

DELIVERABLE 5.3

Case Study 3 (LUT) Stage 1



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A HORIZON 2020 RESEARCH AND INNOVATION ACTION

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SUMMARY

Deliverable 5.3 – Case Study 3 (LUT) Stage 1 – provides an overview of the outputs of Stage 1 of Case Study 3 in the ParCos project, which is led by LUT, Finland. It is the output of Task 5.3 in Work Package 5 (WP5) – Case Studies and Communications. This report contains an introduction to ParCos, describes the purpose and role of this deliverable, describes how the three case studies in ParCos worked together to plan their case studies and then describes the Finnish case study set up, the outputs of Stage 1 of the Finnish case study and planned future activities. An updated version of this deliverable report will be published in August 2022 (month 32 of project) which will expand upon this report and integrate the outputs and learning from Stage 2 of the case study.

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1 INTRODUCTION

Deliverable 5.3. (D5.3) provides an overview of the outputs of Stage 1 of Case Study 3 in the ParCos project, which is led by LUT University, Finland. It is the output of Task 5.3 in Work Package 5 (WP5) – Case Studies and Communications. This report contains an introduction to ParCos, describes the purpose and role of this deliverable, describes how the three case studies in ParCos worked together to plan their case studies and then describes the Finnish case study set up, the outputs of Stage 1 of the Finnish case study and planned future activities. An updated version of this deliverable report will be published in August 2022 (month 32 of project) which will expand upon this report and integrate the outputs and learning from Stage 2 of the case study.

1.1 THE PARCOS PROJECT

Participatory science and engaging activities are key to ensuring science communication increases public engagement in science. This can be achieved through collaborations between scientists and the non-scientist public. However, concerns about public science literacy are on the rise. The EU-funded ParCos project will work to create participatory science stories that link to source material that the public can interpret for themselves. The project will explore ways to ensure diversity and inclusion in science participation and communication. It will also discuss the creation of engaging stories for the public that include the public in science activities and the interpretation of the outcomes. By disseminating stories alongside evidence, the audience will be invited to tell their own stories using the ParCos tools.

1.2 PURPOSE AND ROLE OF THIS DELIVERABLE

This deliverable sits within WP5 ‘Case Studies and Communications’ which is being conducted over a 28-month period (June 2020 to October 2022). There are 3 case studies within the ParCos project in three different countries – Belgium, Finland and the UK. The purpose of Task 5.3. within WP5 is to implement and evaluate Case Study 3, which is the Finland case study, which is reported on in D5.3.

There are 2 stages to the ParCos case studies:

- Stage 1: focuses on the methods of conducting science and collecting data that are relevant to the framing of the case study and to their local context. Each case study will use an appropriate scientific method for collecting data, either predetermined within the case study description or selected by the case study participants in the early stages.
- Stage 2: the case study participants receive training (prepared in WP4) for creating participatory science stories and participate within a participatory design process to

create participatory science stories and to integrate methods for communicating these stories to their wider communities and the general public.

Common activities that are being conducted in the context of the three ParCos case studies are:

- a) Identifying and/or collecting data for science stories
- b) Exploring data using ParCos tools
- c) Creating and communicating participatory science stories designed to prompt further engagement by the public.

This first version of D5.3 is published in month 16 (April 2021) and focuses on the implementation of Stage 1 of the Finnish case study. An updated version will follow in M32 (August 2022) which integrates Stage 2 of the Finnish case study and the evaluation. The final version of D5.3. will be published on the ParCos Platform.

1.3 CASE STUDIES PLANNING

1.3.1 Goal

The goal of ParCos is “To improve science communication with the public by creating participatory science stories that link to source evidence that the public can interpret for themselves and then build new science activities on top of this using popular forms of broadcast media and VR/AR technologies”. As shown on Figure 1, ParCos is developing participatory design models, methods and tools which are being tested within three case studies in Belgium, Finland, and the UK. Each case study has a different focus, in terms of the science topics and the group of participants it is working with, but the learning is then brought together and feeds into the creation of the ParCos models, methods and tools.

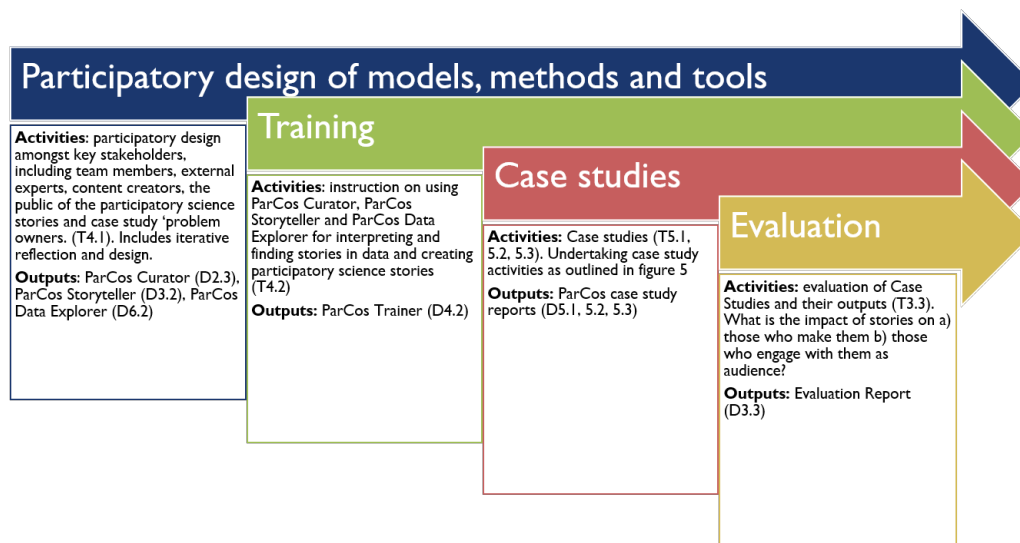


Figure 1: Overview of the ParCos Methodology

Each case study will focus on a different set of stakeholders, who are using data as evidence and who want to tell a story with the data to reach a wider audience. ParCos understands that data is experienced in subjective ways. The case studies will explore participatory approaches to data analysis and the use of arts-based methods to build empathy to data and support discussions about conflicting ideas or interpretations of data.

A brief summary of the three case studies is provided below:

- **Case Study 1:** design explorations based on weather or astronomical data to guide innovative storytelling in broadcasting (Belgium)
- **Case Study 2:** local communities, collecting and using data to address issues of importance to them, and communicating findings in personalised, intelligent and accessible ways including using immersive technologies (UK)
- **Case Study 3:** science in schools, looking at how schoolchildren can use the research data generated by universities and contextualize it to their own context and use through and share with others through documentaries (Finland)

1.3.2 Methods

At the heart of the ParCos project is the development of the participatory design methodology - The Bristol Approach to Citizen Science and the use of arts-based methods. Each of the ParCos case studies is using and testing elements of The Bristol Approach as a methodological framework to guide their citizen science communication activities. There is a particular focus on empowering citizens in communicating the outcome of citizen-led science initiatives,

drawing upon the work within WP3 (Finding and telling stories from science data, the ParCos Storyteller), which is using arts-based methods for participatory sense making of science data, and WP6 (ParCos Platform).

1.3.3 Planning

As part of Task 2.1. in WP2 (Supporting community-led science practice), the ParCos project partners received online training on The Bristol Approach on 16th April 2020 as described in the D2.1. report (Hudson et al., 2020). KWMC (who developed the original version of The Bristol Approach) is supporting the three case studies to use the methodology in their own contexts. This has included supporting each case study to identify its project boundaries (i.e. guided by resources, timescales, criteria in bid, challenges such as COVID-19 restrictions) and providing advice to how to engage with potential participants (citizen scientists). Project partners are also working together to agree common terminology and its use within the ParCos project, which was an issue discussed within the consortium monthly meetings where we settled on the idea of creating a glossary of terms. In September and October 2020 KWMC led two Scoping Sessions to support the case study leads in starting to plan their citizen science projects. In November 2020, VRT organized a workshop to share ideas about the immersive technologies that could be used in the different case studies, previously discussed in D4.1.

