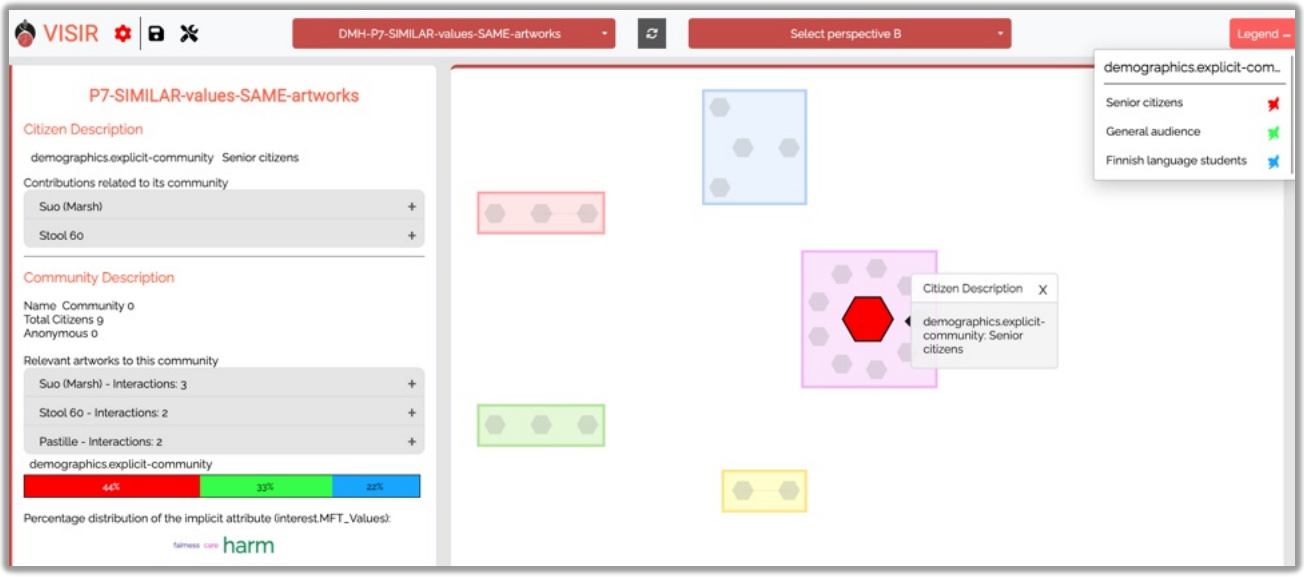

Fig.36: Community clusters based on similar values for the same artworks in the DMH Case Study (Credit: UCM)

Semantic Annotator

The SPICE Semantic Annotator (SSA) is a tool that analyses textual information from user contributions in the Case Studies to detect sentiments, emotions, entities, toxicity, and more. Recently, semantic annotation was carried out for the DMH datasets containing written stories and transcribed and translated audio recordings. These two datasets are stored in the LDH. An example of semantic annotation on a transcribed audio-recorded story in the DMH Case Study is presented in Fig.35 below. For more details on the Semantic Annotator, please see D3.4 – Final Semantic Annotator.


```
{
  "_id": "63738b53fb9758706e727878",
  "Object name": "Canister – Jerry",
  "Object number": "32030",
  "Date of recording": "22/03/2022",
  "Context/event/workshop": "Laajasalo",
  "Story ID(#)": "#32030S1",
  "Original language ": "Finnish",
  "Audio recording file name": "JERRY 2, Group recording, 22.3.2022, Laajasalo",
  "Start timestamp": "0:04",
  "End timestamp": "0:40",
  "English translation": "And I chose this Jerry canister because there may have been
juice, water, and gasoline in it. ",
  "Other language translation": "*",
  "emotions": {
    "Interest": 1
  },
  "sentiment": {
    "Positive": 1
  },
  "toxicity": [],
  "entities": {
    "dbr:Gasoline": {
      "@types": [
        "http://dbpedia.org/ontology/ChemicalCompound"
      ],
      "confidence": 0.99890906
    },
  }
}
```


Fig.37: Updated semantic annotation of a transcribed-audio recorded story in the DMH Case Study to detect emotions, sentiments, toxicity, and entities stored in the LDH. (Credit: HFarm)

Social Recommender
In their previous deliverable, D3.6 – Prototype Social Recommender, WP3 outlined the framework and technological infrastructure for the social recommender that provides content recommendations to visitors and users of the Case Study application with an aim of supporting social cohesion. Currently, based on the community models, the API for the Social Recommender is being developed and integrated across DMH, GAM, and HECHT.

WP4

Linked Data Hub
As stated by WP4 in D4.2 – Linked Data server technology, integrating feedback from use case requirements, the SPICE Linked Data Hub (LDH) "was developed as a data infrastructure to support the acquisition and management of dynamic data from a variety of sources including: museum collection metadata and digital assets, social media events and user activities, systems' activities (e.g., recommendations, reasoning outputs), ontologies and linked data produced by pilot case studies". Currently all the Case Studies are making use of the LDH, some require dynamic live calls to the LDH while others do not.

WP5

Pilot application and curators' interface
Initial implementations for integrated interfaces for citizen curation are described in WP5's final Deliverable 5.3 – Integrated Interfaces for Citizen Curation. This document provides a framework for reusable interface components named inSPICE containing a collection of templates for citizen curation activities. Here, curators and other citizens can instantiate and configure activities for users. In this report, inSPICE examples are provided for GAM, HECHT, and MNCN. The dashboard of inSPICE interface in the GAM Game is also discussed in D7.6 – Case Studies Fully Operational.

WP6

Value Reasoner
The Value reasoner is a tool representing and extracting moral, cultural, and personal values of a user in relation to artefacts in the Case Studies (D6.6 – Knowledge Based Exploration Support, p.18).

```
{
  "_id": "636c144a3f72b3416c26d2ed",
  "Object name": "Armchair – Paimio armchair 41",
  "Object number": "9249",
  "Date of recording": "27/09/2022",
  "Context/event/workshop": "Design Evening",
  "Contributor name": "Anonymous",
  "User ID": "747249",
  "End-user community": "General audience",
  "Comment ID (#)": "#9249C7",
  "Original language": "English",
  "Finnish translation": "Tämä tuoli näyttää väsyneeltä, koska ihmiset istuivat sen päällä.
Näyttää siltä, että se haluaa vapautua sen päällä istuvista ihmisistä.",
  "English translation": "This chair looks tired because people kept sitting on it. It
looks like it wants to be free from people sitting on it.",
  "Swedish translation": "Den här stolen ser trött ut eftersom folk fortsatte att sitta på
den. Den ser ut som att den vill vara fritt från folk som sitter på det.",
  "Other language translation": "*",
  "Additional info": "*",
  "_datasetid": "5f9f3f35-f36a-4e99-8180-f33988182bc7",
  "_timestamp": 1669805790,
  "_timestamp_year": 2022,
  "_timestamp_month": 11,
  "_timestamp_day": 30,
  "_timestamp_hour": 10,
  "_timestamp_minute": 56,
  "_timestamp_second": 30,
  "MFT_Values": [
    "liberty"
  ],
  "EkmanEmotions": []
}
```


Fig.38: An example of the value “liberty” extracted from a written story in the DMH Case Study. (Credit: UNIBO)

Thematic Reasoner

The Thematic Reasoner is a tool detecting themes from a collection of entities such as artworks or stories (D6.6 – Knowledge Based Exploration Support, p.14).

