DELIVERABLE 3.6
Final evaluation report.

"ParCos – Participatory Communication of Science"
A HORIZON 2020 RESEARCH AND INNOVATION ACTION

Consortium: Lappeenrannan-Lahden teknillinen yliopisto (FI, coordinator), Katholieke Universiteit Leuven (BE), Vlaamse Radio- en Televisieomroeporganisatie (BE), and Knowle West Media Centre LBG (UK).

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SUMMARY

The ParCos D3.6 deliverable report provides an outcome evaluation of the developed ParCos science communication tools (ParCos Curator, Storyteller, Data Explorer, Trainer) and ParCos case studies. This evaluation is contextualized as a part of the case studies in WP5 and will assess the usefulness, impact, and potential of the created tools. The assessment is guided by the ParCos Trainer Cards (D4.4) which is a reflexive and practical tool, based on the quality markers from the created evaluation framework (D4.2).

This evaluation is sensitive to the stakeholder's perspectives by giving agency to the team members in the evaluation process and in the reflection upon the strengths, weaknesses, and potentials of their own processes and outputs. Furthermore, these different team members involved direct and indirect other stakeholders such as external experts, content creators, and the envisioned tool users, in the tool development process.

Keywords: evaluation, tools, case studies, iteration, quality markers, participatory science communication

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1 CONTEXTUALIZATION

This report describes the outcome of an evaluation and reflection on ParCos tools, guided by the D4.4. ParCos Trainer Cards. These Trainer Cards contain several key quality markers for the evaluation of participatory science dissemination practices. There are twenty cards in total (see Appendix 5 for a structural overview), which are organized into four basic science communication dimensions (see Figure 1), namely: scientific foundations, communication, curation tools (optional), and impact. A detailed overview of the Trainer Cards and their content can be found in D4.4.

Figure 1. The four basic science communication dimensions, including scientific foundations, communication, curation tools, and impact.

The ParCos partners used these Trainer Cards to evaluate a selection of their own key tools and cases independently. The reasoning behind this participatory self-reflective approach, where consortium members join forces to evaluate the tools instead of one partner conducting an isolated top-down evaluation, could be explained from the participatory values that drive the ParCos project. It gave each consortium partner agency in the evaluation process and in the reflection upon the strengths, weaknesses, and potentials of their own processes and outputs. Since the Trainer Cards themselves are also considered a ParCos tool, the card deck was evaluated by its own quality markers. This yielded input for its further iterative design process in D4.4.

The initial evaluation process description of this deliverable was to conduct surveys and interviews to include these different stakeholder perspectives. During the development process of WP3, alternative methods appeared to be more suitable to achieve the same outcomes. Instead of conducting surveys and interviews, workshops and meetings were organized to bring in these stakeholder perceptions in the report.

2   EVALUATION OF THE POTENTIAL OF PARCOS TOOLS

Within the ParCos project, several tools were developed to support and encourage participatory science communication. In this report, we evaluate the outcome of the Trainer Cards tool, the Storyteller tool, the Data Explorer tool, and the Data Curator tool.

The stakeholders that interacted with the specific tools during the case studies, vary from case to case. So do the evaluation processes of the different tools.

2.1   PARCOS TRAINER CARDS (KU LEUVEN) – A REFLEXIVE, PEDAGOGICAL TOOL FOR THE EVALUATION OF PARTICIPATORY SCIENCE STORIES

The ParCos Trainer Cards are a pedagogical reflection tool to support future science storytellers with the design and evaluation of participatory science stories. The Trainer Cards give guidelines related to scientific foundations, communication, tools, and impact in the form of questions, to engage in reflective science communication efforts. The card deck can be used individually or within a team context, but the different dimensions with their different layers should be used as an interwoven whole. More specific information on the use of these cards can be found in the manual in D4.4.

The cards are participatory on three levels. Firstly, the science storytellers actively interact with them. The cards give their users responsibility, autonomy, and agency in the process. Secondly, they can be used to collaborate as a team on a science story or to jointly evaluate a science story. From this perspective, the cards encourage communication between various stakeholders in the process. The science storytellers can improve the science story based on their expertise and they can also learn from one another. Thirdly, the cards encourage to develop participatory science stories.

This tool was developed and evaluated throughout numerous deliverables. The iterative creation and evaluation process was led by the KU Leuven team (see Figure 2), with contributions of the ParCos consortium partners as part of the activities of D3.4.
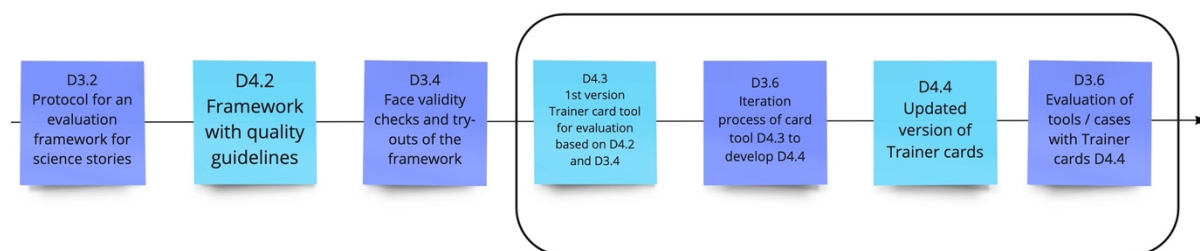

Figure 2: Interconnectedness of deliverables

2.1.1 Iteration processes of the Trainer Cards

The ParCos Trainer Cards are an evaluation tool based upon a framework with quality guidelines for science storytelling (for more info on the initial framework, please see D4.2). This updated card set as described in D4.4 has been developed through a process of five main iterations, as visualized in Figure 3. The stakeholders that interacted directly and indirectly with the Trainer Cards in the evaluation process, were team members, a graphic designer, researchers, and students.