1.3.4 Case Study Scoping Session 1

KWMC ran an online ParCos Case Study Scoping Session 1, using Microsoft Teams, on the 9th September 2020 (09:30-11:00 UK time) which involved all the project partners. The session covered the following topics:

- a) What are we trying to achieve in our case studies?
- b) Activity: barriers, opportunities & boundaries (JamBoard)
- c) Principles for diversity and inclusion
- d) Belgium, Finland and UK case studies – Activity: Our citizen scientists
- e) Planning our next steps – timeline

1.3.4.1 What are we trying to achieve in our case studies?

In the first part of the session, we explored the different elements of the ParCos project and how they linked to the case studies and would feed into the development of The Bristol Approach. This is illustrated on Figure 2, a diagram used in the session. The pink box shows how the steps of The Bristol Approach align with the timing of the case studies. Whilst the blue circles show the key elements of the ParCos case study approach. Concepts mentioned in different work packages are captured in the green circle and the yellow squares are

selection of the key performance indicators. The text on the right-hand side links back to the European Citizen Science Association (ECSA) ten principles of citizen science which is discussed in the report - D2.1. The Bristol Approach for Citizen Science (Hudson et al., 2020).

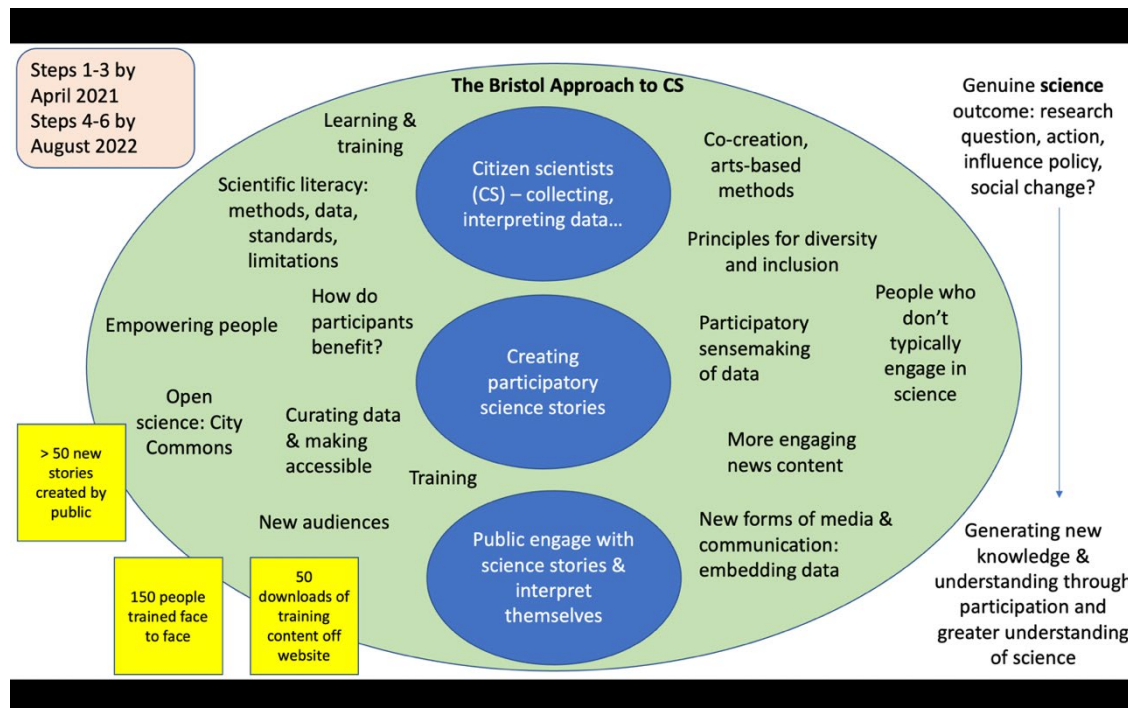


Figure 2: Key elements of the ParCos Case Studies and The Bristol Approach Development.

1.3.4.2 Barriers, opportunities, and boundaries

As ParCos is being undertaken at a time when many of the countries involved are in lockdown due to COVID-19, where people have been asked to stay at home and not mix with others in person, we recognised that this posed a significant challenge for all the project partners. So we captured the barriers different partners envisaged in co-designing and implementing their ParCos case studies by posting them on a Google JamBoard, as shown in Figure 3. We then discussed how to address the barriers, what the opportunities may be and how we should establish boundaries for each of the case studies which we would need to review over time.

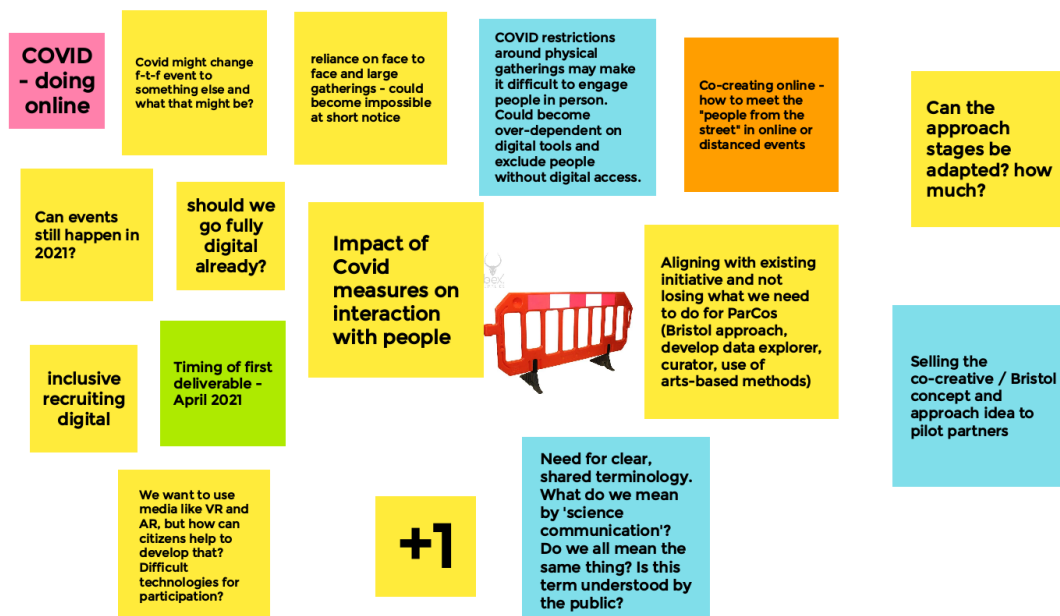


Figure 3: Barriers in implementing the ParCos case studies

Figure 3 shows that there were concerns about whether we should decide at this point to take the activities fully online, as face to face interaction and working with large groups of people in person was unlikely to be feasible due to national restrictions in each pilot country. However, we also discussed concerns about how inclusive using just online interaction would be in terms of who would be likely to attend. We decided to try and use a blended approach i.e. a mix on online and offline activities within the case studies. We recognised that we would need to be flexible with scheduling events, as there were likely to be delays due to COVID-19 and we would need to make changes to plans at short notice. However, as a consortium we agreed we would still work towards completing Stage 1 of the pilots by April 2021 (Deliverables 5.1., 5.2. and 5.3.).

An opportunity of the COVID-19 crisis is that by digitising events a more diverse audience can be invited. It is for example possible that consortium partners join workshops and lecturers in other countries.

We also discussed the need for shared terminology across the pilot in terms of defining how we understand terms such as science communication, co-design etc and decided to create a glossary of terms. Due to the many restrictions the project partners faced, we decided the case studies should build upon existing activities the project partners were working on with their communities, so they were more likely to happen. But that in doing we recognised it was important not to lose the ethos of ParCos e.g. it would be important to ensure the activities contributed to methods and development of tools we had committed to create in the ParCos bid, such as The Bristol Approach to Citizen Science, ParCos Data Curator, ParCos Data Explorer etc.