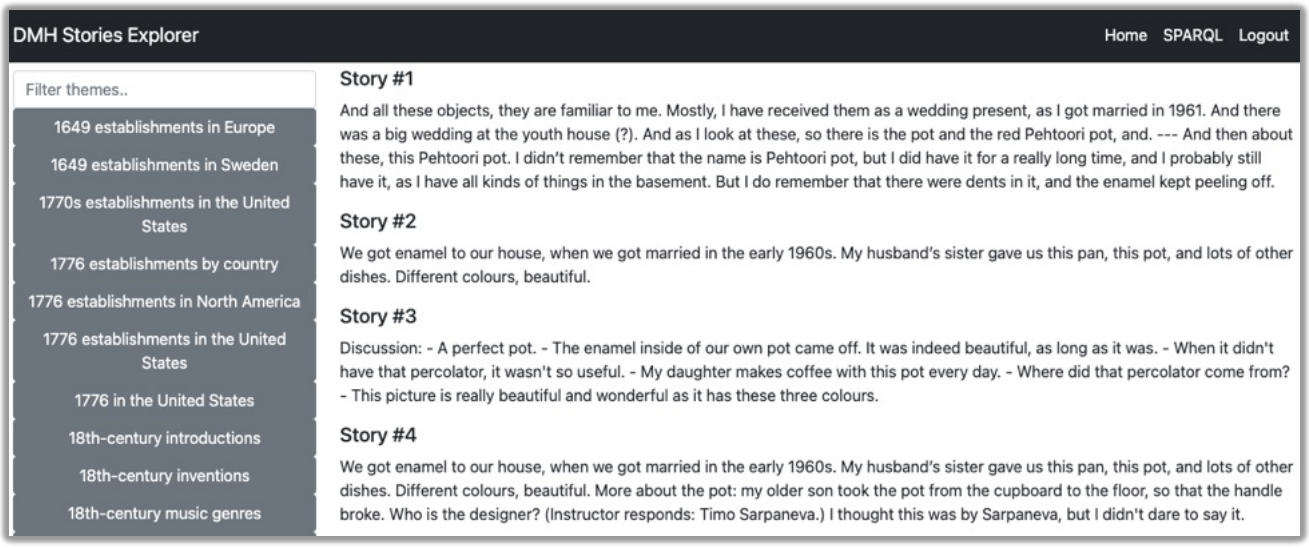

Fig.39: An example of the Thematic Reasoner filtering stories around the theme *Ceramics* in the DMH Case Study. (Credit: UNIBO)

DEGARI

The DEGARI framework "allows one to describe and reason upon an ontology with common sense (i.e prototypical) descriptions of emotional concepts, as well as to dynamically generate novel prototypical concepts in a knowledge base as the result of a human-like recombination of the existing ones" (D6.6 – Knowledge Based Exploration Support, p.2).


```
{
    "caption": "Vase – Aalto vase",
    "dc:description": "It was my mother's finest object. She would never have had the
opportunity to buy it herself, but she received one as a present for her 50th birthday."
    "degari_extracted_emotions": [
      "Love",
      "Pride"
    ],
    "plutchik_emotions": {
      "anger": 0,
      "anticipation": 0.4807692307692308,
      "disgust": 0,
      "fear": 0.19230769230769232,
      "joy": 0.576923076923077,
      "sadness": 0.38461538461538464,
      "surprise": 0.2884615384615385,
      "trust": 0.38461538461538464
    },
    "emotion_recognition": "enthusiasm; joy",
    "concept_parsing": "['goods'; 'finest'; 'opportunity'; 'buy'; 'receive'; 'present';
'birthday'; 'died'; 'vase'; 'home'; 'collection'; 'design'; 'realize'; 'brought'; 'mess';
'joy'; 'sorrow']",
    "subjectivity_detection": "SUBJECTIVE",
    "polarity_classification": "POSITIVE",
    "intensity_ranking": "0.75",
    "aspect_extraction": "['goods']",
    "personality_prediction": "O↓C↑E↑A↑N↓",
    "depression_categorization": "0%",
    "toxicity_spotting": "0%",
    "@id": "63738b79461cf10d8073bc9a"
}
```


Fig.40: An example of DEGARI analysis carried out on a transcribed audio-recorded story in the DMH Case Study. (Credit: UNITO)


```
{
  "_id": "35567",
  "ref_id_artist": "31",
  "dateOfModify": "2018-04-17 17:01",
  "title": "Orange Car Crash (5 Deaths 11 Times in Orange) (Orange Disaster)",
  "@type": "schema:CreativeWork",
  "inventary": "",
  "collection": "Novecento – primo piano",
  "author": "Andy Warhol",
  "year": "1963",
  "materialAndTechnique": "serigrafia su acrilico su tela",
  "dc:source": "Acquisto dalla Galleria Sperone, Torino, 1967",
  "image":
"https://www.gamtorino.it/sites/default/files/opere/Warhol%2COrange_Car_20130403102126.jpg"
,
  "dc:description": "At the end of the 1950s, Andy Warhol, who had been devoted to painting
for a few years in parallel with his activity as an advertising designer, was thunderstruck
by the New Dada of Jasper Johns, Robert Rauschenberg and the first Pop vaguities. ",
  "dc:lang": "en",
  "Note Blind": "",
  "degari_extracted_emotions": [
    "Disgust"
  ],
}
```


Fig.41: An example of DEGARI analysis carried out on the description of an artwork in the GAM Case Study. (Credit: UNITO)

StoryID	DEGARI extracted emotions	How did the previous story make you feel? (Select multiple)							
		Delight 🥰	Love 😍	Joy 😄	Optimism 😊	Hope 😌	Curiosity 🤔	Disapproval 😔	Anxiety 😟
#32030S1	Optimism				1		1		
#32030S3	Love		1					1	
#41768S15	Joy			3					
#41768S2	Delight	2	2	1					
#41793S6	Love	2	2						
#44163S2	Delight	3		1					
#44165S1	Love	1	4						
#44165S3	Delight	1			1				
#44165S7	Love, Hope		1						
#8182S6	Joy								
#C370S1	Love	3	1						
#C370S3	Hope	1			1				

Table 12: Comparison between DEGARI extracted emotions for transcribed audio-recorded stories in the DMH Case Study and user-annotated emotions after listening to the same stories in the Pop-up VR Museum.

Scripting services

An end-user interface for scripting citizen curation activities is described in D6.7 – Curation Scripting Support with several examples in the document showcasing the authoring tools for IMMA Deep Viewpoints. This framework is currently applied to the DMH case study content from the Pop-up-VR Museum using the object classification from the LDH and an example of it is presented in the next page in Fig.40.