To keep D4.4 coherent and practical oriented, the detailed iteration processes of the cards are described in this report. Since the Trainer Cards
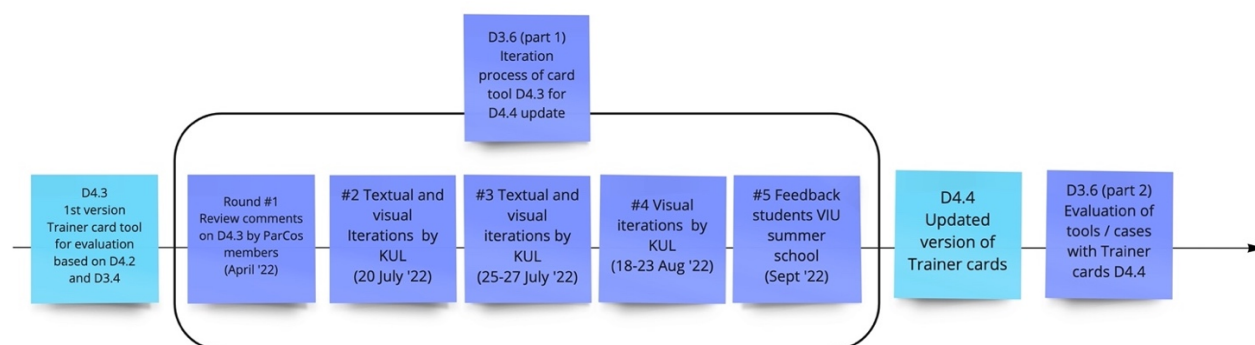

Figure 3: Iteration process of the D4.4 Trainer Cards

The first iteration focused on improvements to the textual aspects and were based upon the comments of the ParCos consortium review of D4.3 (April 2022). The suggestions for improvements mainly concerned issues regarding readability and simplification of the text on the cards. It was mentioned that the reflection questions were concise and to the point, but that the overview of the in-depth cards contained too much text. Consortium partners believed that the large amount of information could put off participants before they would use the cards, and therefore suggested to shorten the text. Furthermore, it was suggested to finetune and improve the lay-out of the cards and to work together with a graphic designer to sketch visual illustrations that could accompany and illuminate the texts on the cards.

During a second and third round of iterations (20 July & 25-27 July 2022), we improved the cards in terms of their size, colour scheme and lay-out. Special attention was paid to an evaluation of the initial sketched illustrations from the graphic designer. The project team noticed that the sketches depicted several one-sided stereotypical representations of scientists and science. To tackle these stereotypical elements, suggestions were made to be more inclusive and sensitive concerning diversity in race, gender, age, and (non-positivistic) scientific disciplines. There were also some adjustments made concerning the way the relationship between the public and scientists was represented in the sketches. The public was sometimes portrayed as passive and too much in adoration of an all-knowing

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professor standing on a stage. Since the cards are designed to encourage interactivity and participation with the public, it was recommended that the public should be represented as taking up a more active role and the interaction between the scientists and the public as one building upon principles of dialogue.

Alongside the suggestions for improvements of the graphical designs, we also implemented further textual iterations, concerned with the shortening of sentences, and the deletion of redundant questions. We hereby consciously decided upon word choice, coherency in word choice between the different cards, and the correction of typos.

In the fourth round of iterations (18-23 August 2022), follow-up visual revisions of the cards were suggested by the KU Leuven team, mainly concerning the way the dynamics between the public and the scientists are represented. The KU Leuven team also argued for an even more in-depth diversification of characters in the cards in terms of discipline, race, gender, and age.

A fifth and final activity concerning the iteration and evaluation process of the Trainer Cards, was a try-out of the updated Trainer Cards during an international and interdisciplinary summer school dedicated on the topic of science communication (September 2022). This try-out with printed cards, focused on the practical use of the cards in an educational teamwork context. The participating students came from various countries, backgrounds, and disciplines. They were asked to use the Trainer Cards to evaluate or iterate the science story that they had developed in group during a previous activity in which they were instructed to create a design of a scientific theory.

The students remarked that the cards looked professional, were useful to create and iterate science stories, and were helpful to think about different dimensions and modalities they would otherwise not think of that are part of science story communication. However, some improvements can still be made. They mentioned that initially the pile of twenty cards felt overwhelming and that there are a lot of questions on each card. They wondered whether all these questions should be answered. When they took the cards and started using them (one by one) they did feel it was 'manageable', and the questions were considered as good prompts for reflections.

Some students suggested to stack the cards in such a way that they can be kept together to keep an organized and structured overview, while making it possible to disconnect them from the stack as well so that the cards can be used individually. An idea would be to use paperclips to group the cards, so that they can easily be attached and detached. Another way to cope with this difficulty, is by making the colour difference between the four dimensions more defined and clearer.

Furthermore, it was mentioned that it is difficult to be critical about your own work and that the cards should perhaps be used as a peer review tool for evaluation. Although the cards can be used as a peer

review tool for evaluation, the card set has been developed as a self-reflection tool. Being critical about your own work can be a challenge, but the guiding questions on the cards are a good way to think about the potentialities and limitations of your own science story. The cards should not be seen as a 'checklist', but as a process support.

A final note concerns the jargon on the cards. Some words on the cards such as 'scientificity', 'haptic', and 'embodied' were not entirely clear for everyone. To tackle this matter, we will clarify difficult jargon in the card manual.

These different comments and remarks that came up during the iteration processes were either directly implemented in the redesign process of the cards or were addressed in the card manual in D4.4.

2.1.2   Evaluation based of the Trainer Cards based upon the Trainer Cards

Based upon the four dimensions and quality markers of the Trainer Cards, we conclude that:

2.1.2.1   *Scientific foundation dimension*

The content of the cards is based upon a systematic review conducted to distinguish important quality criteria for creative and interactive science communication evaluation. This systematic review has resulted in a framework (D4.2) that has been peer reviewed and has undergone additional iterations based upon face validity checks, co-creation activities, and findings within the PhD research of ParCos member Priscilla Van Even. The content is therefore based upon first-hand data and multiple scientific investigations.

2.1.2.2   *Communication dimension*

To communicate the science content in an engaging, connecting, and interactive manner, the framework has been translated and visualized into a card deck. To make sure that the cards are used in an ethical way and not used for propaganda or misinformation by distortion, cards with topics and guiding questions for ethical reflections were added.

The narrative on some of the cards is not easy to understand, and several concepts are abstract if people miss the necessary research experience or scientific background. For example, to ensure scientific nuance and complexity in the science story, specific jargon has been added to the 'Nuancing the science story' card such as 'path-dependency' or 'interpretive flexibility'. During our iterative testing, we found that an intermediary without a scientific background is likely to find it hard to grasp these concepts. Within the card deck, we had to balance in-depth and specialized expertise in the science translation process on the one hand, and broadly accessible concepts and language on the

other. To do so, the cards are divided into three layers: a basic level that is meant to be easy to understand without a specialized background, an intermediary level in which the topics are broadly approached, but for which the specialization is more relevant, and an expert level for which a specific disciplinary background is needed.