1.3.4.3 Principles for Diversity and inclusion

Activities in Task 2.2. (WP 2 – Supporting community-led science practice) of ParCos will lead to the development of a set of principles to support diversity and inclusion in science activities. Therefore, our next activity in the workshop was to discuss how this was relevant to the case studies so that each case study could consider this within their case study design. This involved thinking about what the terms diversity, inclusion and accessibility mean and partners also watched the video <https://www.youtube.com/watch?v=hArUbSpQC1g> ‘Bristol Living Lab – Diversity and Inclusion’ created as part of the dissemination work in ParCos. This video details how KWMC are implementing diversity and inclusion within their wider work and the learning that is feeding into ParCos.

1.3.4.4 Belgium, Finland and UK case studies – Activity: Our citizen scientists

Next each project partner talked about their ideas and current plans for the ParCos case studies. We also discussed how we would start the engagement and recruitment of participants within each case study, covering the issues shown on Figure 4. The detail of how each case study has progressed with this work can be found in the Case Study Stage 1 Reports (D5.1, D5.2 and D5.3).

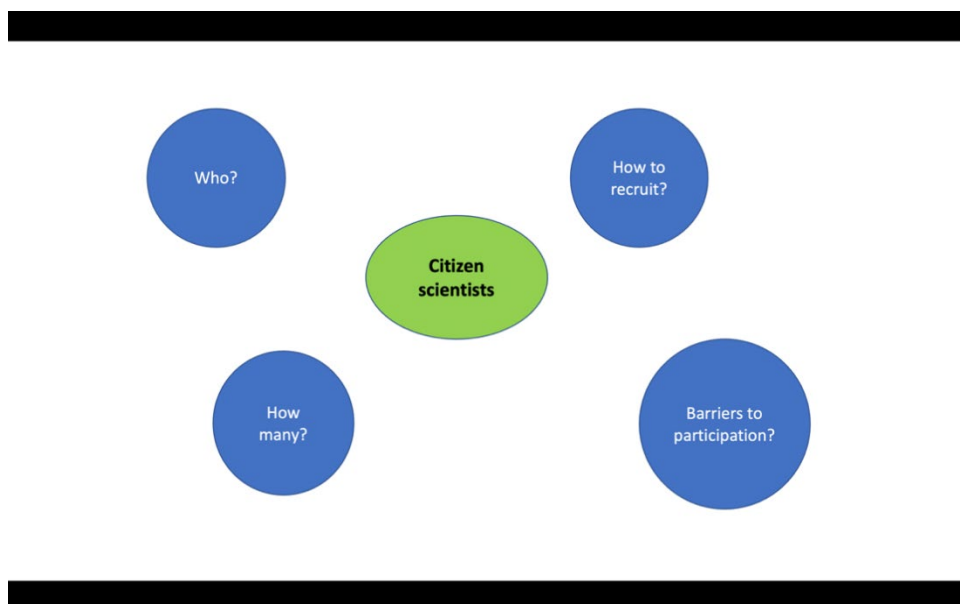


Figure 4: Issues to consider in deciding who would participate in the ParCos case studies

1.3.4.5 Planning our next steps

Finally, we agreed on our next steps for developing the case studies and decided to hold a workshop as part of the Consortium meeting in October 2020, and that each case study would bring further details of their plans to this next session.

1.3.5 Case Study Scoping Session 2

The 2nd case study scoping session took place online via Microsoft Teams on the 13th October 2020 (13:00-15:00 UK time) and was attended by all ParCos partner organisations. The session covered the following topics:

- a) Case Studies - Aims, objectives, outputs, outcomes, data collection
- b) Individual Case Study presentations
- c) Co-creating with Communities using The Bristol Approach and aligning case study activities
- d) Co-creating online + offline: sharing best practice
- e) Aligning case study activities with ParCos deliverables

It was an opportunity for each case study lead organisation to share how the plans for their case studies were developing and how they linked back to the ParCos project aims, objectives, outcomes, tools, deliverables etc. We also agreed to complete the Miro board summarising the plans for our case studies, which is illustrated in Figure 5. We also shared learning between partners identifying opportunities to collaborate over the next few months as well as to discuss how we could address the ongoing challenges individual ParCos partners faced in project delivery due to the COVID-19 restrictions. We shared our experiences of delivering blended activities using a mix of online and offline activities. Zoe Banks Gross from KWMC shared her experiences of co-creating with communities in another EU Horizon 2020 project REPLICATE¹ and we discussed how the learning from that could feed into how we work with communities in ParCos.

¹ <https://replicate-project.eu>

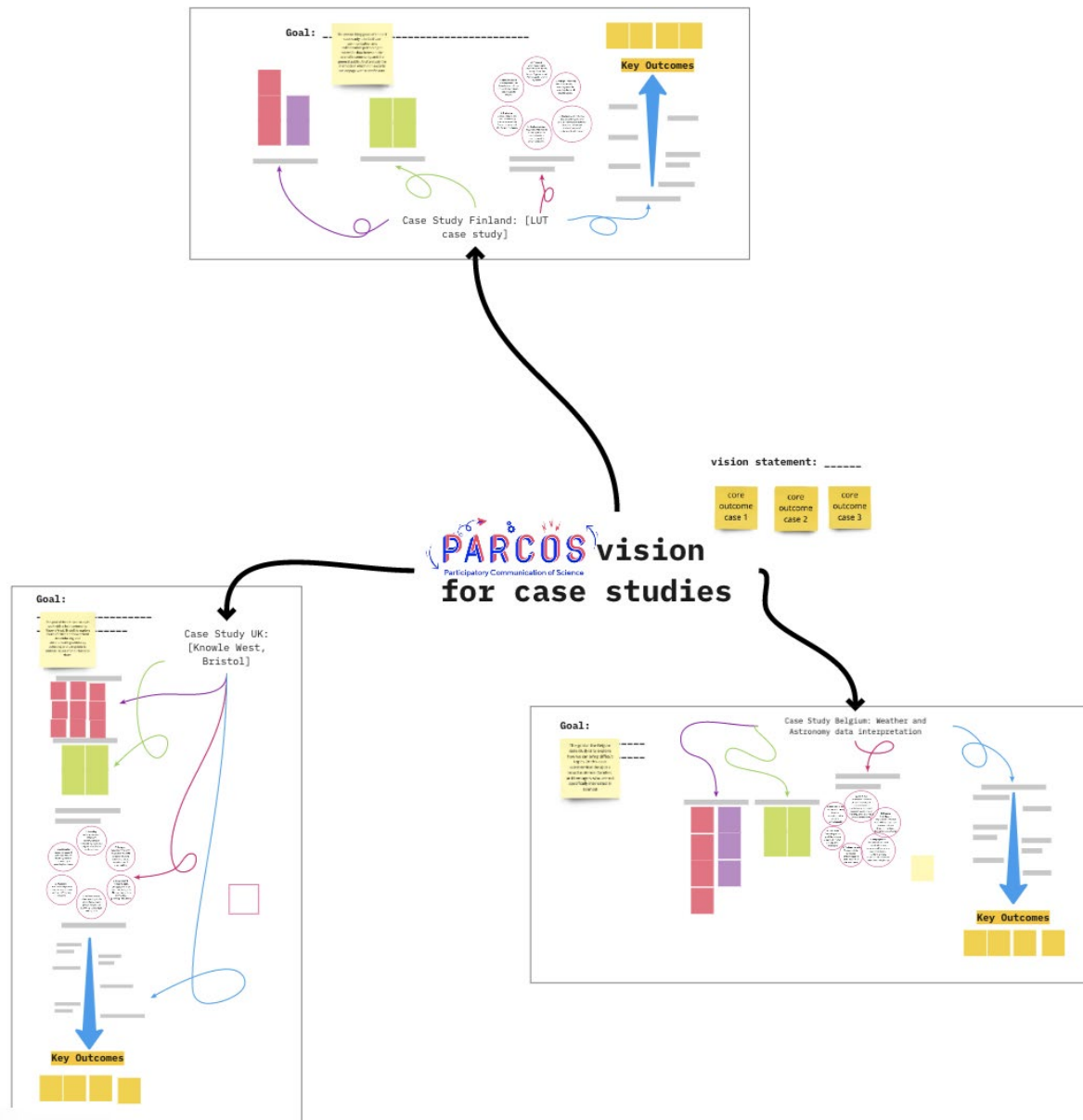


Figure 5: ParCos Vision for Case Studies on Miro Board²

1.3.6 Case Studies Stage 1 Sharing Session

Between November 2020 and April 2021 each of the case studies have secured their relevant ethical approvals and focussed on implementing Stage 1. The first version of D5.1, D5.2 and D5.3. presents the information of on the activities undertaken to date. In May 2021 KWMC is organising a Stage 1 sharing session to bring the case study leads together to reflect on the activities and their future plans, to share learning and experiences, to use this as an opportunity to feed this into the methods and tools development in ParCos.

