Pedagogy & Physicalization: Designing Learning Activities around Physical Data Representations

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Abstract

In an age where data and their various representations proliferates many aspects of our professional and private lives, a new form of awareness and visual literacy is required to interpret, critically discuss and actively engage in activities around data representation. Research has found Physicalization to be a productive way to introduce people to activities around data collection, processing, and representation – be it to learn about the concepts of making abstract data graspable, or to learn about complex phenomena represented within the data. This full-day hands-on workshop will explore how designing and building Physicalizations can be a way to actively learn the principles of data representation. The aim of this workshop is to (1) discuss different learning scenarios in which Physicalization activities can be beneficial, (2) explore different approaches to introduce Physicalization activities to different learning audiences, and (3) to build a community interested in the pedagogy of Physicalization.

Author Keywords

Data Representation; Pedagogy; Physicalization; Physical Material; Activity-based Learning.

Figure 1. A: Physicalization of hand movement © Bettina Nissen, B: Data jewellery © meshu.io, C: Laser-cut bar chart showing annual unemployment rates in Europe Fundament [8]

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

Theme, Motivation and Goal

Data Physicalization is an emerging research field that explores the potential of physical artefacts whose geometry or material properties encode data as a way to make sense of and communicate data [10]. Current examples range from physical forms that represent the hand-movement of crafts people (see Fig 1a) [16], to Data jewellery representing GPS data (see Fig. 1b) and physical bar charts (see Fig. 1c) used to compare physical and virtual visualizations [8].

Through a series of workshops we have discussed this topic from different perspectives and with different academic and professional audiences, starting in 2014 at the IEEE VIS conference [9] aimed at visualization researchers and practitioners, ACM CHI 2015 [1] and TEI 2016 [5] to engage the HCI and Interaction Design community into the discussion, and DRS 2016 [11] to introduce designers into the process of Physicalization (see Fig.2). The general aim of these workshops was to build an awareness of and a community around Physicalization, as a field that connects multiple and cross-disciplinary perspectives. These workshops, as well as other research [10,18] have explored the potential benefits and use scenarios for Physicalization. This proposed workshop will add to this workshop series by focusing on a relatively underexplored area: the pedagogy of Physicalization.

Pedagogical questions in the context of data representation have only recently received increased attention, for example within the visualization community [4,12,13]. In parallel, discussions around

the value of Physicalization to teach critical approaches to data and its representations [6,**Error! Reference source not found.**,18] and how to integrate Physicalization activities in educational settings in the wider sense [7] have started to emerge. These trends find their backing in extensive research dating back to the 1950's that has shown the potential of tangibles to support learning (c.f. [15,17]).

The goal of this workshop is to start a discussion on the pedagogy of Physicalization in the light of active [2] and project-based learning [14] within and outside of educational environments. This will unpack two entwined perspectives: A *pedagogical perspective* focusing on scenarios where Physicalization can be beneficial to convey certain learning objectives (that include but are not limited to teaching visualization concepts) and a *practical perspective* that explores how to facilitate the activity of Physicalization in learning scenarios (e.g., schools, universities, workshops, community centres) and with audiences of varying size, age, and background.

The workshop will provide opportunities for participants to share their experiences, questions and practical approaches around the pedagogy of Physicalization and to explore Physicalization hands-on while experiencing one method of running a Physicalization workshop that we have designed and explored previously. Through sharing experiences and ideas alongside practical explorations, this workshop will foster reflective discussions on the pedagogical methods, scenarios, and benefits of Physicalization.
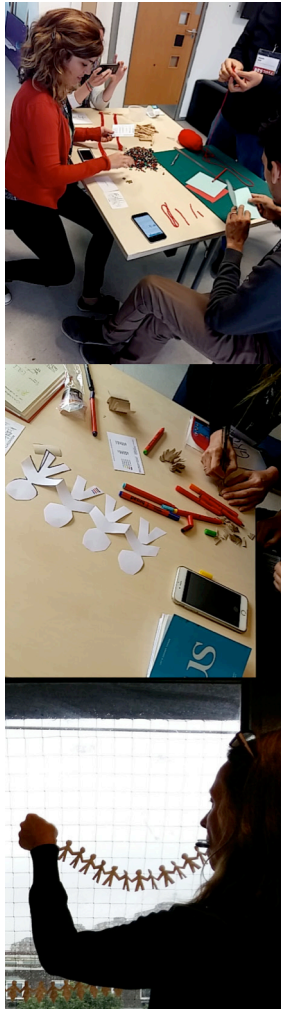
Figure 2. DRS 2016 Workshop: "Let's Get Physical, Exploring the Design Process of Data "Physicalization"

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