2.1.2.3 Curation tool dimension

The curation format of the science story are the cards. These cards are in a sense supported by a digital curation tool, namely an online website page. The function of this website is to make the cards widely accessible and easy to disseminate. However, this website is very basic and not a replacement for actual printed cards. The supportive online curation tool is not as exciting or relatable, but it is easy to use and practical.

2.1.2.4 Impact dimension

Up until know, students, researchers and media intermediaries have given feedback on the cards which has led to several iterations and revisions of the card design. We opted for process evaluation and feedback.

The target group of our cards are science intermediaries that communicate to the public, and not the public itself. We thus want to encourage science translators via these cards to develop responsible and relatable science stories and reflect upon the affect and effect their stories will have. To make the dimensions of the cards more relatable and understandable to the science storytellers, illustrations were added.

2.1.3   The potential for this tool

These cards can be potentially used by scientists, students, and intermediaries such as media professionals, and museums curators. The KU Leuven team will look for further opportunities to use and implement these cards in various contexts such as for educational activities and transdisciplinary workshops.

This tool would benefit from a more comprehensive training approach, for instance supported via videos integrated and distributed on a MOOC platform. It would allow us to go deeper into content nuances and the contextualization of the cards. However, the development of such audio-visual support is beyond the scope of this project. The KU Leuven team will look for ways to further develop this potential in other research projects.

2.2   PARCOS STORYTELLER (VRT)

The ParCos Storyteller is an interactive pdf that aims to support science communication professionals (including journalists, media professionals and scientists) in incorporating participatory approaches in their data stories. Guidelines are illustrated with examples (see for example Figure 4) and linked to existing tools (e.g., napa cards).

The first version of the storyteller was evaluated with students of the third Bachelor in media and information design (i.e. the future target audience), after which the tool was refined. The tool was deployed in two case studies and through this deployment evaluated with professional users (i.e., journalists and scientists).
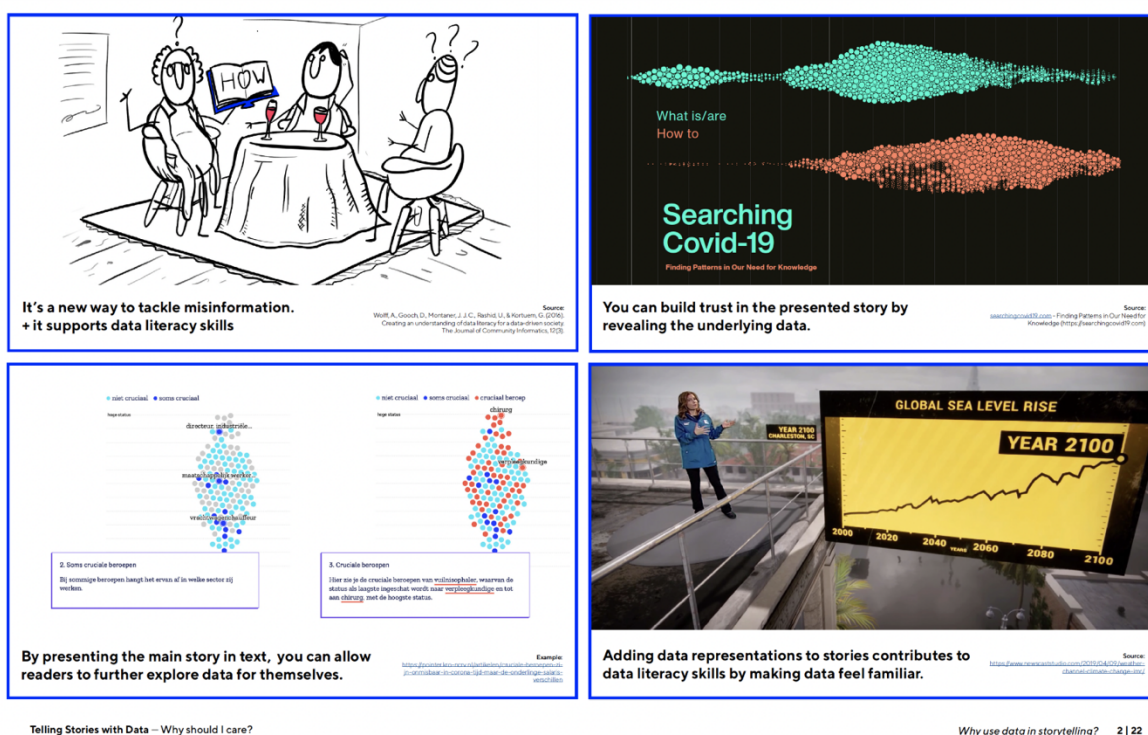

Figure 4. Screenshot of page 2 of 22 of the ParCos Storyteller

2.2.1   Evaluation based upon the Trainer Cards

2.2.1.1   Scientific foundation dimension

The knowledge that is interwoven within the ParCos Storyteller is drawn from academic research in the field of Information Visualization (InfoVis) and Human-Computer-Interaction (HCI). Since the publication of Segel and Heer in 2011 on narrative visualization, there has been an increasing research interest in understanding how storytelling can engage lay people (i.e. those who do not need to use visualizations for their work or other expertise) with data, in both academic fields.

2.2.1.2   Communication dimension

The ParCos Storyteller translates the academic insights to science communication practice by deploying more popular language and an easy-to-read presentation format, illustrating it with rich, visual and interactive examples and linking to hands-on tools that are derived from this academic knowledge. The ParCos Storyteller is brought into science communication practice by using it in hands-on workshops on data storytelling, e.g. with VRT NWS journalists, with information design students of LUCA and within outreach activities, as well as through presentations. The online link to ParCos Storyteller is shared with participants and audiences in order to facilitate re-use.

2.2.1.3   Impact dimension

The ParCos Storyteller is a living document as examples of novel data stories are collected on a monthly basis with new techniques and concepts to be shared. By its deployment in workshops, we spread its knowledge to the participating audiences who can re-use the tool for their own means, i.e. bringing it to their science communication practice.