² https://miro.com/app/board/o9J_klznvDI/

2 FINLAND CASE STUDY SET UP

The ParCos project aims to bridge the gap between scientific research and how the general public understands science. The aim of the LUT Finnish case study in particular is how to facilitate science communication between the scientific community and high school students through the development of methods and tools for information dissemination. The ParCos project is based on the Bristol Approach which is designed to foster and support a people and issue-led process for citizen science and engagement. (Hudson L., Evans, P. Banks Gross, Z. 2020). A key aspect of the Bristol Approach is that people are able to identify the issues that are concerning them and use the approach to try to find solutions. In the Finnish case study, the primary focus is on how to engage youth with real and current problems that are the subject of scientific research and how to get them to participate in that process. Therefore, in this case study the problems are not defined by the youth, instead the aim is to foster interest in the science subjects to the extent that the youth are interested to participate and then potentially extend that participation towards then framing their own problems. Therefore, the starting point for the Finnish case study is ‘not from scratch’ in defining new problems but does align with the Bristol Approach hereafter.

2.1 FINLAND CASE STUDY SUMMARIZED

The aim of the Finnish case study is to engage school children with scientific research. LUMA Keskus is a science education network in Finland that aims to inspire and motivate youth towards STEM subjects. LUMA is concerned both with activities that link schools and research institutes as well as teacher training. LUT junior university is an initiative local to LUT university that also aims to foster links between local schools and LUT university, by arranging different types of activities that school students and researchers participate in together. Through these initiatives, ParCos has joined a collaborative project called Veden Armoilla, which also involves the city of Lahti. The goal of Veden Armoilla is to develop a location-based (LARP – live action role-playing) game for school students in Lahti, that at the same time allows them to participate to research activities of LUT researchers. ParCos is supporting this game, while at the same time developing the ParCos tools and methods. Additionally, LUT will also be conducting a **test case** to further evaluate the ParCos tool and methods prior to the final case study. This will allow some activities and testing of ideas to take place under more controlled conditions and without the need for collaborating externally. Delays caused by COVID to the collaborative initiative is the main reason for this addition.

2.2 CONNECTING CASE STUDY GOALS TO PARCOS OBJECTIVES

The goals of both the test case and the case study are based upon the overall objectives of the ParCos project as stated in the Description of Action Part B and the description of the Task 5.3. These connections are detailed in Table 1.

Table 1: Finnish case study aims and objectives and alignment to wider ParCos objectives

ParCos Objective	Finnish Case Study Aims	Finnish Case Study Objectives
Objective 2: To improve interaction between difference science stakeholders through participatory approaches to science communication	1)To increase Lahti high school student’s engagement with science through participation in science communication activities with other stakeholders, facilitated with high school teachers and the Theatrum Olga group.	a) To recruit > 30 high school students and educators for a test case b) To run participatory science communication activities with the >30 participants in the test case c) To work with Case Study participants to create a participatory science story for online delivery and interaction
Objective 3: To develop pedagogical approaches and to deliver teaching of new practices for communicating science to both professional and non-professional users	2) Developing art-based methods further and adapting them for online delivery in cooperation with ParCos researchers, and the senior lecturer and youth workers in training that comprise the Theatrum Olga 3) Sharing these lessons learned with the stakeholders in the ParCos and Veden Armoilla networks	a) To run face to face training on science communication methods with at least 50 members of the public (to be realized in stage 2) b) To share learning from ParCos Case Study with > 100 people (to be realized by stage 2)

2.3 REVIEW OF METHODS BEING USED IN CASE STUDIES

The methods used in designing the case study are summarized in subsections 2.3.1 to 2.3.4.

2.3.1 Data storytelling

Data Storytelling uses storytelling techniques such as narratives to help people effectively understand data. By framing data within a story, we can not only give context to the data being presented, but we can also make interacting with said data an emotionally engaging experience. Data storytelling has the potential to foster greater understanding among non-scientific audiences when it comes to big data. Data storytelling is a growing area of research

in the field of science communication and is one of the methods for facilitating science communication that ParCos seeks to explore.

2.3.2 Participatory stories

Participatory stories are science stories that are made collaboratively between both the audience and the “author”, the author at first being a researcher. However, the process of participatory storytelling can be iterative. With a “reader” of a story becoming an author themselves by creating their own participatory story. Participatory stories are a concept for citizen science that ParCos is building upon, it has its roots in the Bristol Approach and the idea that science should be inclusive and collaborative. Bringing in new perspectives when building narratives about scientific data may help researchers find new ways of interpreting the data which they had not considered. Furthermore, by allowing non-scientific audiences to be part of the process of telling stories related to science we can increase trust in, and understanding of, scientific findings.

2.3.3 Arts-based methods

The goal of art-based methods is to allow individual perspectives to emerge by using artistic mediums. We as people, often seek out evidence that supports our own beliefs, ideas, and assumptions. Arts-based methods offer an opportunity for innovation and collective imagining Adams, J. and Owens, A. (2015). Through arts-based methods, we can come to reflect on and understand different perspectives. And with the help of arts-based methods, our individual assumptions and beliefs can be explored and made visible. Arts-based methods are a core pillar of ParCos and are defined in the handbook, Pässilä, A., et al. (2020).

2.3.4 Co-Creation

Co-creation is central to the Bristol Approach. Co-creation is design practice that incorporates the perspective of many different people from different backgrounds. Including citizens, designers, artists, educators, researchers and stakeholders. Co-creation aims to generate new ideas, and to test and evaluate, new products, practices and concepts. Co-creation empowers citizens to feel that they have influence in the design of their own communities. Co-creation means creating an environment where citizens can act on a common issue, conducting scientific experimentation autonomously. This means building new tools for civic engagement such as the city common framework (Balestrini, 2017), which helped define the Bristol Approach.

2.4 CASE STUDY CONTEXT: THE VEDEN ARMOILLA NETWORK

The Veden Armoilla Case Study is a collaboration between the LUT ParCos team, local actors in Lahti such as Theatrum Olga, and other stakeholders to arrange a participatory, science communication Live Action Roleplaying (LARP) Game.

This case study is bringing researchers, scientific experts, teachers, and high school students together in a LARP game that revolves solving the mystery of how the water of a local lake has been poisoned. The experts range in various scientific fields, including biology to chemistry and crisis management. The experts will provide workshops for the students in which they will communicate scientific data from their field to the high school students using the narrative framework of the LARP game. The experts will be provided with support for curating workshop data using ParCos principles. One expert workshop will be conducted by project researcher Anne Pässilä – this workshop will be in the form of a ‘future workshop’ where arts-based methods will be used to engage participants with the different themes of the game, using drama based and other creative approaches. This will allow to test many of the ParCos approaches but specifically the role of arts-based methods in fostering participation to science and scientific data. The Veden Armoilla case study was originally meant to run in April of 2021 but has been postponed until the autumn due to the Covid situation.

A wide network of stakeholders has been established for planning and dissemination purposes. Table 2 lists participant numbers in the “Veden Armoilla” network.

