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Social cohesion, Participation, and Inclusion  
through Cultural Engagement

## **D1.2 Data Management Plan**

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## Project information

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**Project website:** <https://spice-h2020.eu>

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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 deliverable introduces the Data Management Plan (DMP) of SPICE. The DMP outlines the strategy for the management and accessibility of data generated in the project, including software and data from experiments, surveys, and interviews.

## Document History

<b>Version</b>	<b>Release date</b>	<b>Summary of changes</b>	<b>Author(s) - Institution</b>
V0.1	28/10/2020	First draft released	UNIBO
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V1.1	10/05/2022	Revised version	UNIBO
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## Introduction

The goal of the Data Management Plan (DMP) is to ensure that results and scientific products resulting from the project are as open and accessible as possible. SPICE data and software will be available from the project web portal, dedicated infrastructures developed by SPICE consortium, and through selected dissemination infrastructures such as GitHub, ZENODO, and institutional repositories for data and publications.

Data collected, produced and managed during the project mainly cover aspects related to museum visitors' encounters with artworks, such as emotions, interpretations, and opinions. Data are generated and/or leveraged in engagement activities relevant to the five project pilots (WP7). This information is collected in workshops (WP2), engagement activities planned in the aforementioned five case studies (WP7) and mined from social media platforms (WP4). Existing and bespoke ontologies are developed so as to organize collected data and enable further analysis and reuse (WP6).

Software solutions developed by SPICE are primarily meant to allow stakeholders (e.g. copyright holders, museum curators, developers, end users) to manage and share collected data according to different levels of privacy and copyright restrictions (WP4). Secondly, bespoke software solutions are developed in order to apply reasoning methods on collected data (WP6), visualize and explore users' opinions (WP5) and derive information on citizens' communities and reflection for recommendation purposes (WP3).

Due to privacy concerns and commercial opportunities for SME involved in the project, not all the data and software solutions will be fully openly available, even if some of them could be made available to the consortium for the purpose of the research run in SPICE. In such cases, the software will be made available to the consortium as a service. Following the Software as a Service (SaaS) model, the software will expose REST APIs to other software clients developed by the consortium. As a result, the functionalities provided by the software are available to the consortium, but the source code of the software remains private. An example of this solution was adopted for the Semantic Annotator (cf. D3.2 and D3.4). Museum visitors' identities and user-generated data will be mostly anonymized so as to open as much data as possible without disclosing personal information and comply with ORDP requirements. Whenever applicable, users will be asked to give their consent in order to publish their identities. This will be done in full compliance with any European and national legislation relevant to the country where the data collections are taking place. Only data for which user's consent has been asked will be fully disclosed and publicly available for reuse along with anonymized data.

## Data summary

The following table includes an overview of datasets and software solutions developed by SPICE project partners ordered by responsible WP.

*Acronyms used: Type = S (Software) / D (Dataset); Status = A (Available) / O (Ongoing) / NA (Not yet available). The DMP identifier is used through the document to identify research outputs.*

Type	DMP identifier	Short name	WP	WP Task	Status
D	Workshop	<a href="#">SPICE Participatory Workshop Database</a>	WP2	1-2	A
S	Annotation	<a href="#">Semantic annotation service of social curatorial products</a>	WP3	2	A
S	UM	<a href="#">User Model</a>	WP3	1	A
S	Community	<a href="#">Community visualization tool</a>	WP3	3	A
S	Recomm	<a href="#">Recommender</a>	WP3	4	A
S	LDH	<a href="#">SPICE Linked Data Hub</a>	WP4	1-4	A

D	LDHReg	<a href="#">SPICE Linked Data Hub Registry</a>	WP4	1-4	A
S	inSPICE	<a href="#">Interface components for citizen curation</a>	WP5	1-3	A
S	Reasoner	<a href="#">On Demand Ontology Reasoner and Server</a>	WP6	1	A
D	Ontologies	<a href="#">SPICE Ontologies network</a>	WP6	3	A
D	IMMAdata	<a href="#">IMMA Pilot Study dataset</a>	WP7	3	A
S	IMMAPilot	<a href="#">IMMA Pilot Study software</a>	WP7	3	A
D	MuOpinion	<a href="#">Museum visitor opinion dataset</a>	WP7	3	A
S	HaifaPilot	<a href="#">Haifa case study web application</a>	WP7	3	A
D	Demog	<a href="#">End users' demographics, preferences and results from activity analysis</a>	WP7	3	A
D	Ethnog	<a href="#">Autoethnographic and duoethnographic accounts of material culture</a>	WP7	3	A
D	PortableMu	<a href="#">Surveys documenting responses to prototypes</a>	WP7	3	A
S	VRpopup	<a href="#">VR experience of the Pop-up Museum</a>	WP7	3	A
D	FTMdata	<a href="#">User-generated data on the web</a>	WP7	3	A

Table 1 Overview of datasets and software produced in SPICE

In the following tables we further describe the outlined research outputs, including persistent identifiers, creators, contributors, rights holders, description and intended purpose, data “utility”, data types and formats.