2.2.1.4   Curation tool dimension

The interactive pdf can be accessed via het ParCos platform (currently in development). At this moment, the pdf is spread via e-mail in the VRT organisation, and on request, e.g. after presentations and workshops. When the ParCos platform is in place, the ParCos Storyteller is presented for download, together with the other tools described in this deliverable.

2.2.2   The potential for this tool

The ParCos Storyteller has the potential to be adopted by science communicators as a reference document, to support their stories with data.

2.3   PARCOS DATA EXPLORER (LUT)

There is a gap in how data is presented by researchers and how the average person understands data. Although there is an abundance of good research data available for free online, it can be very hard for people to access and make sense of it on their own. The Parcos Data Explorer provides people with limited data expertise with an entrance point into data exploration via data sets that are curated into data comics and allows for the general public to participate in data curation via the creation of data stories that incorporate these data comics. This tool was developed by Parcos member and LUT PhD candidate Natasha Tylosky, and the current version can be found online at: https://natashatylosky.itch.io/data-explorer-v1.

A set of requirements for the Data Explorer were first gathered in an online workshop conducted with the Parcos group in autumn of 2020. This session informed the aim and goals of the Data Explorer. Shortly after that an initial user testing session was done in Miro with the internal team at LUT, using virtual sticky notes to represent the conceptual model of the Data Explorer. For this user testing session, users were asked to investigate labelled sticky notes that contained links to corresponding open-source data bases that users could explore. The sticky-notes were coloured depending on the type of data they related to, light green was "green spaces" dark green was "squirrel habitats", dark blue was "bat areas", purple was "population data" and red was "pollution data". After they investigated the open-source data bases, the users were then asked to create a story describing what relationship they believe the data sets could have to each other, if any. The users were then asked to put the sticky-notes they used in their stories into their "data story collection circle".
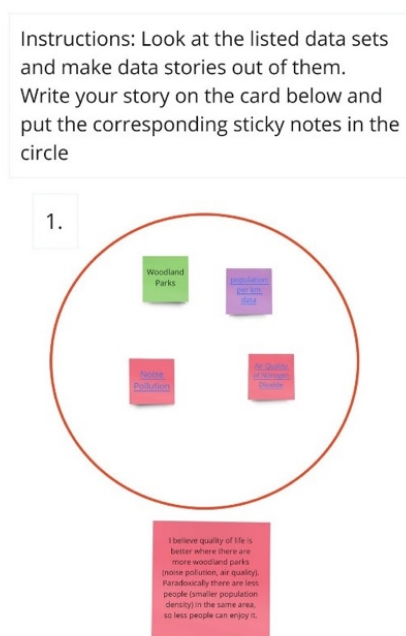

Figure 5. A user's data story from the user testing session

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Based upon the feedback of this session a wireframe using high fidelity mock-ups was made which showed a potential user's progression through the system. This wireframe was shown to the entire Parcos team during one of the monthly meetings in early 2021. After getting approval on this wireframe from the team, work on a clickable prototype began. This clickable prototype was made in Figma and went on to inform the design of the final version of the Data Explorer.
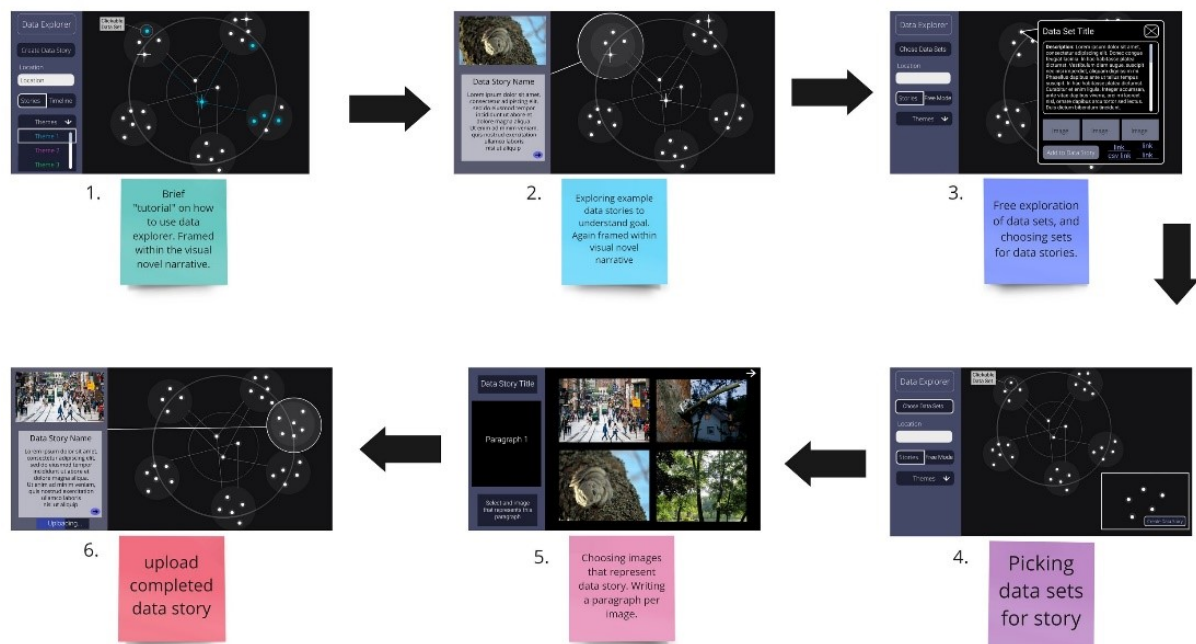

Figure 6. Wireframe with high-fidelity mock-ups

The current online iteration of the Data Explorer is centered around the test case of biodiversity in Helsinki, and it will be tested sometime between 2023-2024 with LUT students.

2.3.1   Evaluation based upon the Trainer Cards

2.3.1.1   Scientific foundation dimension

The Parcos Data Explorer incorporates data comics based upon real-world data sets that have been curated by researchers from vetted open-source data portals, all these data comics contain links to the open data portals that the information came from. Requirements for the system were gathered from Parcos stakeholders prior to its creation. The design of the Data Explorer was based upon a systematic mapping review conducted by Parcos member and PhD candidate Natasha Tylosky, and its usability will be further investigated in a real-world context as part of Ms. Tylosky's ongoing research.