Table 2. Participants in the Veden Armoilla network

Role	Number of Individuals
Students	60
Teachers	20
Decision-makers and municipal representatives	7
Science experts and communicators	9
LUT researchers	4

The current status is that the planning for the Veden Armoilla case study has been completed and the experts who will be involved have been selected. A series of co-creative workshops have been arranged together with decisionmakers have been conducted with the experts. The data, which revolves around the local lake, Lake Vesijärvi, and the fictional “crime”, that the experts will be disseminating to the students has also been selected and refined. The organization the data was collected from is the Päijät-Häme Water Lake Foundation. Furthermore, ParCos has provided the experts with a template for their workshops that will be run with the students. Once the second case study has been conducted, there is potential to provide the template and other material to be exploited by other organizations. The workshop template is available in Appendix 3.

The goals of the Veden Armoilla Case Study are as follows:

1. Collaborating with high school students in the process of creating participatory science stories and data storytelling.
2. Collecting data on how scientific experts disseminate data to high school students in their workshops.
3. Facilitate communication between the scientific experts involved and the high school students involved.

2.5 APPLYING NARRATIVE PRINCIPLES TO SCIENCE STORIES

Figure 3 is a graphical representation of how science stories, linked to different data sets may be constructed into fictional narratives and ‘gamified’, using gameplay mechanisms that move a story forward. In terms of ParCos the diagram also shows how the player experience represents a personal narrative, based on how the player engages with the game play elements and the underlying story. It also shows how a player may then create their own narratives, based on what they have encountered but bringing in new elements, perspectives, and potentially new data. Thus, the game may align with the overall ParCos goals as well as leading to new stories/inquiries following the Bristol approach. This framework describes some of the activities we may expect to see happening when the Veden Armoilla game event takes place.

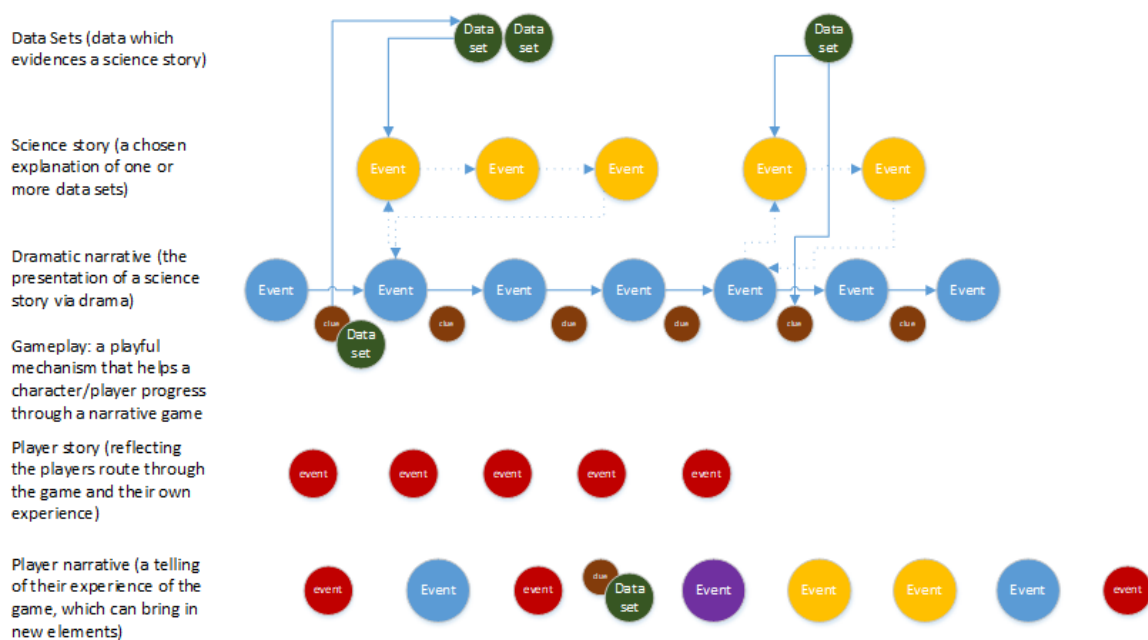


Figure 3: Veden Armoilla steps in relation to ParCos research goals

2.6 COVID ADAPTATION AND CURRENT STATUS

Due to delays caused by the COVID crisis, the full LARP game by the Veden Armoilla network was delayed until late 2021. To address these delays, two smaller events were arranged:

- the Biodiversity Test Case, whose design is reported in more detail in Section 3. This test case will be implemented online over the summer 2021, as an intermediate step between stage 1 and stage 2.
- the Veden Äärellä Online Pilot where different online tools were tested in April 2021, in case the COVID crisis is extended in duration. A subset of the Veden Armoilla network participated in the event. As the LUT contribution, one art-based method was tested online by LUT researchers, Lahti high school students and participants from Theatrum Olga, reported in more detail in Section 4.

3 BIODIVERSITY TEST CASE DESIGN

The biodiversity test case was conceived after it became apparent that Covid restrictions would be postponing the timeline of the Veden Armoilla case study. It was thought up as a way to test the concepts and tools that will be used in the Veden Armoilla case study.

The biodiversity test case is intended to engage a non-expert audience with open data sources through the use of a **visual novel** narrative about biodiversity in Helsinki. Figure 2 shows a very rough prototype of a visual novel using some data from Helsinki related to biodiversity and telling a story about flying squirrel populations. The aim of this mockup is to show the links between parts of a story and the data that evidences it. A final version of a visual novel would integrate the data in more aesthetic ways.

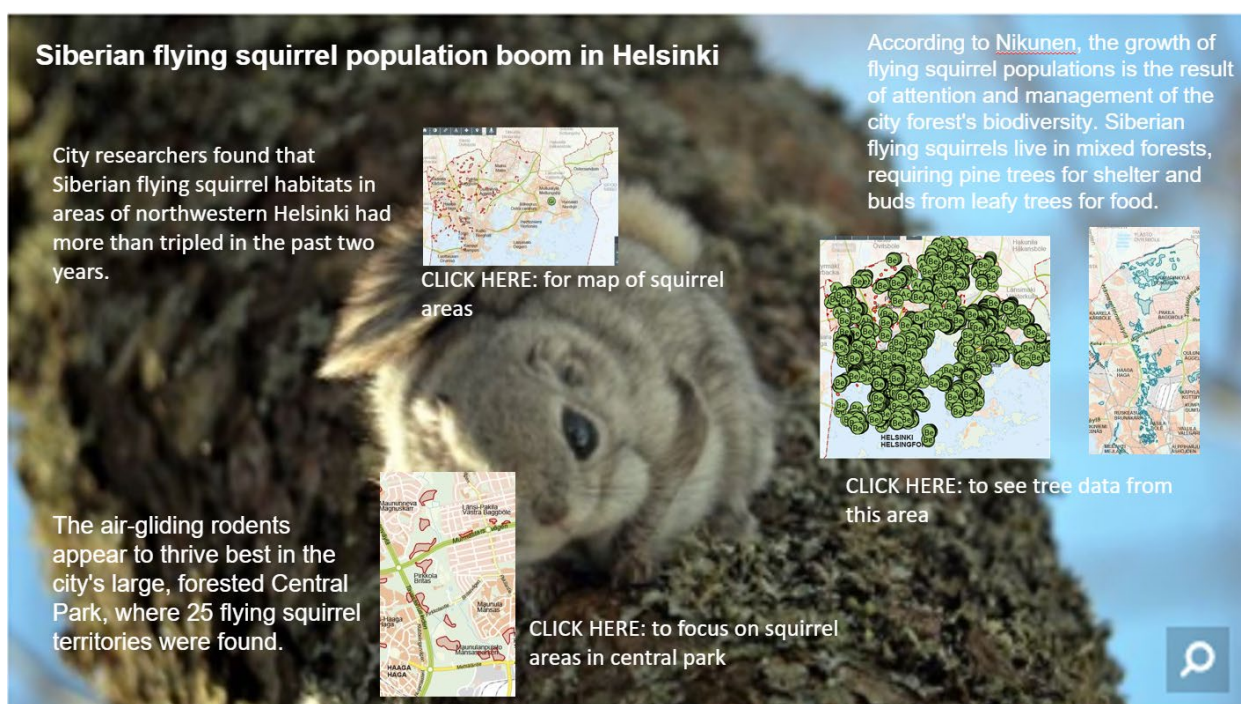


Figure 2: A mockup of what the visual novel could look like

This case study uses the technique of “data storytelling” to engage non-experts on an emotional level with open data, and further encourages non-experts to create their own data stories. The goal of this test case is to examine if non-experts comprehend data better through the emotionally engaging process of creating data stories.