<b>Short name</b>	<i>SPICE Participatory Workshop Database</i>
<b>DMP identifier</b>	Workshop
<b>Identifier</b>	-
<b>Creators</b>	<i><a href="#">Luis Emilio Bruni</a>, Aalborg University; <a href="#">Mark Maguire</a>, Irish Museum of Modern Art Company</i>
<b>Contributors</b>	<i><a href="#">Luis Emilio Bruni</a>, Aalborg University; <a href="#">Luca Simeone</a>, Aalborg University; <a href="#">Thomas Anthony Pedersen</a>, Aalborg University; <a href="#">Diaz-Kommonen Lily</a>, Aalto University; <a href="#">Vishwanath Gautam</a>, Aalto University; <a href="#">Leena Svinhufvud</a>, Design Museum Helsinki; <a href="#">Mark Maguire</a>, Irish Museum of Modern Art Company; <a href="#">Anna Follo</a>, Fondazione Torino Musei; <a href="#">Giorgia Rochas</a>, Fondazione Torino Musei; <a href="#">Federica Sesia</a>, Fondazione Torino Musei; <a href="#">Alan Wecker</a>, University of Haifa and Hecht Museum; <a href="#">Tsvi Kuflik</a>, University of Haifa and Hecht Museum; <a href="#">Joel Lanir</a>, University of Haifa and Hecht Museum; <a href="#">Anna Maria Marras</a>, University of Turin; <a href="#">Rossana Damiano</a>, University of Turin; <a href="#">Cecilia Marchisio</a>, University of Turin; <a href="#">Barbara Bruschi</a>, University of Turin; <a href="#">Enrico Dolza</a>, University of Turin; <a href="#">Antonio Pizzo</a>, University of Turin; <a href="#">Stefano De Giorgis</a>, University of Bologna; <a href="#">Francesca Tomasi</a>, University of Bologna; <a href="#">Bruno Sartini</a>, University of</i>



	<i>Bologna; <b>Silvio Peroni</b>, University of Bologna; <b>Marilena Daquino</b>, University of Bologna.</i>
<b>Rights Holders</b>	<i>Aalborg University; Aalto University; Design Museum Helsinki; Irish Museum of Modern Art Company; Fondazione Torino Musei; University of Haifa and Hecht Museum; University of Turin; University of Bologna</i>
<b>Description and purpose</b>	<p><b>Description:</b> Survey results, interview transcripts, with general data about participants' personal views and perspectives related to themes and subjects identified in particular artworks proposed in cultural heritage activities.</p> <p><b>Purpose:</b> Collect requirements, and assess success and challenges of the project's activities, that are shared with relevant WPs. Used anonymously externally to illustrate the development of the project. These data are internal to consortium for co-designing purposes and will not be made available.</p>
<b>Data utility</b>	Useful for other WPs to define requirements for data modelling, reasoning (WP6), visualization and analysis (WP3, WP5).
<b>Data types and formats</b>	Qualitative and quantitative, collected raw data. <b>Formats:</b> txt, docx, pdf, xlsx, jpg, png

Table 2 SPICE Workshop Database

<b>Short name</b>	<i>Semantic annotation of social curatorial products</i>
<b>DMP identifier</b>	Annotation
<b>Identifier</b>	<a href="https://sophiaanalytics.saas.celi.it/">https://sophiaanalytics.saas.celi.it/</a>
<b>Creators</b>	<i><b>Alessio Bosca</b>, CELI</i>
<b>Contributors</b>	<i>Alessio Bosca, CELI; Chiara Albano, CELI</i>
<b>Rights Holders</b>	<i>CELI</i>
<b>Description and purpose</b>	<p><b>Description:</b> Annotation Service for multilingual user generated contents. It enriches multilingual textual contents from museum visitors with semantic annotations (Entities and Key Concepts, Emotions and Sentiment, Opinions). The supported Languages are English, Finnish, Hebrew, Italian, Spanish. The service output consists in a JSON LD document and it will be used by other WP3 tasks in the process of generating users and communities models.</p> <p><b>Purpose:</b> Extract structured data from natural language texts generated by users.</p>
<b>Data utility</b>	Data extracted by means of the tool are mainly used in the context of WP3 to support the design of user and community models.

Table 3 Semantic annotation service of social curatorial products

<b>Short name</b>	<i>User Model</i>
<b>DMP identifier</b>	UM
<b>Identifier</b>	-
<b>Creators</b>	<i><b>Alan J. Wecker</b>, University of Haifa</i>
<b>Contributors</b>	<i>Tsvi Kuflik, University of Haifa; Joel Lanir, University of Haifa; Iris Reinhalz-Berger, University of Haifa</i>
<b>Rights Holders</b>	<i>University of Haifa (UH)</i>

<b>Description and purpose</b>	<b>Description:</b> Techniques for identifying user groups and communities from the content provided by users. Content provided by museum visitors is analysed by using unsupervised machine learning techniques for identifying key concepts representing individuals and groups. Multilingual text analytics will be applied to user content in order to perform named entity recognition, opinion mining and emotion recognition.
<b>Data utility</b>	<b>Purpose:</b> To create community models based on content similarity. Preliminary to other activities in WP3 (see <a href="#">Recommender</a> ) and meant to be used in WP7 case studies.

Table 4 User Model

<b>Short name</b>	<i>Community visualization tool</i>
<b>DMP identifier</b>	Community
<b>Identifier</b>	-
<b>Creators</b>	<i><a href="#">M Belén Díaz Agudo</a>, Universidad Complutense de Madrid; <a href="#">Guillermo Jiménez Díaz</a>, Universidad Complutense de Madrid</i>
<b>Contributors</b>	-
<b>Rights Holders</b>	<i>Universidad Complutense de Madrid</i>
<b>Description and purpose</b>	<b>Description:</b> A interactive tool using clustering techniques for identifying commonalities and variabilities among user communities. The tool is an experimental environment where we can explore different techniques and different levels of abstraction. The tool will perform experimentation using synthetic, real user data and content from the different case studies about the artifacts, and real user's contributions. It will be evaluated with user studies, by providing a visual interface and interactive options. <b>Purpose:</b> To visualize communities and aggregation of users so as to understand patterns and differences.
<b>Data utility</b>	The tool is mainly used in the context of WP3 to support data exploration and design of recommendation models tailored for different communities.

