Psephos: Artifact ecologies & Participatory Design of Physical Data Representations for Deliberation

Host: Institut Mines Télécom (DIVA) / Inria (Aviz)

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Fig. 1. Photography of a deliberation session organized by Res Publica. Multiple artifacts are engaged: map, dot stickers, pens, paper, smartphone, topic cards.

In this PhD project, we aim to explore novel ways to organize deliberation processes. Deliberation is an important mechanism for decision-making, particularly on divisive issues. Physical computer-supported data representations have the potential to support such processes by providing a common external representation of the discussion including participants' opinions and arguments. We will investigate the current artifact ecologies of deliberation organizers and explore the use of computer-supported physical data representations to facilitate deliberation through a participatory design approach. This work will provide a new understanding of the role of physicalization in deliberation, novel tools for deliberation organizers and a toolkit accessible to the public.

1 Context

This PhD project will study the use of physical data representations to facilitate deliberation processes. The first representation of a democratic deliberation process is depicted on a Greek wine cup from 490 B.C., which allowed citizens to express their opinions on political matters by dropping a pebble in an urn [17]. Counting the stones provided the mechanism which anchored one of our earliest voting systems. We aim to investigate the use of physical data representations, in the historic tradition of the pebbles scenario to support more effective ways to organize deliberation. Although dedicated deliberation processes have been shown to reinvigorate democratic practices [24] in the face of waning trust in democratic institutions [22], there remains a lack of tools specifically tailored for in-situ deliberation. Numerous digital platforms attempt to foster asynchronous civic participation, but they often struggle with low engagement and accessibility issues [6], particularly for non-digitally literate participants. This project will tackle the challenges of supporting civic deliberation from the research area of information visualization and

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physicalization [17, 18]. While data physicalization has a historic tradition for deliberation, it has only recently emerged as a dedicated research direction in information visualization. Work in information visualization on decision-making has mainly focused on single-user desktop computer tools to help weigh options with the help of charts. What is primarily missing are tools for the collective participation of people in a deliberation process. Computer-supported data physicalization is a promising approach to address this challenge, since physical tools support people with different backgrounds, including digital novices, due to their tangible nature, potential for collaborative and co-located use, and ability to collect complex data with simple actions [16], while also collecting and storing the data digitally. In this project, we have multiple objectives: 1) Studying the dynamic artifact ecologies [4] of existing citizen deliberations in partnership with deliberation organizers (Res Publica) [1], 2) conducting a participatory design process with these deliberation organizers to create a deliberation toolkit that supports the facilitation of in situ deliberation processes with a specific focus on how data physicalization can be used to collect, record, and represent multiple trade-offs, opinions, positions, and arguments of people over time, 3) producing knowledge on the representation models and processes appropriate for these collective representations of deliberations, and 4) exploring how our findings can inform and scale up collective representations of deliberation processes without reducing their quality.

This project investigates the following research questions:

RQ1 What are the artifacts and their ecologies used to support the organization of current deliberation processes?

RQ2 How can we co-create computer-supported physicalization tools to facilitate deliberation process together with deliberation organizers in a participatory design process?

RQ3 How can the results of the artifact ecology analysis and the participatory design process be operationalized into a deliberation toolkit that bridges the benefits of physical and digital interactions?

These research questions, especially **RQ2** and **RQ3**, align with the needs and interests of our partner, Res publica.

2 Nature of Digital Collaboration

This project focuses on deliberation as a mode of collaboration. Deliberation is an exchange of arguments leading to a choice [21] and is as such a crucial mechanism for decision-making. Deliberation processes can renew democratic decision-making, participant trust, and engagement [24]. A notable example of a deliberation process is the Citizen Convention for the Climate [13] which consisted of multiple sessions to propose policies to reduce France's carbon emissions. The potential deliberations we are targeting include local workshops, on-campus meetings, neighborhood councils, or city hall deliberations. These types of deliberation processes are often mediated by a mix of different tools including online platforms [10] and a variety of physical and digital tools. We will focus first on investigating deliberation from a holistic perspective by mapping out the artifact ecologies of our PD partner, Res publica, which includes a mix of tools for asynchronous online deliberation with their own online platform as well as physical and digital tools for synchronous co-located deliberation. In the next step, we will focus on co-located, synchronous deliberation where we will investigate the use of computer-supported data physicalization. These types of deliberation processes usually involve between 30 and 150 citizens, and can be organized with invited experts (2—50), and multiple facilitators (2—20).