The goals of the Biodiversity Test Case are as follows:

1. to produce a new science communication method through different media, namely through medium of an interactive visual novel.

2. To build upon and evaluate the concepts of data storytelling and participatory stories related to big data.
3. Use it as a basis to create and test the artifact of the data explorer for the ParCos project, which could be further used during the Veden Armoilla case study.
4. Provide a framework for the process of data curation, i.e., the data curator cards.

4 CURRENT ACTIVITIES: VEDEN ÄÄRELLÄ ONLINE PILOT

4.1 VEDEN ÄÄRELLÄ ONLINE PILOT IMPLEMENTATION AND OUTCOMES

Due to the Covid-19 crisis, the date for the Veden Armoilla LARP event has been pushed forward by at least half a year. Therefore, in addition to the test case using open-source biodiversity data about Helsinki we have conducted one online pilot event, building towards the Veden Äärellä biodiversity test case.

This Veden Äärellä was arranged in cooperation with the Veden Armoilla network. During the same day, different participants of the network performed trial runs of various online technologies, including interactive video events and for example the gather.town 2D virtual environment. The online event described in this section was the LUT contribution.

On April 21st, we arranged art-based online game/experience event for local Lahti high school students and educators. The goal of this event was to communicate scientific information about Lake Vesijärvi in the town of Lahti, and the importance of water conservation to local Lahti high school students via a “data drama”. The data drama was set in the future and framed as future scientists looking back at the history of the lake. This event used the art-based method of an interactive theatre experience to convey information to the students. The goal was to get the high school students, who are from Lahti, to feel interested in and involved in the preservation of their local lake.

The data drama took place at a local Lahti theatre school, Theatrum Olga. Theatrum Olga provided both a suitable theatre space and assisted in the data drama itself, as well assisting in the prep work for the drama. Due to Covid, the audience attended virtually over Microsoft Teams. The virtual audience included both the students, who were the primary participants, and the LUT researchers. Participation numbers are reported in Table 3.

Table 3. Veden Äärellä Online Pilot Participants

Participant type	No. of participants
High school students	18
Drama educators	4
LUT researchers	3

The set up involved a theatrical space named the “Matrix Laboratory”, which included a set and costumes. The drama educators were framed as futuristic scientists observing and discussing past data about Lake Vesijärvi, water conservation and the climate crisis. The event included pre-recorded videos on different topics as well as the interaction with the drama educators themselves. For example, one video set the scene by talking generally about the importance of water. Another was conducted as a Q&A with an expert on water data in which they explained the data that had been obtained about the lake over a period of years. Students were then asked open-ended questions over the video call about the lake, water conservation, pollution, and climate change, and were encouraged to express their opinions and feelings on these topics. The data drama and discussion with the students lasted roughly one hour. A screenshot from the data drama stream is displayed in Figure 4.

The goals of the data drama were:

- a. To explore water pollution and conservation with the help of the story of Lake Vesijärvi’s past, about how it went from being a pristine lake, to becoming highly polluted to becoming clean, drinkable water once again.
- b. To interpret data related to Lake Vesijärvi artistically.
- c. To dramatize the problem of water pollution and conservation.
- d. To engender empathy towards the local environment among the participants.
- e. To encourage young people to think about the oncoming environment crisis and to reflect on how we may act in a crisis situation.
- f. To raise awareness about water conservation and ecological preservation.



Figure 4: A picture from the online data drama

As a part of evaluating the data drama approach, we deployed a survey at the end of the event measuring the connection between engagement (O’Brien et al., 2018), motivation (Brühlmann, 2018), and the interactive theatre experience that the students had. There was a total of 9 questions arranged into three constructs (involvement, rewardingness, and intrinsic motivation). After pairwise elimination of missing cases, a total of 18 analyzable answers were collected.

The findings from the survey were promising. An initial analysis with Partial Least Squares Path Modeling indicated that felt involvement had an impact on intrinsic motivation. Descriptive statistics indicated high participant satisfaction and are summarized in Table 4 for each construct. The initial survey results are displayed in more detail in Appendix 2.

Table 4. Construct averages for data drama post-event survey

Survey construct	Average value (Likert scale 1 to 5; the higher the better)
<i>Engagement (O’Brien et al., 2018)</i>	
Rewardingness	4.01
Felt involvement	4.28
<i>User motivation inventory (Brühlmann, 2018)</i>	
Intrinsic motivation	4.18

4.2 CURRENT ACTIVITIES FOR THE BIODIVERSITY TEST CASE

The data sets that will be used in the biodiversity test case have been selected. These data sets have been predominately chosen from various open data sources relating to Helsinki and revolves around the biodiversity of flying squirrels in Helsinki. The data sets are related to biodiversity in Helsinki and include topics such as green spaces in Helsinki, wildlife populations and noise pollution. A full list of selected datasets are listed in Appendix 1. Currently the data sets are being curated and translated for non-experts so that they may be used in the visual novel and data explorer.

5 CASE STUDY FINDINGS INFORMING FUTURE PROJECT ACTIVITIES

The design of the LUT ParCos case study is built around an overarching game narrative. Within that narrative there are a variety of science-oriented workshops meant to engage the students with different topics such as microbiology, chemistry, and crisis management. Each workshop will be run by an expert their respective field. There will be a total of six workshops. Each of these workshops will give ParCos an opportunity to observe how the experts running the workshops curate and communicate data to the students, and provide insights related to participatory science. We foresee the following contributions to upcoming deliverables.

- Bristol Approach (D2.4): Exploring different ways how to kickstart cycles of inquiries through pre-set narratives, before participating youth initiate their own cycle of inquiries. This also links to co-creating and testing data literacy principles (D4.3).
- ParCos Storyteller (D3.3): During the case study development, it was found that the largest difficulty is in creating stories from scratch from raw data. Therefore we are developing a framework that proposes stories as an entry point for data re-use and

that the ParCos storyteller will use the stories to frame the types of interactions people may have with the data.

- ParCos Curator (D2.3): we have used our initial research to create principles that were loosely used to guide initial activities and will be used more methodically in the future. We have also reflected on case study activities so far to understand how the curation practices in those align to our principles.
- Data Explorer (D6.2): During data preparation and case study design, we discovered that most support is actually needed for finding interesting data related to a story and then also seeing what other data may be 'close' to it, rather than simply visualising data that can be done with other tools. This will inform data explorer tool requirements.
- Diversity and Inclusion Principles (D2.2): students have been involved at different stages in the co-design of the Veden Armoilla case study, determining that the event should be conducted as a game. In addition, student teachers are involved in co-designing the event. Intermediate test cases have been used for feedback. The Veden Äärellä was conducted in two different languages (Finnish and English), to increase participation for the non-native Finnish participants. The event is part of regular school activities (not extracurricular) so there are no barriers to participation, teachers support attendance, and the Finnish school system is for all demographics and there is no partitioning based on economic circumstance or academic achievement.
- Updated guidebook on the use of arts-based methods (D3.5): Case study materials, media, templates, and summaries of successful approaches will be uploaded to the online guidebook with an open license. This will provide better access to lessons learned and exploitable, replicable materials to other research or practitioner participatory science communication projects.