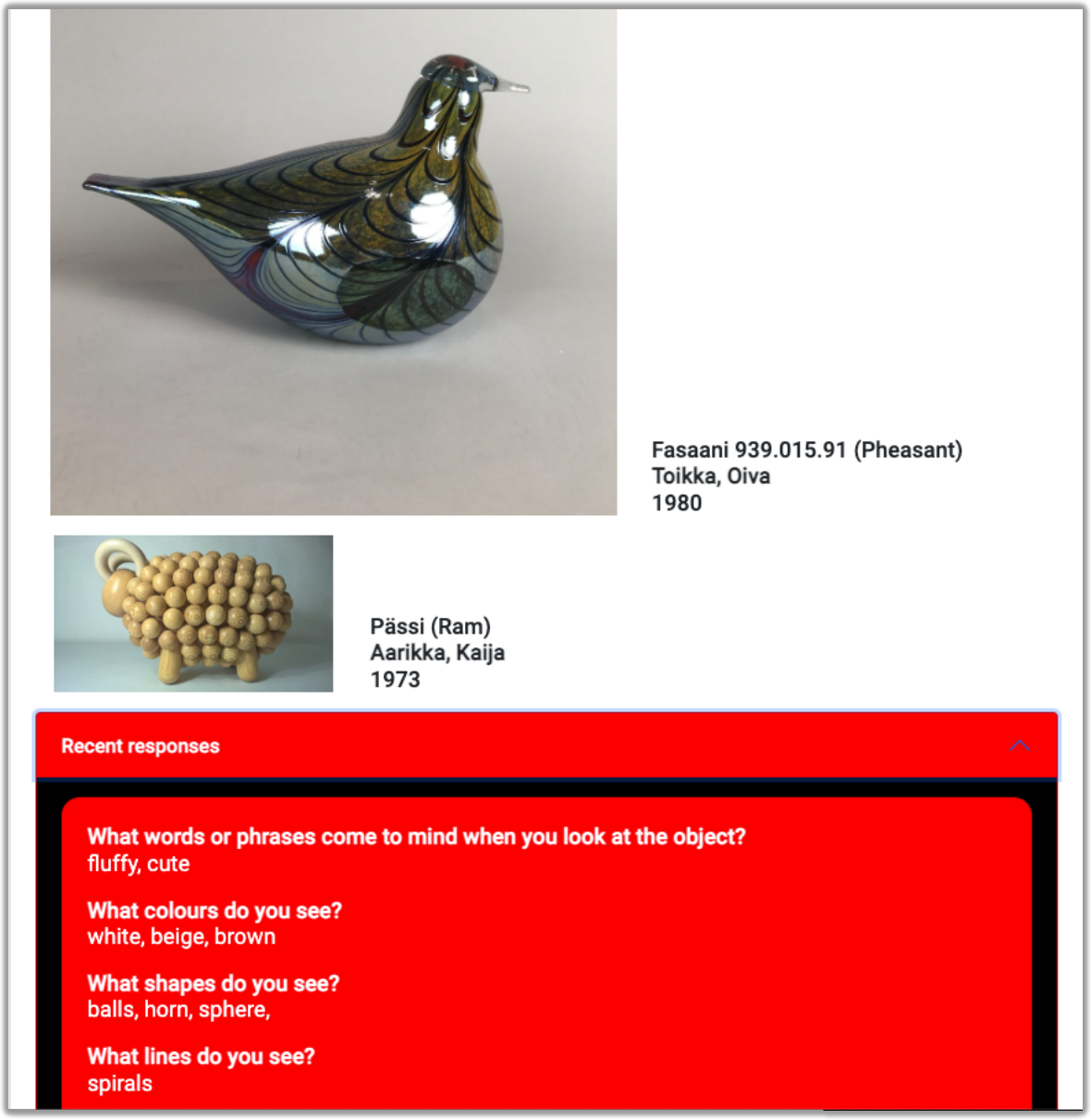

Fig.42: An example of the authoring tool used for IMMA Deep Viewpoints applied to the Pop-up-VR-Museum selection of the DMH collection. Here the curators of activity can see user responses to questions linked to specific objects. (Credit: OU)

WP7

User-experience design

User-experience (UX) was previously defined within the context of SPICE as in D7.1 – Evaluation Methods Protocols as "an end-user's interaction with front-end tools in order to foster engagement and reflection" (p.33). Due to considerations for social cohesion, participation and inclusion, a meaningful UX would also consider fulfilling engagement and fostering equality (see D7.1 – Evaluation Methods Protocols, p.33). The UX and customer journey maps have been visualized in elaborate details in D7.5 – Case Studies Progress and Plan and D7.6 – Case Studies Fully Operational.

Service Blueprints
The theoretical framework for the service blueprints of all the Case Studies has been described in D7.6 – Case Studies Fully Operational. The final ones are visualized in the previous chapter – Final Service Blueprints.

Socio-Technical Systems
The framework for the socio-technical roadmap has been described in D7.2 – Socio-technical Roadmap with Project Management Tool and an initial version of the STS map of all the Case Studies has been presented in D7.4 – Socio-technical Roadmap with Project Management Tool. The next chapter *Final Socio-technical Systems Map* presents result of the complex dynamic interplay between the social and technical components of each Case Study.

Ethical considerations
The deliverable report from WP9 (D9.8: GEN – Requirement No.19 Second Report of the SPICE Independent Ethics Advisor) available only to the consortium members examined the initial methods for interpretation and reflection and highlighted potential issues of bias from research practices selected due to remote collaboration during the COVID-19 pandemic. Further on, focusing on the Case Studies, the report describes the nature of informed consent, anonymization/pseudonymization, data processing, data transfer, profiling, human participation in Case Studies, and potential bias. Based on this, recommendations were provided, and several meetings were conducted in the consortium to discuss it.

In D7.6 – Case Studies Fully Operational, questions regarding the topics for ethical consideration were provided to members each Case Study. Tabled comparisons of individual Case Study museums' responses to the questionnaire have been categorized and is available to the consortium members here. The individual responses are also available in the same project SharePoint folder. Based on all the responses, it is worth noting that each Case Study faces unique challenges with regards to privacy, anonymity, accessibility, inclusivity, transparency, and more, however, all the Case Studies have thoroughly taken ethical aspects into consideration.

5 – FINAL SOCIO-TECHNICAL SYSTEMS MAP

The Socio-technical system (STS) in SPICE is the complex interplay between social and technical components in a Case Study. To achieve citizen curation in the Case Study museums, the STS needs to balance the needs of people and technology within the museum. The theoretical foundation for STS in the context of SPICE has been described elaborately in the earlier deliverables which have also provided the first iteration of the STS maps of the Case Studies (D7.2 – Socio-technical Roadmap with Project Management Tool and D7.4 – Socio-technical Roadmap with Project Management Tool). While both service blueprints and STS are useful for analysing complex dynamic systems, service blueprints focus specifically on the service delivery processes and improving user experience, whereas sociotechnical systems maps take a higher-level systems-thinking approach to understanding interactions between social and technical systems as well as their potential impacts. The final maps of each Case Study are shown in this chapter. Each of the Case Studies has a synopsis indicating: 1. Activity particular to the system design created for each museum institution; and 2. Brief description of ethical issues that might be encountered.