Table 5 Community visualization tool

<b>Short name</b>	<i>Recommender</i>
<b>DMP identifier</b>	Recomm
<b>Identifier</b>	-
<b>Creators</b>	<i><a href="#">Alan J. Wecker</a>, University of Haifa</i>
<b>Contributors</b>	<i><a href="#">Tsvi Kuflik</a>, University of Haifa; <a href="#">Joel Lanir</a>, University of Haifa; <a href="#">Iris Reinhalz-Berger</a>, University of Haifa</i>
<b>Rights Holders</b>	<i>University of Haifa</i>
<b>Description and purpose</b>	<b>Description:</b> Recommending system based on the user and community models built from the analysis of textual contents (WP3) and terms from the concepts ontology (WP6) to help users to explore and discover different and even conflicting points of view. <b>Purpose:</b> To suggest content to be “consumed” by community members - content related to their communities (intra-community) or other communities (inter-community e.g. not only similar but also diverse and possibly conflicting points of views).
<b>Data utility</b>	To be used in case studies (WP7) for engaging with museum visitors.

Table 6 Recommender

<b>Short name</b>	<i>SPICE Linked Data Hub</i>
<b>DMP identifier</b>	LDH
<b>Identifier</b>	<a href="https://spice.kmi.open.ac.uk/">https://spice.kmi.open.ac.uk/</a>
<b>Creators</b>	<i><a href="#">Enrico Daga</a>, The Open University</i>
<b>Contributors</b>	<i><a href="#">Enrico Daga</a>, Open University; <a href="#">Jason Carvalho</a>, Open University; <a href="#">Paul Mulholland</a>, Open University; <a href="#">Luigi Asprino</a>, University of Bologna; <a href="#">Marilena Daquino</a>, University of Bologna</i>
<b>Rights Holders</b>	<i>The Open University</i>
<b>Description and purpose</b>	<b>Description:</b> The SPICE LDH is a repository and mediator in the linked data ecosystem of the SPICE project. <b>Purpose:</b> Hub for accessing and managing data policies of all SPICE datasets. Its functionalities also include services related to the research output of WP4.
<b>Data utility</b>	LDH is a policy and privacy-aware environment supporting all SPICE partners producing, managing, and publishing data.

Table 7 SPICE Linked Data Hub

<b>Short name</b>	<i>SPICE Linked Data Hub Registry</i>
<b>DMP identifier</b>	LDHReg
<b>Identifier</b>	-
<b>Creators</b>	<i><a href="#">Enrico Daga</a>, The Open University</i>
<b>Contributors</b>	-
<b>Rights Holders</b>	<i>The SPICE Consortium</i>
<b>Description and purpose</b>	<b>Description:</b> The registry of the linked data resources produced in the SPICE project. Data are mainly of qualitative nature, including cataloguing information of the datasets generated by SPICE partners. <b>Purpose:</b> The dataset is generated to support the Data catalogue management system included in the SPICE Linked Data Hub.
<b>Data utility</b>	All the partners producing or consuming data in SPICE; Developers and stakeholders that want to access the data.
<b>Data types and formats</b>	Qualitative, newly generated raw data. <b>Formats:</b> json-ld

Table 8 SPICE Linked Data Hub Registry

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<b>Short name</b>	<i>Interface components for citizen curation</i>
<b>DMP identifier</b>	inSPICE
<b>Identifier</b>	DOI: 10.5281/zenodo.7989535
<b>Creators</b>	<i><a href="#">Pedro González</a>, PadaOne Games</i>
<b>Contributors</b>	<i><a href="#">Pedro Gonzalez</a> (PG), <a href="#">Marco Gómez</a> (PG), <a href="#">Guillermo Laseca</a> (GVAM), <a href="#">Jaime Solano</a> (GVAM)</i>
<b>Rights Holders</b>	<i>PadaOne Games, GVAM</i>
<b>Description and purpose</b>	<b>Description:</b> The interface components for citizen curation will consist of a number of independent interface modules for (1) different types of interpretative tasks, such as tagging, collecting, and storytelling, for specific communities, including those with disabilities; (2) for browsing and exploring across a set of interpretations to understand the range of responses.

**Purpose:** Support users in developing and discovering different opinions.

**Data utility** Components will be integrated into the final version of the use cases (WP7) in SPICE.

Table 10 Interface components for citizen curation

<b>Short name</b>	<i>On Demand Ontology Reasoner and Server</i>
<b>DMP identifier</b>	Reasoner
<b>Identifier</b>	-
<b>Creators</b>	<i><a href="#">Antonio Lieto</a> and Rossana Damiano, University of Turin; , University of Bologna; <a href="#">Antonio Lieto</a>, University of Turin <a href="#">Luigi Asprino</a>, University of Bologna;</i>
<b>Contributors</b>	-
<b>Rights Holders</b>	<i>University of Bologna, University of Turin</i>
<b>Description and purpose</b>	<p><b>Description:</b> A service-oriented application that accept as input the IRI identifying an entity or a SPARQL query about that entity and returns a list of facts about the entity, either explicitly asserted or deduced using the SPICE ontologies network. This component reuses state-of-the-art reasoners like Pellet and HermiT, available through frameworks such as OWLAPI, OntoAPI, JENA and uses the Apache Jena Fuseki 2 server for exposing its reasoned models to other services. The ontology reasoner exploit the DEGARI system to recommend novel items/artwork to the users based on the interpretation/reflections loops. The software has been evaluated through a proof-of-concept deployed in the context of the case studies.</p> <p><b>Purpose:</b> Infer knowledge about entities stored in the knowledge base of SPICE.</p>
<b>Data utility</b>	Complements activities of WP3 in data sense-making.