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APPENDIX 1. ONLINE TEST CASE DATASETS

No		themes	Description
d1	Tree data ³	Environment and nature vegetation wood stand	The Helsinki Wood Register Wood Atlas is the City of Helsinki's Urban Environment industry system which contains information on street and park woodland in public areas streets squares parks Forest information is not included in the tree register The material is maintained for the use of the Urban Environment business area and does not generally include trees under the responsibility of other administrations or institutions such as plot trees The material contains information on the location species and size of street and park property Planting year data can also be found in some trees There are gaps and errors in the registry information which should be taken into account when using the material The information is not systematically updated For street trees the information has been updated quite comprehensively but for park trees the information is only partially in the register The material can be downloaded in several different formats e.g. JSON KML CSV Esri Shape and XML The available formats can always be found in the outputFormat section of the GetCapabilities query in the service For more information and instructions see the Find WFS Objects Guide id:int The unique identifier of the item identifier string Tree registration number starting with K street tree starting with P park tree street name string Street tree location street park name string Park Tree Location Park boat type string Town plan marking of the location of the tree street park finnish name string The trivial name of the tree in Finnish suku string The scientific surname of the tree species Scientific species name of the tree size class string Size class according to the bust height diameter of the tree planting year:int Tree planting year data owner string Material owner updated_data service date Date the data service was saved yyyy_mm_dd geom GeometryPropertyType Object geometry environment_and_nature nature vegetation wood stand
d2	flying squirrel core area ⁴	nature fauna and flora flying squirrel core area	Helsinki's nature the core areas of the flying squirrel The material includes the core areas of the flying squirrel delimited in the 2014 2016 2018 2019 and 2020 flying squirrel surveys Core area A central part of the habitat delimited by scat finds and the structure of the forest from

³ https://miro.com/app/board/o9J_lKjS0mE=?moveToWidget=3074457356996489267&cot=14

⁴ <https://kartta.hel.fi/>

		nature conservation	which abundant trees have been found which the flying squirrel has used as a place to stay or eat on the basis of the discovery of waste The nesting tree of the flying squirrel has also often been found in the core area Flying squirrels can move and feed far outside the core area and not even nestlings are located in the core area Adjacent core areas may belong to the same habitat Individual scat sightings that are remote from other sites of discovery have been left out of the core areas
d3	habitats of flying squirrel ⁵	nature fauna and flora flying squirrel urban nature	Nature of Helsinki Living squirrel habitats The data include the flying squirrel habitats delimited in the 2019 and 2020 flying squirrel surveys In previous surveys in 2014 2016 and 2018 all areas are core areas The core areas are at a separate data level The habitats of the flying squirrel have been interpreted as those in which debris has been found from only a few trees and no nesting sites are known The droppings have often been old-looking as if a flying squirrel had just visited the site
d4	important bird areas ⁵	archipelago bird birds forest nature bird waters	The Important Bird Areas material includes the sites that are in the report Ellermaa Margus Important Bird Areas in Helsinki and Significant Birds 2017 Urban Environment Publications 2018 In addition the material contains 36 items transferred to this category from the previous Valuable Bird Sites material Helsinki important bird areas and significant birdlife 2017 The definition of important bird areas in 2008-2017 is mainly based on volunteer genetic bird surveys The data and methods are described in the report Helsinki Important Bird Areas and Significant Birds 2017 The report also describes the most representative nesting areas in Helsinki by species for significant species
d5	air pollution ⁵	Environment and nature air quality air pollution effluent nitrogen dioxide	The data on the area where the annual limit value for nitrogen dioxide is exceeded in the Helsinki Metropolitan Area shows in which areas the annual limit value for nitrogen dioxide 40 µg m ³ is exceeded or is in danger of being exceeded The crossing area is assessed and updated annually at the end of that year The assessment is made not only on the basis of the measurement results of the year in question but also on the basis of the measurement results of previous years and the weather conditions Nitrogen dioxide concentrations and exceeding the limit value are affected by traffic emissions and the ventilation of the area Concentrations of air pollution are higher on streets lined with tall and cohesive buildings In such areas the dilution of air pollutants is weaker Read more about

⁵ <https://kartta.hel.fi/>

			the impact of traffic on air quality and measures to improve air quality Nitrogen dioxide annual limit value exceedance characteristic data street the name of the street limit_value indicates whether the annual NO2 limit value is exceeded in the area or is in danger of being exceeded assessment year the assessment year of the crossing area
d6	noise pollution ⁶	traffic noise	Helsinki noise data has been collected since the beginning of 2018 with accurate CESVA TA_120 noise sensors Data have been collected in the mySMARTLife EU project where Forum Virium Helsinki is a co_implementer of Helsinki sensor_calculated average per minute and the maximum value for each second as an A_weighted dB dBA
d7	important bat areas ⁵	nature fauna and flora agricultural bat area nature biodiversity	Helsinki nature The most important bat habitats The information is from the bat survey carried out in 2014 and from the bat surveys carried out in the Ostersundom area in 2015 The 2014 survey updated the data from the previous bat survey conducted in 2003 In addition the beaches were mapped from the sea The Ostersundom connection area was not included in the study Some of the material is based on previous studies eg Seurasaari in 2009 Santahamina in 2008 Vartiosaari in 2012 The Ostersundom area survey in 2015 covered the Lansisalmi and Karhusaari survey areas The material includes target boundaries and target information In addition the key factors and threats to the area for bats have been described as well as a proposal to manage the area in a way that favors bats , Class I valuable bat area Bats are usually abundant and there are several species of bats in the area There are breeding colonies day hiding places or wintering places in the area The condition of the area is particularly good for bats There are several buildings suitable for bat hiding places and insect predation sites such as ponds and alleys The area should not be changed without special consideration Class II important bat area There are many bats but the exact location of the colony is not known or some building structure or natural formation in the area is occasionally a breeding or resting place for bats A typical Class II area is for example a good mustache wing forest Class III locally important bat area There are usually only one or two bat species and there are not as many bats as in Areas I and II For example bats actively prey on only part of the summer in

⁶ https://iot.fvh.fi/grafana/d/mnWQ_DOiz/melumittarit-noise-sensors?orgId=6&refresh=30s%20via%20https://hri.fi/data/fi/dataset/iot-meludataa-helsingista

			<p>the area or they use the area according to the weather for example Areas III are generally slightly larger areas where partial changes can be made as bats have an abundance of this area at their disposal However bats should be considered when planning land use in the area Some measures may also improve the value class of such an area</p>
d8	core forests ⁵	nature forest wood network	<p>Network of urban forests and wooded areas 2019 The purpose of the Helsinki Forest and Woodland Network is to show the forest trunk connections that are significant for the forest species and the regional connections that connect them The material contains areas describing the parts of the network and the connections located between them The 2019 network is based on a study completed in the same year which utilized widely available spatial data on forests and other wooded areas in Helsinki The network of forest and woodland has been shown in its current state 2019 and an assessment of changes in the network has been made taking into account the land use planning situation in 2019 Future The trunk and regional connections to be developed by the future network will be indicative and will become more precise as land use and other planning progresses The core forest is a large forest area with an area of more than 4 ha and a diameter of at least 100 m</p>
d9	forest areas and stands ⁵	nature forest wood network	<p>Network of urban forests and wooded areas 2019 The purpose of the Helsinki Forest and Woodland Network is to show the forest trunk connections that are significant for the forest species and the regional connections that connect them The material contains areas describing the parts of the network and the connections located between them The 2019 network is based on a study completed in the same year which utilized widely available spatial data on forests and other wooded areas in Helsinki The network of forest and woodland has been shown in its current state 2019 and an assessment of changes in the network has been made taking into account the land use planning situation in 2019 Future The trunk and regional connections to be developed by the future network will be indicative and will become more precise as land use and other planning progresses Forests and woodland is a forest area characterized by forest vegetation with an area of less than 4 ha Forests can be natural forests in nature or man-made eg manor forests and park forests</p>

d10	woodland parks ⁵	nature forest wood network	Network of urban forests and wooded areas 2019 The purpose of the Helsinki Forest and Woodland Network is to show the forest trunk connections that are significant for the forest species and the regional connections that connect them The material contains areas describing the parts of the network and the connections located between them The 2019 network is based on a study completed in the same year which utilized widely available spatial data on forests and other wooded areas in Helsinki The network of forest and woodland has been shown in its current state 2019 and an assessment of changes in the network has been made taking into account the land use planning situation in 2019 Future The trunk and regional connections to be developed by the future network will be indicative and will become more precise as land use and other planning progresses . Wooded parks include built_up parks characterized by woodland
d11	cultural vegetation ⁵	nature fauna and flora biotope	Nature in Helsinki Biotopes The habitat data includes the Helsinki biotope project 2010 2014 The materials located in different parts of the Helsinki continental region were collected seven surveyors The patterning focused on the lands of the city of Helsinki As a rule aquatic environments were not mapped with the exception of source environments The street network is also not separated to the pattern database Shore side beach environments are included mapping The fieldwork was done during the snowless period Pattern size the lower limit is about one acre Patterns smaller than this have been introduced differentiated if they are considered to be more significant than usual Otherwise patterns smaller than an acre are connected to the adjacent one to a larger figure and is mentioned as additional information A total of 44 habitats were identified located in seven to a wider main group
d12	state taxable income ⁷	housing constructed environment jobs and industries population housing buildings construction	Helsinki regional statistics