2.3.1.2   Communication dimension

The Parcos Data Explorer is a science communication tool that invites the general public to view data comics that revolve around a central theme and build their own data stories based on what they think may be happening in the data. It is an entrance point for those who are unfamiliar with open data portals and allows them to explore curated data in an easy manner.

2.3.1.3   Curation tool dimension

The Parcos Data Explorer is built upon the concept of curation via data stories and data comics. Researchers can curate their data into data comics that are that are "user-friendly" for the general public. Then participants who use the Data Explorer can view the data comics that have been curated by researchers, and then incorporate those data comics into their own data stories, thereby curating data themselves.

2.3.1.4   Impact dimension

The Target user group for the Data Explorer is both the general public and researchers. Researchers are meant to be the initial curators of the data sets contained within the Data Explorer, and then the general public will explore those data sets and further curate them into data stories. The Data Explorer will serve as a tool for data dissemination and science communication that allows for the inclusion of different perspectives on scientific data and can bridge the gap between how researchers present scientific data and how the general public understands it.

2.3.2   The potential for this tool

This tool could be used for a group of researchers to communicate their data to the general public and collect opinions from local people on that data. It could be used in projects in which gathering the opinions of a local community on a certain topic is necessary such as citizen science projects. The Data Explorer can be used with any type of data that a researcher would like to present and could even be used a tool to find connections between very diverse and seemingly unrelated data sets.

2.4   PₐᵣCₒₛ Dₐₜₐ Cᵤᵣₐₜₒᵣ (LUT)

ParCos aims to create a set of data curation principles that better explain how to curate data for science communication. In ParCos, the aim is to use curated data as the first entry-point through which an audience may begin to engage with scientific evidence for themselves, either validating the story that is being told, finding their own interpretation, or using it as a starting point to a new line of inquiry (figure 1). It is therefore important that curated ParCos data can lead easily to ParCos data exploration. Thus the ParCos curator is linked to both the ParCos Data Explorer and the ParCos storyteller. Curator is a set of principles, presented as cards, that can help facilitators curate available datasets for an initial science story for participants to explore
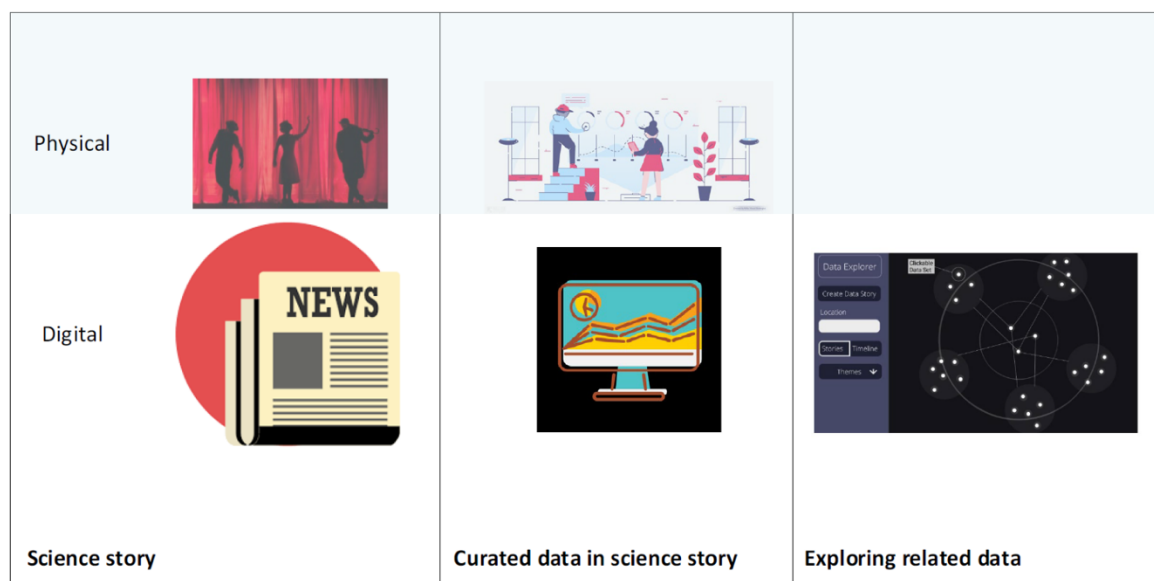

Figure 7. Showing data curation as a bridge between science story and data exploration in physical and digital worlds.

2.4.1   Evaluation based upon the Trainer Cards

2.4.1.1   Scientific foundation dimension

In order to develop the data curator according to scientific rigour whilst also taking project requirements into account, the following approaches have been taken:

1. Understanding curation as a museum practice and as a practice applied to data
2. Literature research into participatory and engaging approaches to data curation, to fit the types of scenarios outlined above
3. Rapid prototyping of data curation principles based on prior work in this area
4. Evaluation of current ParCos case study activities to identify existing practices of curation

2.4.1.2   Communication dimension

Not fully applicable. The tool is intended to help curation, to better build science stories. They are based on Digital Curation Center (Zhao & Zhao, 2017) lifecycle model and aim to enable "including a series of activities such as scientific data planning, data creation or collection appraisal & selection, organization & disposal, description, transformation, storage and reuse".

2.4.1.3   Curation tool dimension

The tool aims to enhance and support curation practices. More specifically, it mainly focuses on how to improve data curation that is part of archiving processes and also presentation processes as these have the most relevance in the context of using data to support participatory science stories. Within both archiving and presentation of data, we consider the following:

1. Metadata aspects: good metadata descriptions support data reuse by making it easier to construct queries that will find data, as well as making it easier to judge the relevance of returned data.

2. Visual aspects: To facilitate data reuse it is often necessary to make a visual representation of the data, to turn something very abstract into images and graphics. Visual aspects are important for sensemaking and for presenting data to others.

2.4.1.4   Impact dimension

Initial impact was found promising. These principles were tested in a case study Veden Armoilla is a participatory live game that is being created to engage Finnish students in Lahti with research related to water. As a first step in creating the game experience, an online pilot workshop 'Veden Äärellä' was held to trial some of the arts-based approaches in the context of participatory science storytelling. Feedback from the audience indicated that they found the overall experience to be participatory.