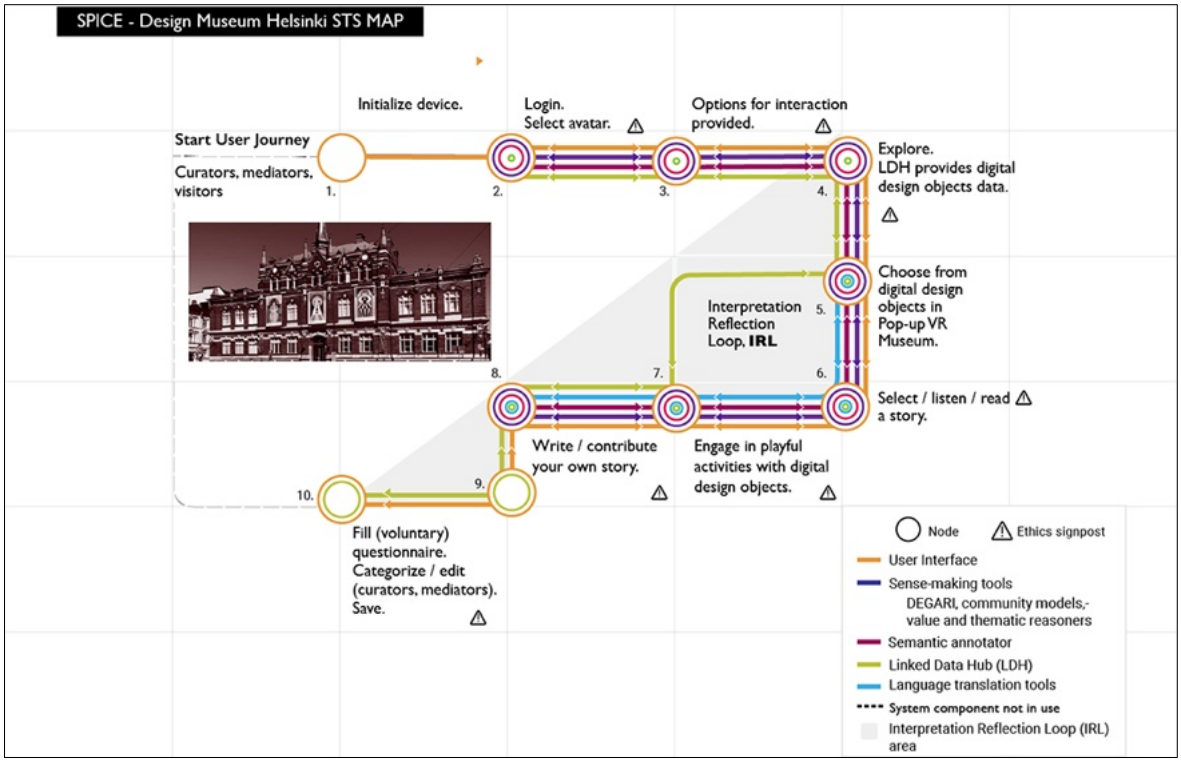

Fig.43: Design Museum Helsinki's interaction with the system features a virtual reality, Pop-up-VR Museum and a multimodal experience involving interaction through avatars with 3D digital replicas of the collection.

Exploring the digital design objects collection and the stories that accompany them is the main activity supported by the Pop-up VR Museum, the SPICE application developed by Aalto University and Design Museum Helsinki in Finland. The main target groups involved in this case study were Senior Citizens as well as Asylum Seekers. Mediators involved have included a variety of professionals from health care providers to language teachers. Very careful procedures, including signed consent forms and keeping of special directories, have been followed to make sure that all personal data gathered follows GDPR compliance.

Ethics signpost included throughout the map highlight potential ethical issues. For example, the tasks included in the user journey, including the Login (2-3) keeps the identity of the interactant anonymous. Nevertheless, if there is a surveillance camera system included in the museum space where the system is deployed, it would be possible to link data gathered to a specific individual's interaction.

The interaction with the VR application occurs while one is sitting and is supported by a table (3-4). This design parameter aimed to make the experience more amenable to individuals with mobility issues. It also anticipated the problematics inherent with motion sickness and virtual reality. Nevertheless, this accommodation did not preclude an adverse reaction to the experience of immersion. Indeed, as has been noted, a percentage of interactants experienced such discomfort.

Exploring the Digital Design Objects Collection (4-5) in the DMH Case Study begins a reflection loop in which the interactant possibly engages in self-contemplation: Which object to choose from the available options? It might be difficult to anticipate how the subject would react and whether this would always be pleasurable experience. An **ethics signpost** is here to indicate the possibility of a negative experience. The next stage of the user journey (5) possibly involves a re-focusing from the inner dialogue to an external and material, artefact-oriented reflection. Here the subject might engage in browsing through different items the collection.

At point (6) the interactant has perhaps already become familiar with the different items in the collection. Once again, there might be a refocusing of the subject's reflective capabilities. Here the interaction features listening to other people's personal stories in relation to the objects in the collection. What feelings and thoughts might these shared memories elicit in the listener? Empathy? Agreement? Divergence? Since the community models are also active, will they be *nudging* the subject towards making certain choices? This is one of the reasons why an **ethics signpost** has been included in this quadrant.

The playful interaction enabled between (6-7) involves the manipulation of the objects' scales. This can be a lot of fun. For example, you can dive inside the big pot or become a small entity inside a cup. For some however, this might trigger symptoms of motion sickness or even inspire fear. An **ethics signpost** indicates that care should be taken at this point in the experience. Between (7-8) you are enticed to write your own story. But the current mechanism used to enter your text, which involves typing on a virtual keyboard, is not necessarily easy to use. This brings up questions regarding accessibility and inclusiveness. This is why yet another **ethics signpost** is lodged in this quadrant. Finally, between (9-10) you are invited to complete a voluntary questionnaire or perhaps engage in a semi-structure interview with the curator. This third part of the loop also involves the curators and other support personnel. The tasks carried out here involve categorization and saving of content created throughout the experience. The **ethics signpost** here signals the care that must be taken to avoid legal issues when dealing with personal data.