Table 11 On Demand Ontology Reasoner and Server

<b>Short name</b>	<i>SPICE Ontologies network</i>
<b>DMP identifier</b>	Ontologies
<b>Identifier</b>	-
<b>Creators</b>	<i>Aldo Gangemi, Italian National Research Centre (CNR); Luigi Asprino, University of Bologna; Marilena Daquino, University of Bologna; Stefano de Giorgis, University of Bologna; Silvio Peroni, University of Bologna; Bruno Sartini, University of Bologna; Antonio Lieto, University of Turin; Rossana Damiano; University of Turin</i>
<b>Contributors</b>	-
<b>Rights Holders</b>	<i>University of Bologna, Italian National Research Centre (CNR)</i>
<b>Description and purpose</b>	<p><b>Description:</b> The ontology consists of two modules: 1) the citizen curation ontology that describes the process by which citizens will produce and share interpretations of museum objects through activities conducted as part of the social curation scripts. 2) The interpretation ontology describes the interpretations produced by the citizen curation activities. The modules will be designed by using the eXtreme Design methodology.</p> <p><b>Purpose:</b> The ontologies network is aimed at connecting the representation of museum objects with interpretations provided by citizens and curators through curation activities.</p>
<b>Data utility</b>	All WPs producing data.
<b>Data types</b>	Qualitative generated data.

**and formats** **Formats:** n-triple, turtle, rdf/xml, json-ld

Table 12 SPICE Ontologies network

<b>Short name</b>	<a href="#">IMMA Pilot Study dataset</a>
<b>DMP identifier</b>	IMMAdata
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Paul Mulholland</a> , <i>The Open University</i>
<b>Contributors</b>	<a href="#">Enrico Daga</a> , <i>The Open University</i> ; <b>Mark Maguire</b> , <i>Irish Museum of Modern Art Company</i>
<b>Rights Holders</b>	<i>The Open University</i>
<b>Description and purpose</b>	<b>Description:</b> The dataset includes survey results, interview transcripts, data on users' activities, and curatorial contributions. The dataset is evaluated according to methods designed in WP2. <b>Purpose:</b> Evaluate results of Irish pilot in WP7.
<b>Data utility</b>	Pilot in WP7.
<b>Data types and formats</b>	Qualitative and quantitative, raw and derivative, processed data. <b>Formats:</b> json-ld

Table 13 IMMA Pilot Study dataset

<b>Short name</b>	<a href="#">IMMA Pilot Study software</a>
<b>DMP identifier</b>	IMMAPilot
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Paul Mulholland</a> , <i>The Open University</i>
<b>Contributors</b>	<a href="#">Enrico Daga</a> , <i>The Open University</i>
<b>Rights Holders</b>	<i>The Open University</i>
<b>Description and purpose</b>	<b>Description:</b> the software for manipulating and reengineering data We follow the evaluation methodology as designed by WP7 (T7.2). <b>Purpose:</b> Evaluate results of Irish pilot in WP7.
<b>Data utility</b>	Pilot in WP7.

Table 14 IMMA Pilot Study software

<b>Short name</b>	<a href="#">Museum visitors' opinion dataset</a>
<b>DMP identifier</b>	MuOpinion
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Joel Lanir</a> , <i>University of Haifa</i>
<b>Contributors</b>	-
<b>Rights Holders</b>	<i>University of Haifa, Museum of Hecht</i>
<b>Description and purpose</b>	<b>Description:</b> Hecht Museum visitor's opinions and comments related to selected exhibits at the museum. Tablets will be placed at selected exhibits at the Hecht museum presenting information on them and asking for visitors to contribute their opinions regarding the exhibits and regarding previous visitor's opinions. Paid participants will be asked to visit the museum, go to the selected exhibits and enter their comments. Regular museum visitors will also be able to enter their comments. <b>Purpose:</b> Classify museum visitors' opinions according to sentiment and according to topics in dedicated tasks in WP3. Evaluate results of Israeli pilot in WP7.

<b>Data utility</b>	Pilot in WP7
<b>Data types and formats</b>	Qualitative, collected and generated, raw and derivative data. <b>Formats:</b> txt, csv

Table 15 Museum visitors' opinion dataset

<b>Short name</b>	<a href="#">Haifa case study web application</a>
<b>DMP identifier</b>	HaifaPilot
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Alan J. Wecker</a> , University of Haifa
<b>Contributors</b>	<a href="#">Joel Lanir</a> , University of Haifa
<b>Rights Holders</b>	University of Haifa (Software reused from other WPs will keep their own rights holders).
<b>Description and purpose</b>	<b>Description:</b> Software to collect data from at most 10 people at a time when visiting the museum, including components developed by other WPs. <b>Purpose:</b> Evaluate results of Israelian pilot in WP7.
<b>Data utility</b>	Pilot in WP7