3 State of the Art

Studies at the intersection of Human-Computer Interaction (HCI) [7, 19] and political science [21, 26] have explored various applications involving both citizens and policymakers [1, 21]. Most of the work in HCI and deliberation

[1] https://www.respublica-conseil.fr/

has focused on online deliberation platforms [12, 15, 19], crowd-sourcing [2, 27, 28], and recently the use of AI [29]. The effectiveness of these deliberation platforms has been criticized as they often lack engagement [6], can polarize opinions [20], and are designed without considering best practices in debate [11]. These platforms also mostly focus on distributed asynchronous interaction. The novelty of our approach is based on two aspects: studying an ecological valid situation by investigating the artifact ecologies of current deliberation processes and exploring the design of data physicalization for deliberation.

Artifact Ecologies and Materiality. In a recent review on participation in democratic decision-making processes, Nelimarkka [23] highlights the research opportunity of studying "the importance of materialities in political participation". Analyzing the artifact ecologies of deliberation processes is well suited to tackle this challenge as this approach foregrounds the relationships between artifacts, people, and their practices as well as the dynamics and multiplicity of computer-mediated collaborative activity [4]. Deliberation processes often happen using multiple interactive physical and digital artifacts with a diversity of stakeholders and a variety of situations, including co-located and remote sessions, as well as synchronous and asynchronous communication. By analyzing these activities and their artifact ecologies, we can get a better understanding of artifacts as mediators and the meaning they hold within the joint activity.

Discussion and Data Physicalization. The use of data physicalization [18] and input visualization[5] as an approach to support the co-located synchronous and asynchronous discussion has been explored in prior research. Data physicalization as a promising research direction for supporting deliberation is well-illustrated by the historical example of pebble voting in ancient Greece [17]. Recent projects demonstrate the effectiveness of physicalization to foster reflection on topics such as Edo [25] which aimed to facilitate discussions around dietary choices and input physicalization to encourage conversations around sustainability at conferences [14]. Other examples include the "Let's Play with Data" kit [8], which enables citizens to collect data on local issues. While most current data physicalization tools focus on asynchronous communication, we will explore synchronous, co-located physicalizations to support discussion.

4 Objectives and Approach

The outputs of this project will create value both for the research community by creating knowledge on the use of data physicalization in deliberation processes and for deliberation facilitators and society at large by providing new tools for real-time deliberation. Data physicalizations have the potential to support co-located collaborative deliberation processes by tracking relevant information, providing a shared view of changing opinions and arguments of people, and enabling people to change and manipulate this shared overview physically. Designing data physicalization tools for deliberation remains an interdisciplinary scientific and design challenge necessitating a deeper understanding of what to represent, how to represent it, and how to design people's interaction with the data physicalization. Another challenge is to design these data physicalization collection mechanisms in a way that they support digitalization of the data [5] as well as reducing the ambiguity of the collected data. To address this, we will engage in a participatory design (PD) process [3] with a company — Res publica that specializes in organizing collaborative dialogues and which has, among other projects, organized the Citizens Convention for Climate [13]. Through engaging in a PD process, we aim to create a data physicalization deliberation toolkit that will be deployed with one of their clients with the goal of actively involving different stakeholders in the design to create a tool that fits the facilitation needs of Res publica. The PD process will encompass co-design sessions, including brainstorming, ideation, and prototyping activities. We will operationalize these sessions by designing and implementing a deliberation toolkit while also investigating the best technical solutions for digital data acquisition through different tangible data collection mechanisms. We will evaluate

how the deliberation toolkit impacts the participant activity in a real deliberation process with Res publica, through a qualitative approach [9]. We will collect data in the form of audio and video recordings which we will analyze regarding the deliberation quality, interactions with the tool, and the implications of using externalization of participants' opinions and arguments through data physicalization.