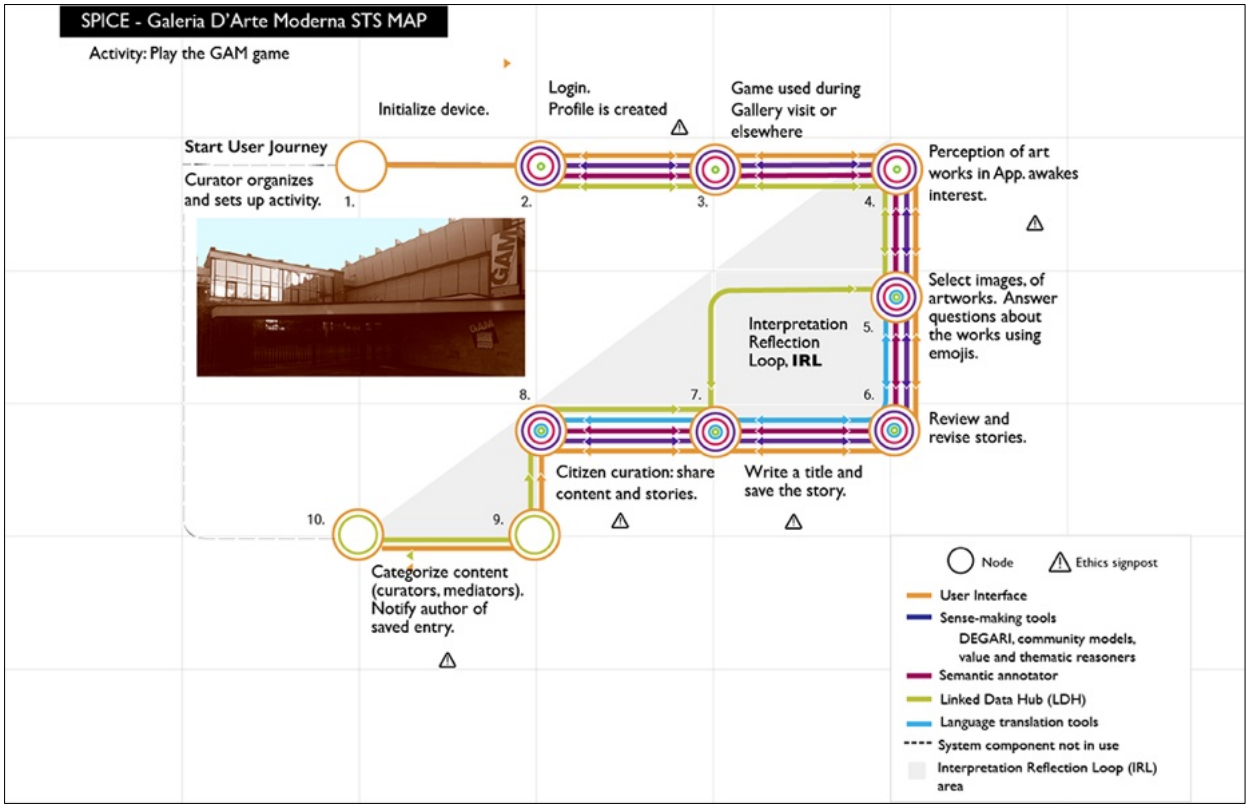

Fig.44: Galleria d'Arte Moderna uses GAM Game, a mobile game application, to enable online and onsite visitors to reflect, create and share stories about their emotional responses to a selection of the Museum's collection.

Playing and reflecting about your emotional responses to artefacts of contemporary art at Galeria D'Arte Moderna is the main activity in the GAM game, the SPICE system developed by UNITO in Turin, Italy. The main target group has been deaf individuals (youngsters) participating in activities organised together with the Deaf Association.

The GAM game is a mobile phone application that can be used as part of your visit to the gallery or elsewhere. It is the curator who sets up the application and selects the works to be included. As you login, a profile which remains anonymous, is created. At (4) the first loop in the Interpretation Reflection Loop (IRL) is triggered. Here the subject's attention turns towards perceiving the works of art, which in this case are primarily paintings displayed in the mobile device screen. The response might possibly be quizzical, even puzzling. Does the subject find them appealing and interesting to warrant further engagement? This is why we place an **ethics signpost** at this location.

At the next step (5), the subject engages in the second reflective loop that involves describing the feelings elicited by the works. Emojis that correspond to emotions ("Happy") can be selected by the interactant. Comments about the responses can also be added and these can accrue and be used to complete a story.

In (6-7) the interactant can save and add a title – which can further expand or restrict – possible interpretations of the story. In (7-8) stories can be shared. **Ethical signposts** are added here indicating that the contents created should be checked to establish whether there are toxic elements present. Finally, an automatic notification indicates to the subject that the story has been successfully saved. The contents created can be categorised and studied by the curator, during the third part of the IRL loop instantiated by the system. S/he might infer that certain artworks are

preferred more by some implicit online communities and less by others. Will this affect her future choices, making them perhaps less serendipitous? Because of this possible curtailment of free thinking, we have placed an **ethics signpost** at this location.

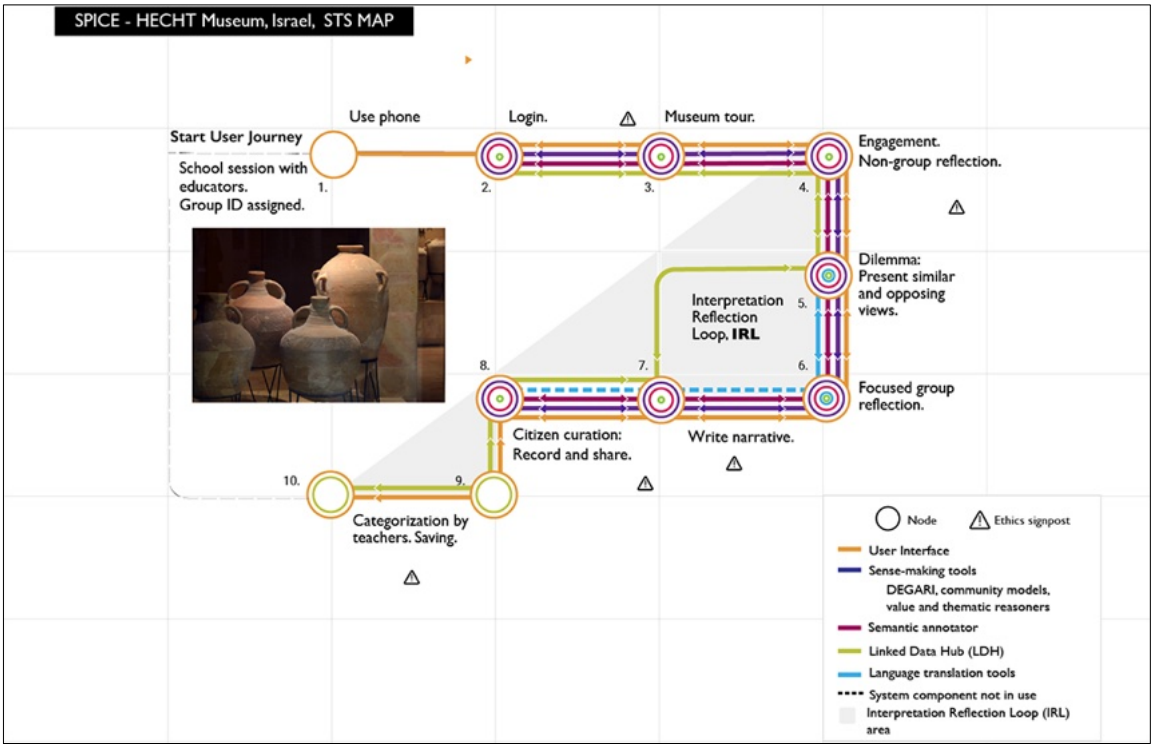

Fig.45: School educators work with Hecht Museum's Case Study developers in promoting inquiry, reflection, and interpretation about political conflict through narratives and encounters with artefacts in the museum's collection.