Table 16 Haifa case study web application

<b>Short name</b>	<a href="#">End users' demographics, preferences and results from activity analysis</a>
<b>DMP identifier</b>	Demog
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Lily Diaz</a> , Aalto University; <a href="#">Leena Svinhufvud</a> , Design Museum Helsinki; <a href="#">Gautam Vishwanath</a> , Aalto University
<b>Contributors</b>	-
<b>Rights Holders</b>	Aalto University and Design Museum Helsinki
<b>Description and purpose</b>	<b>Description:</b> Responses to semi-structured questionnaires with queries regarding users' preferences and general demographic profile and queries about users' preferences. Part of the data will be collected through questionnaires and part of it through recorded interviews that will be transcribed raw using speech to text software. <b>Purpose:</b> Evaluate results of Finnish pilot in WP7.
<b>Data utility</b>	For other partners of WP7 and case studies.
<b>Data types and formats</b>	Qualitative and quantitative, collected raw and derivative data, including also secondary data to support the creation of derivative data. <b>Formats:</b> docx, txt, csv, xlsx, json, jpg, png, tiff

Table 17 End users' demographics, preferences and results from activity analysis

<b>Short name</b>	<a href="#">Autoethnographic and duoethnographic accounts of material culture</a>
<b>DMP identifier</b>	Ethnog
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Lily Diaz</a> , Aalto University; <a href="#">Leena Svinhufvud</a> , Design Museum Helsinki; <a href="#">Gautam Vishwanath</a> , Aalto University
<b>Contributors</b>	-
<b>Rights Holders</b>	Aalto University and Design Museum Helsinki
<b>Description and purpose</b>	<b>Description:</b> Responses to questionnaires about culture and narrative texts describing personal relationship to items of culture and historical events. Data are collected through recorded interviews (used in combination with photographs) that will be transcribed raw using speech to text software.

	<b>Purpose:</b> Evaluate results of Finnish pilot in WP7.
<b>Data utility</b>	For other partners of WP7 and case studies.
<b>Data types and formats</b>	Qualitative and quantitative, collected raw and derivative data, including also secondary data to support the creation of derivative data. <b>Formats:</b> docx, txt, csv, xlsx, json, jpg, png, tiff

Table 18 Autoethnographic and duoethnographic accounts of material culture

<b>Short name</b>	<i>Surveys documenting responses to prototypes</i>
<b>DMP identifier</b>	PortableMu
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Lily Diaz</a> , Aalto University; <a href="#">Leena Svinhufvud</a> , Design Museum Helsinki; <a href="#">Gautam Vishwanath</a> , Aalto University
<b>Contributors</b>	-
<b>Rights Holders</b>	Aalto University and Design Museum Helsinki
<b>Description and purpose</b>	<b>Description:</b> Responses to survey questions in order to understand how a user felt while experiencing the portable museum prototype (see <a href="#">VRpopup</a> ), including multiple choices questions on users' emotions during the use of the prototype. The survey will not collect any personal information or identifier of a participant. The data will be aggregated with other users' responses and patterns will be identified. <b>Purpose:</b> Evaluate results of Finnish pilot in WP7.
<b>Data utility</b>	For other partners of WP7 and case studies.
<b>Data types and formats</b>	Qualitative and quantitative, collected raw and derivative data, including also secondary data to support the creation of derivative data. <b>Formats:</b> txt, docx, csv, xlsx, json

Table 19 Surveys documenting responses to prototypes

<b>Short name</b>	<i>VR experience of the Pop-up Museum</i>
<b>DMP identifier</b>	VRpopup
<b>Identifier</b>	-
<b>Creators</b>	<a href="#">Lily Diaz</a> , Aalto University; <a href="#">Leena Svinhufvud</a> , Design Museum Helsinki; <a href="#">Gautam Vishwanath</a> , Aalto University
<b>Contributors</b>	-
<b>Rights Holders</b>	Aalto University and Design Museum Helsinki
<b>Description and purpose</b>	<b>Description:</b> Users put on the VR headsets and experience the pop-up museum by navigating in the virtual space and interacting with the digital artefacts. Having received consent from the users, their experience/'gameplay' within the virtual environment will be recorded. User-experience is first designed using role-playing methods such as Bodystorming and Wizard of Oz. This data is captured using a combination of drawing, photography and text. Once the prototype has been produced, users are provided with the headset and the designed experience inside it. Protocol analysis and structured questionnaires are used to elicit descriptive data from users regarding the user experience as well as the usability. <b>Purpose:</b> Evaluate results of Finnish pilot in WP7.
<b>Data utility</b>	For other parts of WP7 and case studies.

Table 20 VR experience of the Pop-up Museum

<b>Short name</b>	<i>User-generated data on the web</i>
<b>DMP identifier</b>	FTMdata

<b>Identifier</b>	-
<b>Creators</b>	Anna Follo, FTM; Giorgia Rochas, FTM; Federica Sesia, FTM
<b>Contributors</b>	-
<b>Rights Holders</b>	<i>Fondazione Torino Musei</i>
<b>Description and purpose</b>	<b>Description:</b> Users' comments on cultural objects owned by Fondazione Torino Musei (FTM) are collected via a web application developed by WP5 (see <a href="#">InSPICE</a> ). Comments include reactions, drawings, etc. <b>Purpose:</b> Relevant selected comments will be associated to the existing open datasets about FTM collection.
<b>Data utility</b>	FTM and other partners working on WP7 case studies.
<b>Data types and formats</b>	Qualitative and quantitative, collected raw and derivative data. <b>Formats:</b> csv, json, jpeg

Table 21 User-generated data on the web

## FAIR Data

### Findability

**Persistent identifiers and project metadata** compliant with H2020 requirements will be provided for every research output by at least one certified repository, namely: Zenodo. Other certified institutional repositories are currently under evaluation to increase the findability of resources. The DOI attributed by Zenodo will be used in publications for referencing underlying data and software and facilitate the harvesting and linking by OpenAIRE.