⁷ <http://helsinkiregioninfoshare.github.io/hri-demos/yearmapplot/#tulotyyppi=5&alue=0910000000&vuosi=2012%20%20> & https://hri.fi/data/en_GB/dataset/seudullinen-tilastorajapinta%20 & <http://pxnet2.stat.fi/api1.html>

d13	population data ⁸	Statistic Finland society	population data 1km x 1km
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⁸ https://www.stat.fi/org/avoindata/paikkatietoaineistot/vaestoruutuaineisto_1km.html

APPENDIX 2. DATA DRAMA POST-EVENT SURVEY STATISTICS



Figure A2-1: Part 1 of the survey results



Figure A2-2: Part 2 of the survey results

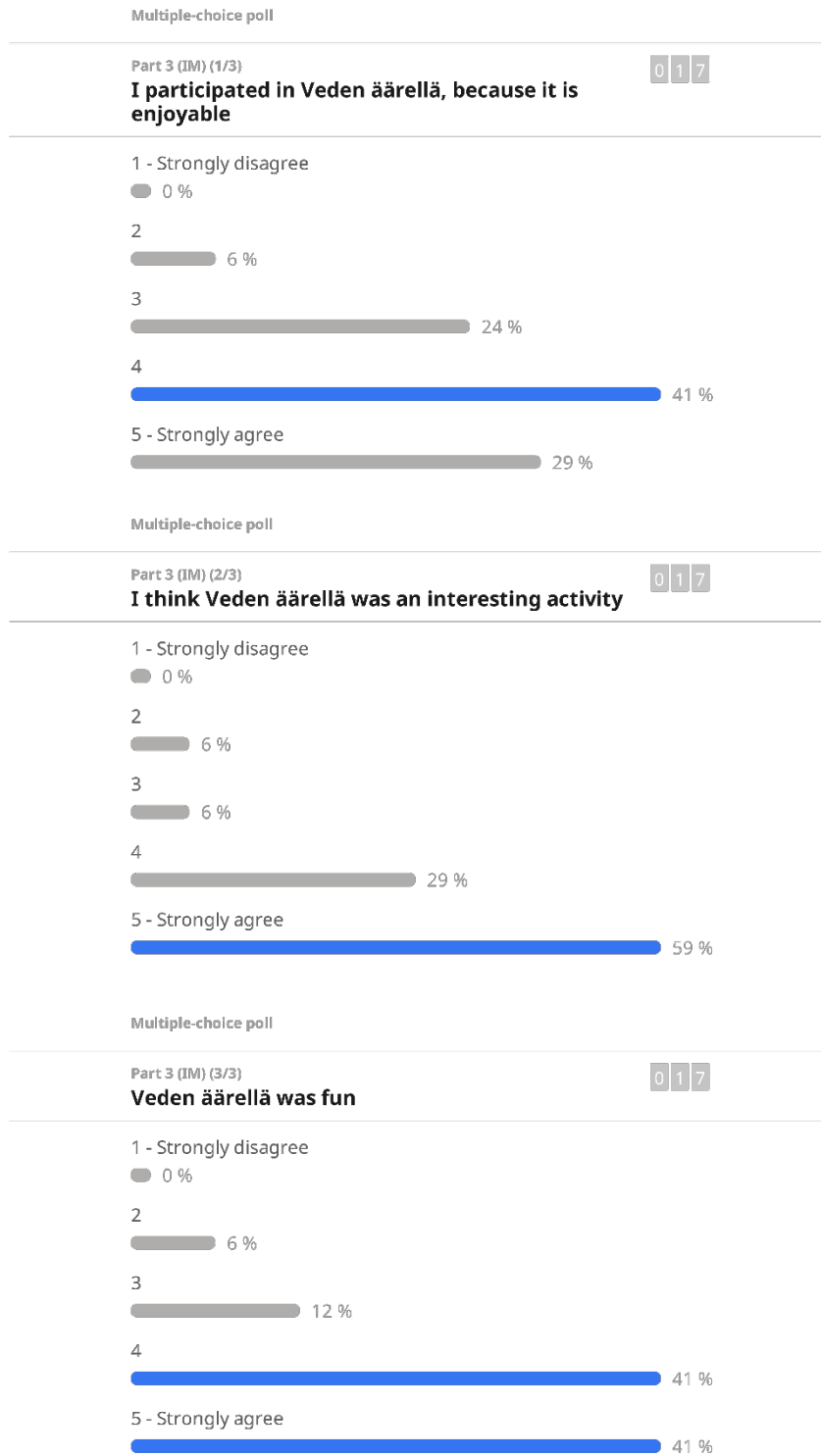


Figure A2-3: Part 3 of the survey results

APPENDIX 3. EXPERT WORKSHOP TEMPLATE PROVIDED TO VEDEN ARMOILLA NETWORK

My Workshop

My Name	My Topic	My Workshop Title

Workshop Activities

Please Find below three outlines for your workshop activities. These outlines are meant to help you format your plan for your workshop and communicate your plan to us. If you only have one workshop activity, then only fill out the first outline. Please feel free to add more workshop activities as needed, we have provided a filled-out example below.

Example Activity

Activity Title	Welcoming (in role)
Purpose	Step right on to the fictional story
Location and/or Facilities	On-line/ Fictional story time is 2500- future.
Description	<p>We welcome participants to a Future world. CyberPunk video is on.</p> <p>Facilitator 1 steps into it in the SciberPunk role (we will be using green screen), he welcomes participants in. Facilitator 1 is in the mediator role; she has ability to be simultaneously 2021 as well as 2500.</p> <p>She will invite participants to choose a SciberPunk role cards. After choosing a one. They also add one superpower to it and gives a nick name to it.</p>
Which Characters Will Participate (any characters may be included.)	Facilitator 1 SciberPunk is kind of a history researcher who have found evidence of water disaster (this is a link to Veden armoilla -plot) and needs help for investigation. Participants will have

	<p>a SciberPunk role and they join to this investigation team.</p> <p>Facilitator 1 passes safety button/ card (this is a working commitment for participants; to appreciate each other's, not to block anyone's ideas...take care of themselves...)</p>
Duration	15-20 minutes
Materials Used	Video, Green screen, SciberPunk role cards, theatre space, safety button
Materials Produced	immaterial; commitment to work together in arts-base way.
Dependencies (Is your workshop dependent on any other workshop outputs?)	Select data from other workshops. (All info that other workshop experts have premade before the game.)
Key Learning Outcomes	Safe enough working environment

Activity 1

Activity Title	
Purpose	
Location and/or Facilities	
Description	
Which Characters Will Participate (any characters may be included.)	
Duration	
Materials Used	

Materials Produced	
Dependencies (Is your workshop dependent on any other workshop outputs?)	
Key Learning Outcomes	

Activity 2

Activity Title	
Purpose	
Location and/or Facilities	
Description	
Which Characters Will Participate (any characters may be included.)	
Duration	
Materials Used	
Materials Produced	
Dependencies (Is your workshop dependent on any other workshop outputs?)	
Key Learning Outcomes	

Activity 3

Activity Title	
-----------------------	--

Purpose	
Location and/or Facilities	
Description	
Which Characters Will Participate (any characters may be included.)	
Duration	
Materials Used	
Materials Produced	
Dependencies (Is your workshop dependent on any other workshop outputs?)	
Key Learning Outcomes	