Using artefacts from a museum exhibition and writing narratives after reflecting about opposing arguments presented is the main activity carried out in HECHT Museum case study realised by University of Haifa. The main target group is youngsters from diverse religious and political backgrounds.

The case study has developed a mobile phone application to support the activity which begins with a school session organized in collaboration with the educators and prior to the museum visit. In this session, group IDs are assigned. Knowledge about the Galilee campaign – Northern Revolt which occurred in 67 AD – is presented and discussed in groups. Later, during their visit to the museum in (4), the student will engage in both individual as well as group reflection with material artefacts from that time. For example, the large sized replica of a catapult on the museum floor shown in image 14 is an indication about the practices of warfare during the Roman empire.

Perhaps this first step in the interpretation reflection loop might prompt a reassessment of the interactant's position. However, whatever opinion s/he might have formulated will be contested during the second instance of the loop in (5), when the knowledge space is broadened through a presentation of opposing views. Such critical form of reflection is followed by a focused group reflection in (6). The results of this stage are recorded (in writing) and shared. Login to the system is anonymous. Nevertheless, **ethics signposts** have been placed in (3) and (4) to highlight the possible need for a moderator to manage and curate the content created. Similarly **ethical signposts**

have been included in (6-8) to indicate possible polarization and presence of conflicting points of view among the students. The need for empathy and fostering of conciliatory discourse should be underscored. The narratives created as part of the third stage of reflection are categorized and saved by the teachers (9-10). An **ethics signpost** has been placed to indicate the importance of privacy and safeguarding such personal narratives.

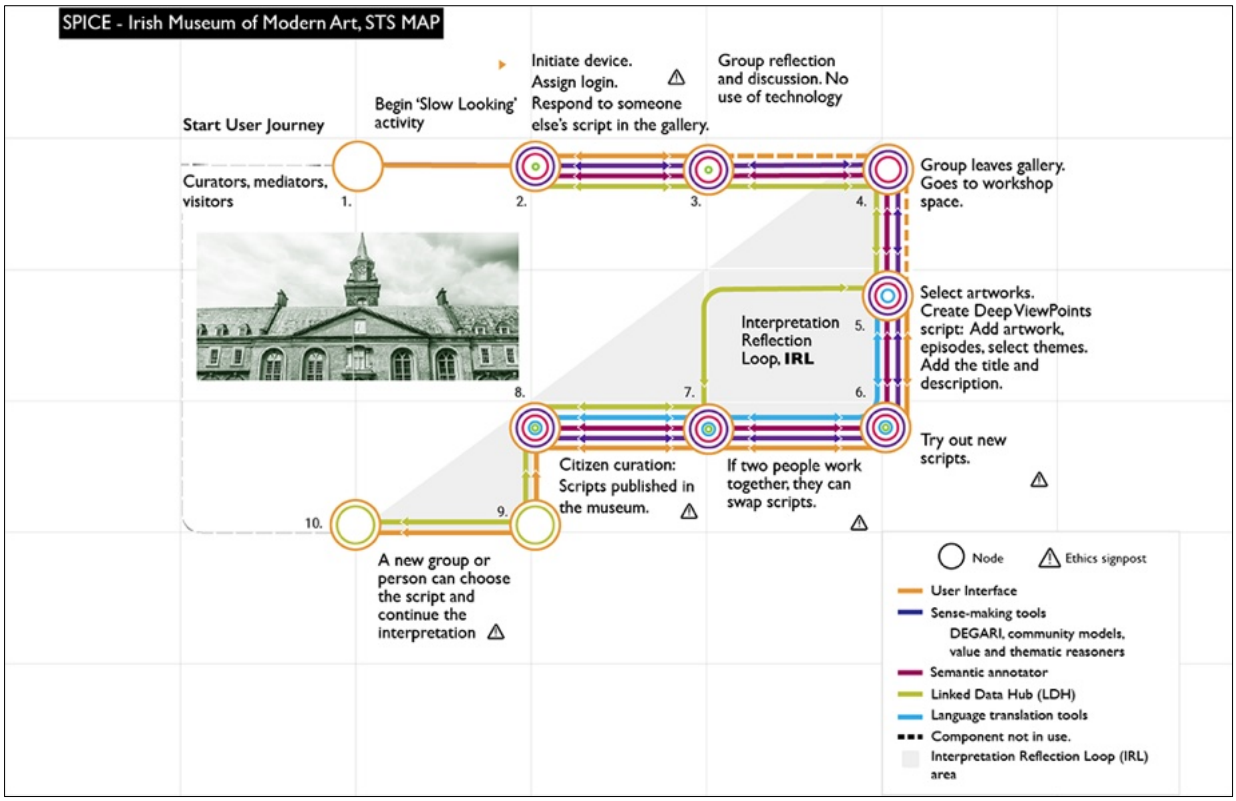

Fig.46: Diverse community groups come together in the Irish Museum of Moderna Art to explore, reflect, and re-interpret contemporary art in the context of present-day societal issues, including identity.

To explore different ways in which art can be appreciated is the main activity featured in the Irish Museum of Modern Art (IMMA) case study. This activity is supported by a "Slow Looking" approach which advocates unhurried, reflective examination of artworks, and the Deep Viewpoints application that enables interactants to create text scripts and other shareable content such as stories and narratives.

The interactant begins her/his journey through an initial encounter with 'Slow Looking' action (1-2). A group login, that remains anonymous, is assigned. There is the opportunity to browse through materials gathered in previous workshops and respond to someone's else's script. An ethics signpost has been placed here since there exists a possibility that via recordings from the gallery a link between the data and an actual person can be made (2-3). A stage of group reflection involving discussion and in which no technology is used (3-4), follows these actions. This is the first turn of the interpretation reflection loop (IRL) in the IMMA case. The group moves from the gallery to the workshop space (4-5). Here they create a script using the Deep Viewpoints application. They select artworks and organise them into stages and themes and to complete the work, they add the title and a description (5-6). They try out the new and possibly swap scripts (6-7). This might be considered the second turn of the IRL loop. How do the different members of the group react? Does

the completed work demonstrate social cohesion or the opposite, polarization? Considering how this situation might make some people feel vulnerable, we have also placed an ethics signpost here.

Citizen curation happens next (7-8). Here scripts are published and shared in the museum. How might someone feel about this sharing, if they have invested their own emotions into the creation of this work? An ethical signpost has been placed to indicate this possible vulnerability. In (9-10) a new person might choose the script and continue with the interpretation. The third turn in the IRL can be discerned here in a new beginning.