2.4.2   The potential for this tool

The principles described in Curator which propose different activities with data that could be embedded into participatory science stories. These cards will be further refined and updated during ParCos as they are utilized in case studies and made available from the ParCos platform. The principles were evaluated in the two Finnish case studies.

3 EVALUATION OF CASE STUDIES

Within the ParCos project, several case studies were conducted by the different partners. Each partner has selected one case study to evaluate.

3.1 VRT CASE STUDIES

In this case study we explored how participatory storytelling techniques can be used to reach a broad and diverse audience, as informing everyone is part of the public task that VRT, the Flemish public broadcaster must fulfil. This case study consisted of several experiments; the most important of these were:

- Interactive weather forecast
    - *Development:* result of design course and workshop, in which the first version of the ParCos storyteller was presented and evaluated by the students Media & Information design
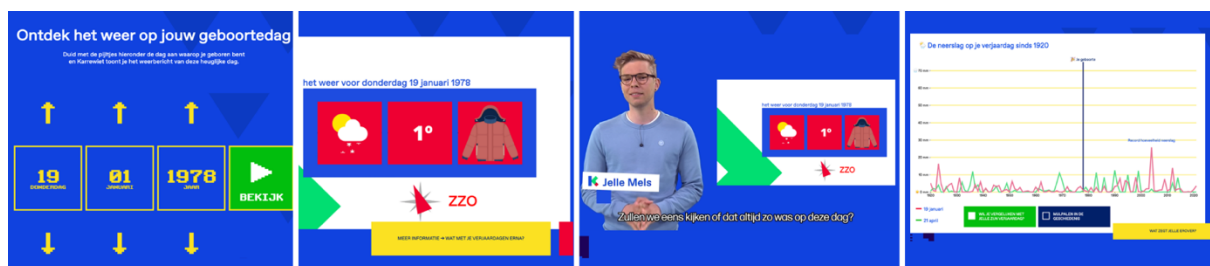   - *Evaluation*: Evaluated using interviews and observations (families who visit the expo)

Figure 8. Interactive weather forecast

- Interactive installation to discover a citizen science project about the sounds that stars make (AstroSounds)
    - *Development*: first ideation: design course (storyteller), further development: collaboration between scientists (astrophysicists) and VRT as an experienced media organization
    - *Evaluation:* video content was evaluated by the public (passers-by) in-the-wild and in an organized study (survey and interview)

Figure 9. AstroSounds

These different parts of the case study resulted in insights and design recommendations that media makers can help to increase the data literacy of the public.

When we reflect on the 4 science communication dimensions and quality criteria of the ParCos Trainer Cards we conclude that:

3.1.1.1 Scientific foundation dimension

The data on which the case studies are based were obtained from scientists associated with academic institutions. The interactive weather forecast was more focused on conveying the information (evolution of weather and precipitation data), but how this data was collected was less emphasized, but we assumed that visitors are familiar with this data because they know them from the daily weather forecast. The scientific process was explained more in detail in the AstroSound case study on the side panels, and how the visitors could contribute to this.

3.1.1.2 Communication dimension

The target group in both case studies is not the standard target group that reads scientific literature or watches difficult documentaries. That is why we have chosen to brand the installation in the typical house style of the children's television channel. The presenter of the youth news also leads the children through the story. By placing the installation in the canteen, there was room for discussion and interpretation between the family members who were present together. With the other installation we tried to lower the threshold by starting first with short, easy movies and then gradually

increasing the difficulty of the installation. At the end there was room for interaction and personal input.

3.1.1.3   Curation tool dimension

The weather data is compiled based on the birthday of the users. If we were to make a second iteration of this tool, we would give the users more tools to manage the data themselves, for example by comparing two data. We noticed that this was already happening verbally. The curation in the AstroSounds installation was done automatically, but the user was enabled for the categorization like a quiz.

3.1.1.4   Impact dimension

The intended impact of the more weather installation is twofold. On the one hand, we want to contribute to data literacy by presenting data in an accessible way. On the other hand, we also want to demonstrate with a practical example how the earth is warming, even if this often goes unnoticed in daily life. In the AstroSounds installation we want to make scientific knowledge accessible, and we want visitors to know that they too can make a difference by contributing without having that specific scientific background

3.2 KWMC CASE STUDY

We collaborated with people in Knowle West a community in Bristol to understand the scale and impact of household waste and explore creative solutions to the problem. We designed an activity called 'ReThink ReMake ReCycle' (RRR) which investigated the scale and impact of common household waste materials, such as paper and plastics, by unpicking the data behind what we waste.

Figure 10. RRR

We followed a process of online learning (workshops) and hands on making to explore sustainable solutions and alternatives. Then we worked together with participants to tell stories using the data collected and communicate what was learnt. This was through the creation of the 'ReThink ReMake ReCycle' Zine a way of communicating what participants discovered, to hear people's stories and advice for reducing waste, and to share a range of tutorials, activities and puzzles inspired by the project.

Most citizens who participate in citizen science are well educated and finding ways of engaging less educated or less privileged participants is an important goal if citizen science genuinely wants to move towards involving everybody. Therefore, the UK case study had a particular focus on working with people and in this case study we targeted local families. These residents also collaborated with other people in Bristol, including artists and businesses interested in the same issues, and shared learning with other communities.

The case study focused on generating new knowledge and understanding of household waste in Knowle West - with the local community collecting data and using this to explore creative solutions to address the problem, including through the use of sustainable materials. Participants were really creative in the objects they created as part of the making activities and the ideas they shared.

The registration and equalities data we collected indicated that we were successful at engaging with our target audience of families and that we attracted a diverse group of people to participate in terms of age and cultural heritage.