When depositing in Zenodo, the following **naming conventions** will be used to name new repositories: <SPICE>\_<Repository Name>\_<Version number>. Version numbers follow specifications detailed in [Semantic Versioning](#). **Keywords** will be provided along with metadata so as to facilitate searchability, and may also include terms from existing classification systems such as the [ACM Classification System](#). Since controlled vocabularies may change significantly within disciplines addressed in the SPICE project, more classification systems will be added in future stages of the project so as to increase findability of resources.

**Versioning** procedures is ensured by the selected repository. If not differently specified, only the last updated, proofread, and evaluated version of data/software is stored for long-term preservation.

In the following table are listed SPICE research outputs, the additional documentation attached or linked as a source when depositing code or data on Zenodo, the metadata set used to describe the dataset, and the provider of persistent identifier.

DMP identifier	Provision of metadata and documentation	Reuse or development of metadata standards	Persistent identifiers
Workshop	Internal documentation	-	-
Annotation	Internal documentation	-	-
UM	Javadoc	Zenodo Metadata set	Zenodo (DOI)
Community	README file and user manual	Zenodo Metadata set	Zenodo (DOI)
Recomm	Javadoc	Zenodo Metadata set	Zenodo (DOI)
LDH	README file and interactive documentation	Zenodo Metadata set	Zenodo (DOI)
LDHReg	README file, JSON-LD context	Zenodo Metadata set	Zenodo (DOI)



inSPICE	README file and interactive documentation	Zenodo Metadata set	Zenodo (10.5281/zenodo.7989535)
Reasoner	README file and Javadoc	Zenodo Metadata set	Zenodo (DOI)
Ontologies	Online ontology documentation	Zenodo Metadata set, AMSActa Metadata set	Zenodo (DOI), AMSActa (DOI)
IMMAdata	README file, JSON-LD context	Zenodo Metadata set, OUDA Data Archive <sup>1</sup> Metadata set	Zenodo (DOI), OUDA (persistent identifier)
IMMAPilot	README file	Zenodo Metadata set	Zenodo (DOI)
MuOpinion	README file	Zenodo Metadata set	Zenodo (DOI)
HaifaPilot	Javadoc	Zenodo Metadata set	Zenodo (DOI)
Demog	Internal docx or README files	Zenodo Metadata set	Zenodo (DOI)
Ethnog	Internal docx or README files	Zenodo Metadata set	Zenodo (DOI)
PortableMu	Internal docx or README files	Zenodo Metadata set	Zenodo (DOI)
VRpopup	Internal docx or README files	Zenodo Metadata set	Zenodo (DOI)
FTMdata	README file	Zenodo Metadata set	Zenodo (DOI)

Table 22 Findability of datasets and software

### Accessibility

In the following table are outlined policies for sharing research outputs, including whether data will be fully open (Y) or partially open (P), motivations for closeness and alternative policies, preliminary procedures for data sharing, repositories for dissemination, and required access methods and tools for their reuse.

As specified in the deliverables D9.1, D9.2, D9.3, D9.4, and D9.5 of the Ethics Work Package (WP9), all the data that will be published and made available publicly by any partner in the SPICE consortium will be either **anonymised or pseudonymised**. Specifically, to ensure the privacy of the subject's information, data collected by a member of a consortium will be either anonymised or pseudonymised before being transferred to other stakeholders. More details are provided in Section Ethical aspects.

Preliminary procedures for sharing data also include quality assurance procedures such as data selection, soundproof, copy-editing and proofread of surveyed data.

Institutional repositories and well-known **dissemination platforms** for source code and data will be used along with Zenodo for sharing research outputs and increase their visibility. As outlined in Section [Data Summary](#), data are shared according to standard data formats that allow stakeholders to access and reuse those by means of free-of-charge or open software solutions.

DMP identifier	Open	Motivations and alternatives	Repository	Access methods
Workshop	N	<b>Motivation:</b> the data we collected are internal for design purposes, it does not involve subjects outside the consortium and it will not be made publicly available.	-	-

<sup>1</sup> <https://www.open.ac.uk/library/digital-archive/>

Annotation	N	<b>Motivation:</b> the software will not be open due to commercial opportunities	-	-
UM	Y	N/A	GitHub, Zenodo	Git, Any Java IDE (e.g. ECLIPSE)
Community	Y	N/A	GitHub, Zenodo	Git, Web browser
Recomm	Y	N/A	GitHub, Zenodo	Git, Any Java IDE, Web browser
LDH	Y	N/A	GitHub, Zenodo	Git, Web Browser
LDHReg	Y	N/A	Zenodo, LDH SPARQL endpoint	Any Text editor or IDE
InSPICE	Y	N/A	GitHub	Git, Web browser
Reasoner	Y	N/A	GitHub	Git, Web browser
Ontologies	Y	N/A	GitHub, Zenodo, LDH SPARQL endpoint	Git, Web browser, Any Text editor or IDE, Protégé
IMMAdat	P	<b>Motivation:</b> Confidential information released in interviews, high-quality images with copyright restrictions, and data belonging to third parties cannot be disclosed. <b>Alternatives:</b> Data will be anonymized, participant consent, and copyright permission will be asked.	Zenodo, OUDA Data Archive, LDH SPARQL endpoint	Any Text editor or IDE, Web browser
IMMAPilot	Y	N/A	GitHub, Zenodo	Git, Web browser
MuOpinion	P	<b>Motivation:</b> Users' identities are not of interest. <b>Alternatives:</b> Data will be anonymized and/or participants' consent will be asked.	Zenodo, LDH SPARQL endpoint	
HaifaPilot	P	<b>Motivation:</b> Museum contents with copyright restrictions, and individual answers to questions are not shared due to privacy concerns. <b>Alternatives:</b> Partial data will be shared in anonymized form to ensure reproducibility of the evaluation of the application.	GitHub, Zenodo	Git, Web browser
Demog	P	<b>Motivation:</b> sensitive data cannot be shared for privacy concerns. <b>Alternatives:</b> Sensitive information will be omitted in the transcriptions but recorded in the modulated audio recordings.	Zenodo, LDH SPARQL endpoint	Any word processing software
Ethnog	P	See motivations and alternatives of prior dataset <i>Demog</i>	Zenodo, LDH SPARQL endpoint	Any word processing software
PortableMu	P	See motivations and alternatives of prior dataset <i>Demog</i>	Zenodo, LDH SPARQL endpoint	Any word processing software
VRpopup	Y	<b>Motivation:</b> Names of contributors collected through thorough informed consent and only if they volunteer. No other personal data collected <b>Alternatives:</b> Data of the contributors anonymized for other end-users of the application.	Zenodo, LDH, GitHub	Other: Link via a WebBrowser, but requires an Oculus Quest headset
FTMdata	P	<b>Motivation:</b> sensitive data cannot be shared for privacy concerns. <b>Alternatives:</b> Sensitive information will be omitted	Zenodo, LDH SPARQL endpoint	Any word processing software