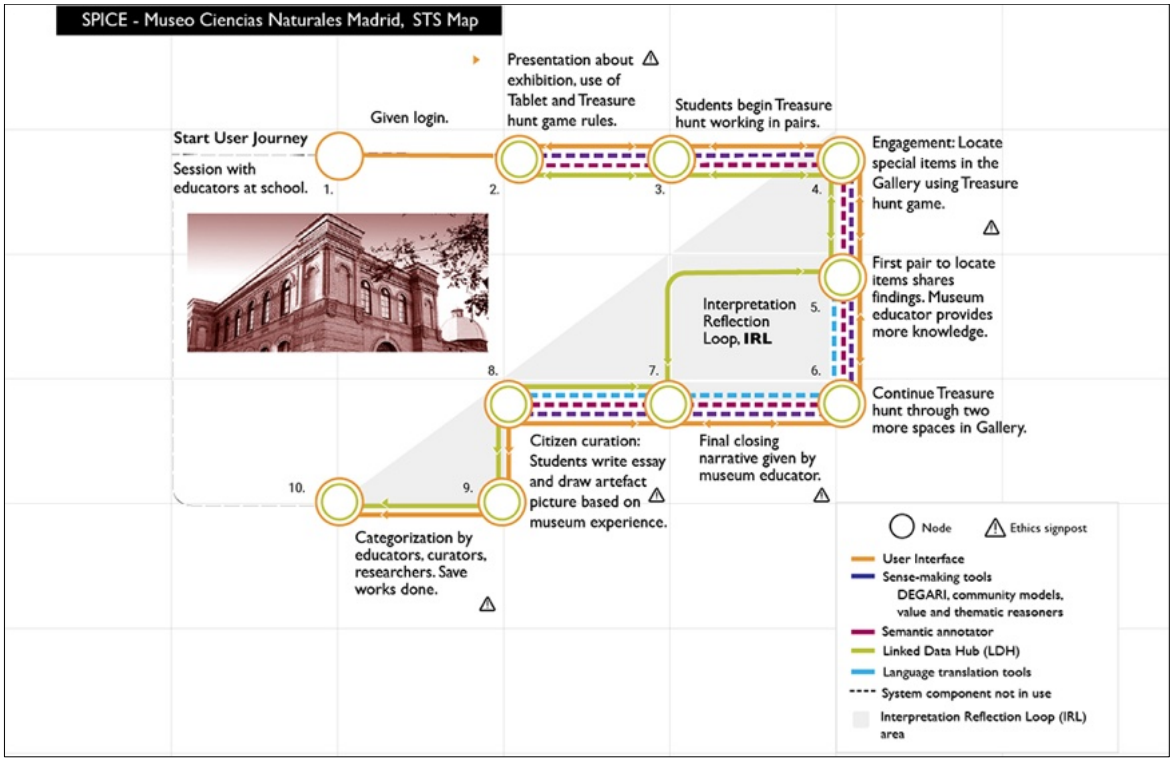

Fig.47: Educators, curators and game developers work with SPICE system to develop a Treasure Hunt activity that uses artefacts from the Museum's collection to promote exploration, reflection, and interpretation of current ecological and sustainability issues.

Participating in a Treasure hunt in which you learn about complex topics such as climate change, evolution, extinction, and sustainability is the main activity for the Museo de Ciencias Naturales Madrid (MNCN) case study. For participants in MNCN the activity begins with a preliminary school visit and session with the educators. The session is planned and scheduled. Students are given a presentation about the contents of the exhibition and the workings of the Tablet and the application. They are asked to demonstrate that they know how to use it and then they are released in the Gallery (2-3). An **ethics signpost** is placed here to indicate whether there might exist special issues with the students participating. For example, some parents might not be willing to sign the consent form which allows for the hunt to be photographed. Other students might have pressing religious issues: What if a student does not believe in evolution?

In (3-4) and working in pairs, students begin the Treasure hunt. Between (4-5) they roam in groups throughout the first section of the gallery and using the Tablet search for the specimen that will provide an answer to the question or 'riddle' asked. As shown in Fig. 20, the first pair to locate the

items gets to present their findings and share their thoughts with the rest of the group in the summary session called by the Museum educator. This is the first turn in the IRL loop (5) for this case and it is carried by the children on their own following the rules of the Treasure hunt. In general, everyone will become involved and follow. However, what happens when a group of students does not get along? To highlight this possible risk, we have placed an **ethics signpost** at this spot.

During each summary session that take place three times before a concluding presentation, the museum educator provides knowledge using the specimens and artefacts in the hall to illustrate the concepts and 'information nuggets' presented. Between (6-7) as a final narrative s/he presents the sad story of the extinction of the Thylacine, a Tasmanian marsupial that became extinct. This is then contrasted with the successful story about the renewal of the Iberian Lynx a specimen which has been literally brought back from near extinction. The students' level of attention is at this point very high. After this they are still allowed to roam free in the Gallery. Citizen curation (7-8) occurs outside the Gallery when each student hands in a written essay about their experience that also contains a hand drawn picture of a specimen from the Museum. The works are gathered and classified by the educators who also share them with the museum educators and researchers (9-10). An **ethics signpost** is included here to note about the responsibility for saving the materials created by the students which some might consider valuable, and which might also contain highly personal observations.

6 – OUR REFLECTIONS AND DISCUSSION

The use of co-design in the project

Throughout the project and in the spirit of participatory design, we have wanted to focus on processes instantiated through the Case Study activities and how they brought together a wide variety of actors and professionals. From the developers and designers of digital applications, as well as other experts connected to the selected target groups, a multiplicity of Communities of Practice (CoPs) and Communities of Interest (CoI) converged within the museum space. In DMH, close engagement with senior citizens and asylum seekers in workshops made it possible for sharing their personal stories about design and cultural heritage. These encounters enabled co-designing accessible inclusive digital experiences. The workshops in GAM involved several focus group sessions of 15-20 participants and the museum professionals felt that this was a right amount for the participants to express and share their opinions while not monopolizing conversations. The Rebellion activities at the Hecht Museum in the Haifa Case Study were co-designed by researchers, history education professors, and university students through bi-weekly meetings throughout the course of the SPICE project. Researchers at IMMA on the other hand felt that the term "co-design" is often misused and rather considered the use of terminology such as "responsiveness", "dialogue", "collaboration", "iterative design", "bootstrapping", and "community-lead" for their workshop activities which involved plenty of "co-curation" with communities rather than only "consulting" with them. IMMA was also constantly tweaking and adapting different approaches without using a fixed "scientific" template for research and other museum activities. Meanwhile, researchers at MNCN emphasis have been on co-designing Treasure Hunt activities with museum educators. Although, these Treasure Hunts were tested with schoolchildren, it was not seen as explicitly co-designing with them, rather the schoolchildren's feedback and opinions were collected to improve the design of their application.

The concept of citizen curation

The term "citizen curation" is relatively new, but the underlying ideas behind it have been developing for several decades. It is connected to a shift towards more collaborative and participatory approaches to museum curation embraced by many museums to increase their relevance and societal impact. The concept of citizen curation emerged in the early 2000s, as museums turned more and more to explore citizen participation and involvement. In SPICE the concept refers to the use of technologies being developed to help communities select paintings, artefacts, and other museum objects and share their interpretations with others thereby enabling citizens to learn more about themselves and develop a better understanding of as well as empathy for other communities.