4.1 Project Goals

Our project follows the following sub-goals:

- **SG1 - Survey** - Understanding the design space of data physicalization to support deliberation: To get a better understanding of the design space of visual representations for deliberation as a basis for **SG3** (PD process), a systematic survey and investigation of visual representations and interaction mechanisms to facilitate deliberation is necessary. This can produce knowledge on the appropriate representation models and processes and inform the design of visual representations to facilitate deliberation processes.
- **SG2 - Artifact Ecology Analysis** - Understanding tools and artifact ecologies of deliberation facilitators: Investigating the experience of deliberation facilitators and participants along with their current tools and processes is crucial for understanding their information needs and designing visualizations for deliberation. Observations and interviews can build the basis for mapping out facilitators' and participants' artifact ecologies [4] including both their physical and digital tools.
- **SG3 - Deliberation Toolkit** - Participatory design of a data physicalization toolkit for deliberation: Based on **SG1** and **SG2**, we aim to investigate how to design a data physicalization that can support an in situ deliberation process. We will organize multiple co-design sessions to create a data physicalization toolkit with Res publica including ideation and brainstorming sessions, low and later high-fidelity prototyping to explore different designs, and the fabrication of the final toolkit.
- **SG4 - Evaluation** - Evaluating the impact of the data physicalization toolkit: We will evaluate the effect of using data physicalization to support a deliberation process. We will deploy the tool from **SG3** in a deliberation process with a client of Res publica and analyze the process with regards to the interactions with the tools and the impact on the deliberation process.
- **SG5 - Scale** - Reflecting on Scaling up: Lastly, we will explore how collective physical representations might scale up in different ways so that the findings from this process can inform other large-scale (online) deliberation processes without compromising their quality.

4.2 Project Partners

This project will bring together partners with complementary areas of expertise from information visualization (Inria), interaction Design (Télécom Paris), and deliberation experts (Res publica). The host for this PhD proposal is the DIVA (Design, Interaction, Visualization & Applications) group at Télécom Paris in collaboration with the Aviz team (Analysis and VIsualiZation) at Inria.

- **Advisor: Dr Nathalie Bressa (Télécom Paris, IPP)** is working on situated visualization and data physicalization for deliberation and has a background in participatory design.
- **Advisor: Dr Samuel Huron (Télécom Paris, IPP)** is an interaction and data physicalization expert and support the design, development, and implementation of the deliberation toolkit.

- **Advisor: Dr Petra Isenberg (Inria)** is an expert in collaborative visualization and will support visually representing the data in the deliberation process.
- **Project Partner: Sophie Guillain (Res publica)** is an expert in organizing collaborative dialogues and deliberation processes like the Citizens' Climate Convention and will be the partner for the PD process.

5 Contribution to Digital Collaboration: Expected Results and Impact

This PhD project will make empirical, technical, and conceptual contributions to human-computer interaction and information visualization. The empirical contributions include an artifact ecology analysis of how deliberation organizers use digital and physical tools to facilitate deliberation processes, along with findings from a participatory design process that explores the co-creation and use of physicalization tools in synchronous, co-located deliberation. The technical contribution involves the design and development of a deliberation toolkit that uses data physicalization as a digital data collection mechanism. The toolkit will be designed through a participatory design process and can be used in other deliberation scenarios. On a conceptual level, the project will formalize the design space of data physicalization for deliberation, providing a structured understanding of the research space.

From an applicative perspective, we will co-construct a deliberation toolkit with Res publica and its documentation will be made available to the public to reproduce the tool and procedure so that the toolkit can be reused in other contexts. The results of this research can benefit deliberation processes in a variety of contexts such as local workshops, neighborhood councils, or city hall deliberations. Citizen collectives will need to make an increasing number of local decisions to adapt to changing environments, and producing easily deployable and accessible tools to support collective deliberation can have a significant impact on the organization of future deliberations on important societal topics.

6 Positioning in the eNSEMBLE program

This research is situated at the intersection of data physicalization [18] civic deliberation [11], and human-computer interaction [19]. This project connects to PC4 CONGRATS as we aim to 1) design and develop community-centered tools that support deliberation processes, 2) infrastructuring data physicalization platform participation, and 3) study deliberation processes that include a large number of people. Projects from our partner, Res publica, typically involve 30 to 150 people (as with the Citizen Convention for the Climate). We expect to explore the space of possible collective representations with tangible tools to understand the activity and how they might scale up in different ways so that the findings from this process can inform other large-scale (online) deliberation processes. We position this research within *WP 4.4 Understanding socio-technical collaborative systems in action* and specifically the sub-task on *Public debate and platforms for citizen deliberation* as we aim to design new collaboration tools for public deliberation where we work together with facilitators in a PD process.

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