Table 23 Accessibility of datasets and software

## Interoperability

Research outputs will be mostly produced by using **non-proprietary, free-of-charge programming frameworks and stacks of standard technologies**, such as Web languages and Semantic Web technologies, and by reusing **open-source or free-of-charge software solutions**, so as to ensure their technological interoperability.

To overcome limits due to different data formats and content heterogeneity across datasets, data produced by partners that are relevant to Citizen Curation will *also* be reengineered as Linked Data according to terms defined in the **SPICE Ontologies Network** and made available through dedicated **SPARQL endpoints and APIs** on the **SPICE Linked Data Hub**. The SPICE ontologies are developed by aligning terms to existing stable ontologies so as to ensure their semantic interoperability.

DMP identifier	Standards for interoperability	Ontologies or vocabularies
Workshop		SPICE Ontologies
Annotation	Programming languages: Java, Python Other: SQL, Docker. Web stack (REST, HTTP) Semantic web (JSON-LD)	-
UM	Programming languages: Java	-
Community	Web stack (HTTP, HTML, CSS, JS)	-
Recomm	Programming languages: Java	-
LDH	Web stack (HTTP, HTML, CSS, JS) Semantic Web (RDF, RDFS, OWL2, JSON-LD, SPARQL). Programming languages: PHP, Java, Python. Activity Streams 2.0. Open Digital Rights Language (ODRL 2.2)	-
LDHReg	Semantic Web (RDF, JSON-LD)	DCAT
InSPICE	Web stack (HTTP, HTML, CSS, JS) Semantic Web (RDF, RDFS, OWL2, JSON-LD) Activity Streams 2.0, Open Digital Rights Language (ODRL 2.2). Programming languages: PHP, JavaScript, Python.	-
Reasoner	Semantic Web standards (OWL, RDF, SPARQL) Programming languages: JAVA	-
Ontologies	Semantic Web (RDF, OWL2, SPARQL)	CIDOC-CRM, ArCO
IMMAdata	Semantic Web (RDF, JSON-LD)	SPICE Ontologies
IMMAPilot	Web stack (HTTP, HTML, CSS, JS) Semantic Web (RDF, RDFS, OWL2, JSON-LD, SPARQL) Programming languages: PHP, Java, Python.	-
MuOpinion		SPICE Ontologies
HaifaPilot	Programming languages: Java	-
Demog		SPICE Ontologies
Ethnog		SPICE Ontologies
PortableMu		SPICE Ontologies
VRpopup	Programming languages: C# Other: Unity Game Engine	
FTMdata		SPICE Ontologies

Table 24 Interoperability of datasets and software

### Reusability

Data and software will be licensed under as open as possible **licenses** to foster their reusability. Due to commercial opportunities for some partner, a few software solutions will not be stored for long-term preservation in open repositories.

All data and software are subject to **quality assurance procedures**, some yet to be defined and agreed between partners producing similar datasets.

As aforementioned, **Zenodo** will be the main reference repository for storing all research outputs, along with a few certified institutional repositories, so as to ensure duplication of resources and increase the chances of their long-term availability.

DMP identifier	Licensing and restrictions	Quality assurance processes	Repository for long-term preservation
Workshop	-	-	-
Annotation	-	Internal peer review. Unit tests and integration tests for continuous development.	-
UM	CC-BY 4.0	Unit and system tests	Zenodo
Community	GPL 3.0	User testing	Zenodo
Recomm	CC-BY 4.0	Unit and system tests	Zenodo
LDH	Apache 2.0	Unit testing, Code review, Issue tracking, User testing	Zenodo
LDHReg	CC-BY-NC 4.0	RDF data validation	Zenodo
InSPICE	Apache 2.0	Unit testing, Code review, Issue tracking, User testing	Zenodo
Reasoner	Apache 2.0	Unit testing, Code reviewing, Issue tracking	Zenodo
Ontologies	CC-BY 4.0	Ontology consistency validation, Usability	Zenodo, AMSActa
IMMAdata	CC-BY-NC 4.0	RDF data validation	Zenodo
IMMAPilot	Apache 2.0	Unit testing, Pair programming, User tests	Zenodo
MuOpinion	CC-BY 4.0		Zenodo
HaifaPilot	CC-BY 4.0		Zenodo
Demog	CC-BY-NC 4.0		Zenodo
Ethnog	CC-BY-NC 4.0		Zenodo
PortableMu	CC-BY-NC 4.0		Zenodo
VRpopup	CC-BY-NC 4.0	Unit testing, User tests	Zenodo
FTMdata	CC-BY 4.0	Data quality is ensured by the application used for collecting data (InSPICE).	Zenodo

Table 25 Reusability of datasets and software

### Allocation of resources

The consortium will use the free-of-charge Zenodo repository for making datasets and software publicly accessible both for dissemination and long-term preservation purposes. This ensures data are safely stored in a certified repository and easily harvestable by EU services such as OpenAIRE.