In the context of the current research, it is interesting to ponder what, where and how citizen curation is carried out in each of the Case Studies. The DMH Case Study has been examining the ways how citizens connect to design heritage and how they react to other people's views and stories about it and this process has taken place during the story collection process in workshops and while participants are experiencing the Pop-up VR Museum. In GAM, citizen curation is seen as a broad terminology in which the process of co-design is a part of. The most relevant aspect of the project

is that under the label of citizen curation, a specific audience was selected. The HECHT Museum sees citizen curation as a series of steps which includes: i) exhibition of their opinions, ii) collecting photographs, iii) collecting artefacts and telling stories, iv) using artefacts to create own stories, v) creating stories with different perspectives, vi) enabling students to create their own narratives. Meanwhile, IMMA and DMH find the term "citizen" to be problematic especially because both Case Studies have been engaging with several non-citizens such as asylum seekers. Rather, IMMA uses the term "civic engagement" which is focused on actions and processes that take place rather than on the noun "citizen". Technology in these Case Studies is seen as secondary and a useful tool to aid broad engagement with communities. Lastly, MNCN would wish to go further with citizen curation after the project has ended, envisioning that teachers would be using the technological framework in SPICE to create several Treasure Hunts for students. Citizen curation here could be fulfilled to its full potential.

On the ethical considerations

All the Case Studies have been very careful to take the necessary steps to be privacy compliant according to GDPR, protect personal data, and anonymize data whenever required (D7.6 – Case Studies Fully Operational).

DMH

The Museum has considered ethical aspects very carefully and managed it in relation to privacy, anonymity, accessibility, inclusiveness, potential harms, and more. However, even after the SPICE project comes to an end, the ethical aspects still require careful consideration. For example, the narrative content collected from citizens challenges the standard documentation processes previously in use in DMH. Archiving the material, thinking about the ownership rights of the donors of the stories, recognition of the voices in the audio recordings and AI, are some of the questions being discussed.

GAM

There have been instances wherein researchers at GAM would have preferred to have authentication for users in the GAM Game application and trace choices made, but instead prioritized ethical considerations to make the application more privacy compliant and maintain anonymity.

HECHT

A big question related to the contributions from the EuCs is which CoP can see what type of content. Teachers did not have access to the questionnaire responses of the students such as data about demographics or contributions related to historical relevance and politics. On the other hand, since the researchers were not familiar with the students, they had access to the responses to analyse the data. Students retained access to their own information in the system but could not access others' contributions. Most importantly, students were offered the choice of not presenting their views during the workshops. The HECHT Case Study was originally envisioned on *changing* people's views through different perspectives of the Rebellion. Rather, upon discussion with educators, the researchers defined the activities with an emphasis on *understanding* others' views for citizen curation. In HECHT, the researchers realised that making schoolchildren justify their beliefs had a detrimental effect on entrenching their own opinions which may be good for inclusivity, but not for

social cohesion, and therefore sought a fine balance between inclusion and social cohesion. In the end, the goal was to create a community of different individuals who respect each other's opinions.

IMMA

All the activities were carried out within the policy framework of GDPR such as data privacy laws, child protection. Adults served as legal guardians during whenever minors participated. No other demographic information was collected other than the names of the participants attending the workshops. The involvement of underrepresented audiences in this Case Study cannot be underscored, especially "non-citizens". What was especially unforeseen was the use of Deep Viewpoints not only to communicate with other visitors, but also to the institution itself, especially with social and political issues. It may have resulted in instances of "necessary discomfort" to the museum but understood the importance of listening and implementing.

MNCN

Since this Case Study dealt with climate change, on many occasions, schoolchildren felt anxiety and fear related to it. Educators and museum professionals though attempted to channel this emotion constructively and engage with the subject more critically.

Potential improvements

All the Case Study museums felt a severe impact during the COVID-19 era and needed to rapidly improvise by digitizing and transferring their resources online. Due to it, some of the work carried out may have been more disorganised, especially during remotely organized collaboration between multiple stakeholders. In many of the Case Studies, it resulted in a change in data collected and analysed. Some felt that due to COVID-19, the time was too short since many of the activities could be conducted in the museum's physical premises only during the final year of the SPICE project. However, there were many benefits as well, such as engaging with wider range of audiences and rapid improvisation.

7 – CONCLUSION

Case studies are not simply examples of pilot applications carried out for the sake of trials related to applied research development. As part of the methodological framework used in qualitative research, case studies can indeed provide a trove of relevant and valuable information pertaining structure, form, and orders of interaction within contexts and situations of use. The SPICE case studies have been carried out in parallel, with cases happening and being studied concurrently. Because they have allowed us to identify novel and unexpected paths, they can also be described as heuristic devices that might allow us to answer questions of 'how' and 'why'. This has definitely, in our opinion been the case with our development of the notion of Citizen Curation in the context of the Interpretation Reflection Loop (IRL).

For a deeper look into the notion of IRL we invite the reader to also engage with the work done in WP2 where our colleagues carefully delve into the topic. From the perspective of the Case Studies, however, the subject of the IRL became an existential conundrum: Is there such a thing as the IRL? From the beginning of our work on the project, we asked ourselves this question. As it is now, we think the IRL that instantiated through our system comprises three loops that enable different interactions: The first loop is the beginning and signals an inner reflection "To engage or not to engage"? In the second loop there is a shift of attention. It includes external orientation towards the artefact, the context, the groups. Finally in the third loop it is possible that there occurs a meta-level observation of the entire process.

A loop is a shape produced by a curve that bends around and crosses itself. As a structure, it can comprise a series of processes including sequences, the end of which is connected to the beginning. The visualizations presented for each of the Case Studies aim to depict the patterns of interaction which emerge because of the 'bringing together' of a diversity of semantic technologies as part of the design of the SPICE system. In this deliverable report, we have presented the co-design in each Case Study together with visualizations carried out through service blueprints, SPICE technological infrastructure, and the socio-technical systems (STS) maps.

REFERENCES

Bettiol, M., Testoni, P., & Franceschinis, C. (2014). Service Blueprinting: A Practical Technique for Service Innovation in the Entertainment Industry. *The Service Industries Journal*, 34(9), 807-820. doi: 10.1080/02642069.2014.905404.

Chan, S. S. F., Lee, W. C., & Lo, S. S. H. (2009). Developing a Service Blueprint for an Airline Check-in Service. *Journal of Air Transport Management*, 15(6), 274-277. doi: 10.1016/j.jairtraman.2008.11.006.

King, L. (2013). Rhetorics in a Museum Space: Connecting Exhibit Spaces, Contexts, and Audiences. *Journal of Advanced Composition*, Vol. 33, No. ¾, 671–688.

McFarland, L. A., Kirova, V., & Kichak, J. S. (2008). Using Service Blueprinting to Analyze Health Care Delivery Processes. *Quality Management in Health Care*, 17(4), 311-318. doi: 10.1097/01.qmh.0000337074.02225.80.

Smith, S.A., Foote, K.E. (2017). Museum/Space/Discourse: Analyzing Discourse in Three DImensions in Denver's History Colorado Center. *Cultural Geographies*, Vol. 24(1) 131–148.

Starman, A. (2013). The Case Study as a Type of Qualitative Research. *Journal of Contemporary Educational Studies*, 1/2013, 28–43.

Yeh, H. C., & Lee, Y. H. (2011). Service blueprinting for effective library and museum services. Journal of Educational Media and Library Sciences, 48(3), 373-391. doi: 10.6120/joems.2011.483/0481.

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