

Let's Get Physical, Exploring the Design Process of Data Physicalization

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1. Workshop Organiser/s

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2. Context of Workshop

Humans have invented and used many forms to represent data, in order to facilitate sense making, communication and exploration processes. Data visualization is becoming a common practice in industry and a recognized research field that contributes to a richer understanding of the potential to encode data visually. Yet representations which address more than the visual sense and which could facilitate sense making in novel ways are still largely unexplored. Data physicalization¹, i.e. the design of physical artefacts whose geometry or material properties encode data, is an emerging research area that explores the potential of physical data representations as a sense making and communication medium; making information genuinely graspable.

This workshop is the fourth in a loosely connected series that commenced in 2014 at the IEEE VIS conference². Since then, we have conducted related workshops at ACM CHI³ and

¹ See also <http://dataphys.org>.

² **Death of the Desktop: Envisioning Visualization without Desktop Computing**. IEEE VIS, Paris. Organizers: Yvonne Jansen, Petra Isenberg, Jason Dykes, Sheelagh Carpendale, and Dan Keefe. <http://beyond.wallviz.dk>

ACM TEI⁴. These have attracted practitioners and researchers from the Design, Information Visualization, Computer Science, Interaction Design and Tangible Interaction communities.

Previous workshops demonstrated that Data Physicalization is a vast emerging field that connects multiple and cross-disciplinary perspectives. Topics of interest range from perceptual and cognitive aspects to application-oriented questions. This workshop proposal is targeted specifically to the design community of DRS: through hands-on activities, we will introduce researchers and practitioners to the data physicalization process and engage them in an open discussion about (1) potential application scenarios, (2) how to engage people in data physicalization practices (e.g., in educational and/or creative settings), and (3) identify the research questions and challenges that arise in their own work.

3. Planned Activities and Expected Outcomes

This full-day workshop will provide a rich hands-on introduction into the area of data physicalization. We will explore different design approaches to representing and communicating data through physical artefacts, while critically reflecting on possible design choices regarding forms and materials. Through these documented hands-on explorations, we seek to engage participants from different backgrounds in critical discussions about the potential, advantages, and limitations of data physicalization. Participants will practically experience all phases of data physicalization: from sourcing data, encoding of data in form and material, building data artefacts, and, finally, reflecting on the design process. We will first provide a quick overview of existing practices and key concepts of data physicalization. We will facilitate four activities:

(1) Building a shared dataset [pre-workshop]. There is no data physicalization without data. So, before the workshop we will ask participants to contribute to the creation of a shared dataset⁵. The purpose of this pre-workshop activity is to make the data meaningful and engaging to participants. This dataset will form the basis for all physicalization activities during the workshop.

(2) Exploring design options [2h]. Participants will work in small groups to explore different design options for the data generated in Phase 1. This involves considering the interplay between the semantics of the data, different analog materials (such as paper/cardboard, plasticine, LEGO), and the intended environment for the data artefact. Outcome of this phase will be a documentation of the design process and the considered design choices. At

³ **Exploring the Challenges of Making Data Physical.** CHI 2015 in Seoul. Organizers: Jason Alexander, Yvonne Jansen, Kasper Hornbæk, Johan Kildal, and Abhijit Karnik.

⁴ **Tangible Data, explorations in Data Physicalization.** TEI; Eindhoven. Organizers: Trevor Hogan, Eva Hornecker, Simon Stusak, Yvonne Jansen, Jason Alexander, Andrew Vande Moere, Uta Hinrichs and Kieran Nolan. <http://dataphys.org/workshops/tei16>

⁵ Recreating a dataset similar to the one used by Walny et al. An Exploratory Study of Data Sketching for Visual Representation. Computer Graphics Forum. Vol. 34. No. 3. 2015.

the end of this phase, we will discuss our results, focusing on data encoding, process, similarities and differences.

(3) Modifying and Iterating on Physicalizations [2h]. Changing groups, participants will modify and/or iterate on the physicalizations built during Phase 2. This could include exploring a different aspect of the data, alternative encodings, or different forms and/or materials. We will invite participants to use objects from the direct environment (e.g., sand, rocks or paper cups) to widen the range of materials and to relate in a different way to the data set. At the end, we will discuss and map the resulting data artefacts and rationales regarding form and material.

(4) Reflection & Discussion [1h]. In a participant-driven discussion, we will reflect on the data physicalization process and discuss the benefits and difficulties of encoding data in physical form. The discussion might include other materials, techniques and methods, such as the potential of digital technologies (e.g., 3D printing, arduino,...) for data physicalization, to frame future explorations that participants may engage in as part of their own work.

4. Intended Audience

We invite designers, researchers and practitioners (ideally 20 participants) from all backgrounds. No previous knowledge is required.

5. Length of Workshop

We envision a full-day workshop (see above for timing). From our experience, a full-day is just enough to offer participants a hands-on experience of the concepts, while allowing time to reflect on their artefacts and to discuss questions and challenges about Data Physicalization.

6. Space and Equipment Required

A studio-like environment with large tables, a projector, and a whiteboard would be ideal (a printer would also be a nice option). We will provide all other equipment and materials.

7. Potential Outputs

Our workshop will produce a number of physical data artefacts, whose production processes will be documented and displayed on a website, along with the challenges and questions that we will identify and discussed during the workshop.

Yvonne Jansen is a post-doctoral researcher at the University of Copenhagen, Denmark. Her research focuses on how people engage, perceive, and interact with data physicalizations. She has co-organized workshops on similar topics at IEEE VIS'14, ACM CHI'15, and ACM TEI'16.

Pauline Gourlet is a PhD student at Paris 8 & EnsadLab. Her research focuses on the design of reflective tools for educational environments, seeking to engage learners in reflective processes through non-verbal channels.

Samuel Huron is an assistant professor at Mines-Télécom ParisTech. His research lies within the domains of design, information visualization, and tangible interfaces.

Uta Hinrichs is a Lecturer at the University of St Andrews, UK. Her work focuses on designing and studying the use and experience of interactive systems that facilitate the exploration of (cultural) data collections from academic, leisurely, and artistic perspectives.

Trevor Hogan is a Lecturer at CIT, Ireland. The aim of his research is to describe how embodiment influences an audience's experience of data representation. His work may be situated in the field of Interactive Design, at the intersection of Tangible Computing, HCI and InfoVis.