Every member of the consortium is responsible for creating their own account on Zenodo and to deposit data and software according to procedures stated in Section “FAIR Data”.

As for the publications, all the findings derived from research data must be published in scientific journals that allow green open access or golden open access. In the case of gold open access, costs related to open access will be claimed as part of the Horizon 2020 grant, compliantly with the budget of each partner of the SPICE consortium.

### Data security and reuse

All documents relevant to the project are stored in a dedicated **GDPR-compliant remote sharing platform (Microsoft 365)** provided by the University of Bologna, which bought a license that is available to any member of the institution and to external guests that have a Microsoft account. In this private storage area, access is granted only to project partners after requesting permission. In case sensitive data are here stored, these are uploaded only after anonymization procedures, so as to ensure no misuse by other partners is possible. Data recovery and secure storage is guaranteed by the service provider.

Moreover, the **SPICE Linked Data Hub (LDH)** developed in WP4 will allow partners to upload their datasets and have full control over the definition of rules for data reuse, including the definition of copyright restrictions and licenses to any asset they manage. Specifically, the SPICE LDH implements an access control mechanism that allows dataset owners to define their own policies for accessing the dataset. Users can subscribe to the dataset and the owner can grant read/write access to it. This mechanism revolves around the concept of key. A key is a sequence of characters (i.e., a password) that enables a user to perform an operation (i.e., read or write) on a given dataset on the basis of the policy configured by the dataset owner. Keys can be:

- *Read only.* The user can only read the dataset;
- *Write-only.* Dataset owners may wish to grant write access to users or applications that need to contribute data to the dataset without having read access to other data potentially submitted by other users;
- *Read and Write.*

Dataset owners can revoke access to specific keys at any time. Where access policy has changed or an application may have become compromised, there are scenarios where a key owner may wish to remove their own access to a dataset or a dataset owner may want to disable specific user or key access.

Moreover, the LDH will provide a provenance layer (which is currently under development) which is meant to streamline the collection and delivery of provenance metadata related to cultural heritage objects (CHO). The requirements of the provenance layer are outlined in the deliverable D4.5.

Finally, LDH also ensures data recovery and data backup on a regular basis. The data will be stored in the LDH for the duration of the project. The dataset owner can then decide whether to keep or delete the data. Long-term secure storage of final versions of datasets and software is guaranteed for all aforementioned research output by **Zenodo**.

### Ethical aspects

All the aspects related to ethical issues are addressed in the deliverables related to Work Package 9 (WP9). In particular, currently, the following deliverables have been already submitted to the European Commission for review:

- D9.1 – POPD – H – Requirement No.3
- D9.2 – POPD – Requirement No.11
- D9.3 – POPD – Requirement No.12
- D9.4 – POPD – Requirement No.13
- D9.5 – NEC – Requirement No. 16
- D9.6 – POPD – Requirement No. 17

We provide a summary of the ethical aspects discussed in those deliverables as follows.

- *Personal Data.* The definition of personal data is set out in art. 4 of the GDPR, and it states as follows: ‘personal data’ means any information relating to an identified or identifiable natural person (‘data subject’); an identifiable natural person is one who can be identified,

directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

- The SPICE consortium will limit the collection of personal data that allows the identification of the data subject/research participant either directly or indirectly.
- The Data Controller (i.e. the member of the consortium who is charge of collecting data) should assure that personal data collected cannot be linked to or singled out a data subject, either by avoiding the collection of specific personal data or by assuring the deletion of identifiers (such as name, identification number, location data, etc.). All the personal data that will be collected by a member of a consortium will be necessarily either anonymised or pseudonymised before being transferred to entities (including other members of the project consortium) different from the one in charge of processing such personal data.
- As stated in SPICE Deliverable D9.2, where the collection of personal data is desirable, it will be limited to the scope of the partner acting as Data Controller and with the sole purpose of allowing the data owners to act on their rights with relation to GDPR.
- It is a recommended policy to use one or more pseudonymisation techniques to enable the exchange of data between partners and where it is not necessary to know the identity of the data subject.
- Anonymisation and pseudonymisation techniques adopted include:
  - *Data Suppression*. Removing identifier references such as data subjects' name, address, location data, online identifier, postcode information.
  - *Data Generalisation*. Modify the precision of the gathered variables, where possible and according to the type of data, represent data using scales. For example, age range (0-3, 4-6), partial information such as year of birth rather than full date.
  - *Data Encryption*. A technique that uses a secret key to obtain pseudonyms from an identifier, it uses an encryption algorithm.
  - *Data Tokenisation*. A non-mathematical approach that generates randomly values that replace data identifiers with non-sensitive information.
  - *Data swapping*. Rearranging records so that they do not match the initial information.
  - *Data perturbation*. changing the original data by using rounding methods and random noise.