Figure 11. Waste audit

We followed a process of online learning (workshops) and hands on making to explore sustainable solutions and alternatives. During the workshops, we highlighted and shared open data behind what people waste in their daily lives. This was followed by utilising digital tools and a creative process to co-design, prototype, and test out sustainable alternatives
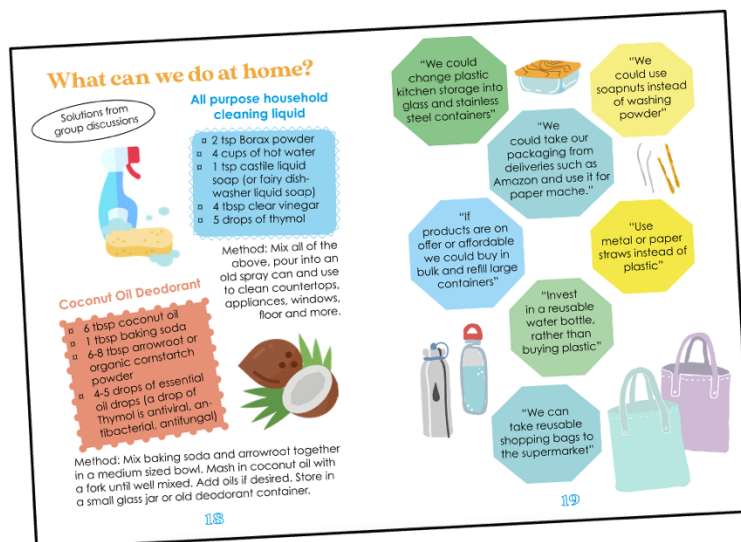
Figure 12. Zine and dishcloth

Then we worked together with participants to tell stories using the data collected and communicate what was learnt. This was through the creation of the 'ReThink ReMake ReCycle' Zine a way of communicating what participants discovered, to hear people's stories and advice for reducing waste, and to share a range of tutorials, activities and puzzles inspired by the project.

Most citizens who participate in citizen science are well educated and finding ways of engaging less educated or less privileged participants is an important goal if citizen science genuinely wants to move towards involving everybody. Therefore, the UK case study had a particular focus on working with people and in this case study we targeted local families. These residents also collaborated with other people in Bristol, including artists and businesses interested in the same issues, and shared learning with other communities.

The case study focused on generating new knowledge and understanding of household waste in Knowle West - with the local community collecting data and using this to explore creative solutions to address the problem, including through the use of sustainable materials.

The Zine communicated what the participants discovered, had information and advice for reducing waste, a range of tutorials, activities and puzzles that were inspired by the project. The Zine worked well as a creative and engaging way to collate, communicate and share a community data set. Participants were really creative in the objects they created as part of the making activities and the ideas they shared.

The registration and equalities data we collected indicated that we were successful at engaging with our target audience of families and that we attracted a diverse group of people to participate in terms of age and cultural heritage.

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3.2.1.1   Communication dimension

This was through online workshops and the Zine. The workshops incorporated mixed presentations, collaborative online tools such as Jam board, group discussion. and video tutorials. 'Home packs' were delivered to the participants. These included:

1. Printed 'waste audit' sheets to measure household paper and plastic waste.
2. Ingredients and tools for making bioplastic pine resin pots and gelatine – based plastic with agar.
3. Safety clothing for bioplastics activities.
4. A sewing kit, fabric, and towel for making washable, reusable cloths.
5. A laser cut keyring made with recycled plastic sheet.

3.2.1.2   Curation tool dimension

The data was curated into a Zine that encompassed all the elements of the workshops and tutorials in a creative and accessible way.

3.2.1.3   Impact dimension

By a combination of packs, workshop information, and jointly collaborating and discussing together. Participants were able to create solutions to waste in the household through the actual making and appreciation of their own recycled and reused waste objects. They were further able to share their learning and knowledge with others through the dissemination and sharing of the Zine.

3.3   LUT CASE STUDY

In this case study we developed a concept of Data Drama through which youth could participate in a science story about water quality in a lake that was local to their area. The lake had undergone a transformation between the 1970s and the present day, from being quite polluted to being one of the cleanest lakes in Finland. Data had been collected during this time to monitor the effects of policies and interventions, such as management fishing in the lake, or creating new wastewater policies to prevent factory activities that compromised the water quality. The data drama was enacted within a physical space that was set up to give the impression of an underwater world. There was one person who played a mythical character called Näkkitär. The character was part of a pretext drama about a future in which a threat to the lake had been detected. The character travelled back in time with the data between the 1970's and present day but with future data missing. The youth were tasked with understanding the data in order to try to understand what the threat could be and to imagine different futures for the lake and how to prevent undesirable futures from happening. Youth workers were trained to facilitate and lead the youth through activities. In order to make the data accessible within the data drama, interactive data comics were used to curate the data, which were card games that presented snapshots of data and activities taken and posed questions to support the youth to identify trends in the data

The case study and curation tool have been developed through a series of co-creative activities between project researchers, a water data specialist and youth workers. Evaluation was conducted through survey and interviews with participants to the event, including the local youth, the teachers of the youth who took part and the trained youth facilitators. Evaluation was also based on analysis of video taken during the event.

Figure 13. Data Drama

The purpose of the case study was to evaluate, through practice, data drama as an approach to participatory science stories and to understand which aspects of drama are important for fostering engagement with the topic and for scaffolding the data sensemaking process. Participants found the event enjoyable, they liked learning about the lake, felt that their knowledge of the lake improved and they liked the use of the card games for introducing the datasets into the experience.

Figure 14. Data Drama impressions

When we implement the 4 dimensions and quality criteria of the ParCos Trainer Cards we conclude that:

3.3.1.1   Scientific foundation dimension

The participatory science story was about the local area in which the participants lived, using real data from a local lake. The participants were therefore able to relate the data to their own experience and memories of the lake and their own personal histories around the lake. The goal of the story was to raise awareness of local issues around the lake and not to take for granted that the water quality will always continue to improve if bad practices are started again in the future. Therefore, the story had relevance to the audience. The science story sought not just to represent the voice and concerns of people but also the environment. The participation in the story was intended to also bring new voices and perspectives to the story rather than presenting the story as a 'finished article'. Since the drama used metaphor and the main character Näkkitär communicated without words it is possible that some aspects of the story were not as clear as they could be even though facilitators were there to help things along. However, while the story and premise was fictionalised, it was always made clear that the data in the story was real and the events talked about for improving lake quality are things that historically happened, thereby maintaining the integrity of the science behind the story. The data was

obtained scientifically and interpreted by people with domain expertise, thereby it was trustworthy and credible. The source was the datasets used to create the data comic cards, this data is openly available on request but it is not in a public repository.

3.3.1.2 Communication dimension

Communication was through the drama, which was presented in an interactive way (performing with, not performing to). Participants were involved in the drama in various ways, for example interpreting the data, enacting the data, drawing their desired and undesired futures. The advantages are to lower the barriers towards engaging with science and data, the disadvantages are that the drama is a time limited event and so specific aspects of the story and data were chosen to highlight and it was not possible in the context of the drama for participants to go beyond that. The drama experience was augmented with real recordings from under a lake. The character wore clothes designed fo the occasion and the entire space was fitted out with props to improve the aesthetic appeal of the story and increase the sensorial experiences.

3.3.1.3 Curation tool dimension

The data was curated into tangible data cards, with game elements. This made it easier to use in a collaborative way where participants could pick up and pass around 'pieces of data'.

3.3.1.4 Impact dimension

The use of drama was intended to support people to be able to connect emotionally to the problems of the lake but using a kind of aesthetic distance where it is not necessarily personal or confrontational. Drama conventions come with rules of respect, so participants in the drama must listen to each other and not interrupt or talk over people who are contributing their ideas.
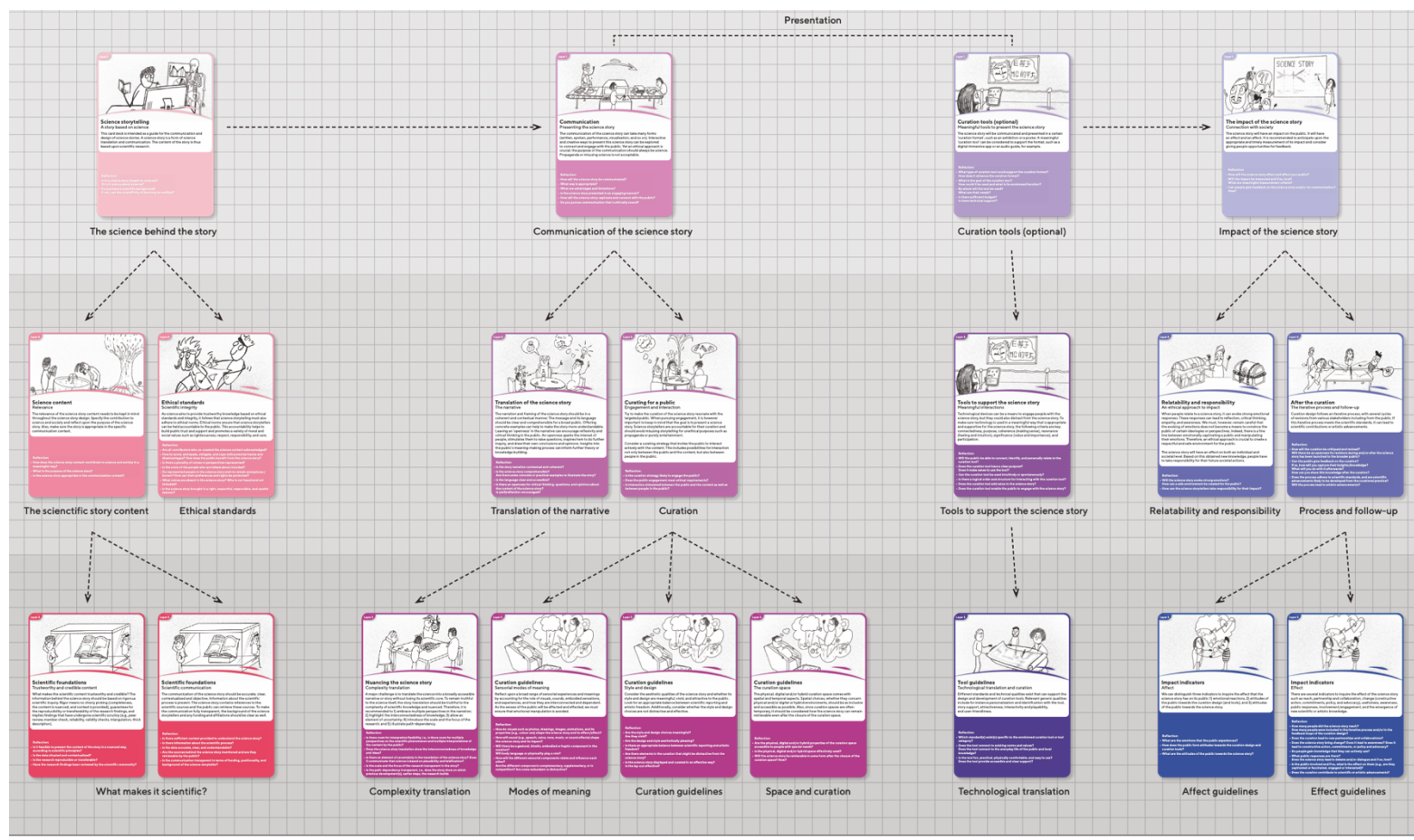
4   CONCLUSIONS

The ParCos partners used the Trainer Cards to reflect on the tools they have developed and the cases they have conducted. Using the Trainer Cards as an evaluation tool made it possible to create a uniform and structured evaluation process to which everyone could contribute.

The evaluation process in this report revealed that the Trainer Cards can be a valuable evaluation tool since they contain quality criteria for participatory science storytelling, but that a lot of time is needed to use them in-depth. Ideally, the whole team sits together to discuss the questions on the cards. In practice, however, it is not always feasible to gather a whole team, nor to go deeper into the four dimensions time management wise.

D3.6 should also be seen as an additional iteration step in the development of the Trainer Cards and it appeared that there are still some adjustments to the cards needed. These adjustments will be applied in the update of the Trainer Cards in D4.4. There will be two major changes in this update, namely: 1.) the name of the 'curation tool' dimension will change to 'technological tool'; and 2.) the text on the cards will be slimmed down. When assessing the different evaluation parts in the report, it appeared that it was not always clear that this 'curation tool' dimension was specifically intended for technological tools. Changing the name of the dimension will make this clearer. Also, there is too much text on the cards which makes them a bit overwhelming and less aesthetical. Slimming down the text also makes it possible to make the fontsize of the cards bigger which will make the cards more reader friendly. Since the manual in D4.4 will contain additional information on the individual cards, there will be no loss of information.

The assessment of the different ParCos tools and cases by means of the Trainer Cards created a useful moment to map them out and reflect on their potential at a key moment towards the end of the project. The evaluations suggested that the tools and cases under scrutiny hold a lot of potential and that they can be used by a wide range of stakeholders.

5 APPENDIX: OVERVIEW OF THE DIFFERENT D4.4 TRAINER CARDS