IEEE VIS Workshop on Data Vis Activities to Facilitate Learning, Reflecting, Discussing, and Designing

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ABSTRACT

This workshop focuses on 'data-visualization activities', especially methods and challenges for teaching and engaging with data visualization concepts, knowledge, and practices. For example, *sketching* aids designers to consider alternative ideas; manipulating *tokens* help students conceptualize quantities for data visualization; user interviews and *discussions* help developers understand requirements. Workshops, classes, or collaborations with domain experts, often include hands-on data visualization activities that involve analog or digital tools and materials and more or less well defined protocols. Recent years have seen the emergence of such data visualization activities in different contexts, including education, visualization design, activism, self-reflection, and interdisciplinary collaboration. However, the broad range of contexts and target audiences that Data-Vis activities have been applied to makes it difficult to collect and identify commonalities and build knowledge in a systematic way. Thus, the goals of this workshop are *i)* start building an understanding and to synthesize protocols and materials used to lead data vis activities, *ii)* to bring together researchers, practitioners, and educators from within and outside of the visualization community, *iii)* brainstorm, design, experience, and try novel activities, and to *iv)* discuss issues around goals, methods, audiences, materials, and evaluation for teaching data visualization.

Index Terms: Human-centered computing—Visualization—Visualization techniques—;Human-centered computing—Visualization—Visualization design and evaluation methods

1 MOTIVATION

With the increasing wide-spread and awareness of data visualizations through media available products (e.g., Tableau [25] or Rawgraphs [18]), and the forming of a public culture (see, e.g., [17]) that targets non-expert audiences, visualization literacy in its broadest sense is becoming an important and valuable asset. In fact, helping people acquire skills related to designing, reading, employing, and discussing data visualizations is no longer confined to the academic context; it is an important part of interdisciplinary collaborations between visualization and domain experts [9, 19, 23], public engagement activities [11], workshop [16], private consulting, pre and highschool teaching [2, 5], upskilling for professional development and personal visual analytic [26].

Visualization as a field is rapidly evolving, and as a growing community of scholars and practitioners who teach visualization at universities, public workshops and beyond, we have a lot of questions about *What to teach? How (and how *not*) to teach? What teaching styles to adapt? How to evaluate students and success? What materials to use? Which teaching activities work well? How do audiences differ and what are the implications for our teaching content and styles?* Discussing and finding answers to these questions is crucial, not only to new university faculty and visualization instructors, but also practitioners in visualization and public engagement, school teachers, etc.—especially since only few of us enjoyed explicit training in pedagogy and how to educate. At the same time, being part of the global scientific community at the forefront of knowledge generation, it is our mission to engage with the wider community to transfer our knowledge in creative and effective ways. Moreover, many of us are engaged in interdisciplinary research which includes on-boarding our collaborators and help them thinking with visualization [24].

Workshops on the topic of teaching data visualization have been held before; as part of a Dagstuhl in 2007 (Information Visualization-Human-Centered Issues in Visual Representation, Interaction, and Evaluation) and two workshops at *IEEE VIS* (Pedagogy of Visualization (2016) [1], Pedagogy of Visualization (2017) [13]). Indeed, participants at the Dagstuhl 2007 workshop discussed approaches to teaching visualization for university courses [15], but these discussions were at a high-level. And although there is a strong interest – within, and beyond, the visualization community on discussing and consolidating methods of facilitating learning, and design processes for visualization – there is surprisingly little literature on the topic. We believe the high-level discussion about visualization teaching, literacy, and education must continue in 2020 and include more practical and applicable elements—potentially becoming a integrated part of the conference.

Our workshop focus is on actionable teaching *activities*. *Data-Vis activities* are activities to engage learners with visualization towards a specific goal. In contrary to didactic learning, activities are hands-on creative processes in which participants learn through performing the activity.

In recent years, we have seen an increase of different visualization activities. These have been created by visualization researchers and designers, and applied to a broad range of contexts, and for different audiences. Examples of activities include the five-design sheet methodology for learning visualization design [22], workshops for data comics [3], methodology [9], design spaces and patterns [14], involving physical tokens [11], creating simple visualization sketches of two quantities [21], self reflection on personal data [26], engaging people with physicalization [12], engaging community in citizen science project [6, 29], and activities to improve data literacy [4, 10].

Such hands-on visualization activities typically involve a series of more or less defined steps to facilitate thinking with, and about data, and their visual representations. Data-vis activities can involve analogue tools such as pen and paper [27], everyday physical materials [12], or digital visualization tools (Tableau Desktop, D3.js, etc.), and the duration of activities can vary from a few minutes to several weeks. Activities have been actively explored to learn visual

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mapping concept [11], learn visualization toolkit [7], to structure visualization design process [22], explore data collectively [8], generate physicalization, and elicit phenomenon [20], better understand people relation to data [8], or empower citizens [20].

2 Workshop Goals

In this workshop, we aim to facilitate both: *i)* a broader discussion on the current state-of-the-art and advances in teaching visualizations and *ii)* foster exchange and creation of data-vis activities for a wide range of goals, audiences, and other factors. We propose to see a Data-Vis activity as an activity where people can learn from the outcome and/or process of the visualization activity.

The goal of this workshop is to discuss and start synthesizing current and visualization activities and, in this way, to inform future visualization activities. This will include learning and teaching approaches, materials, goals, challenges, and experiences, in educational contexts and beyond. Despite the increasing number of data activities that have been produce by designers [17] in academia [3, 12, 22, 26, 27], industry [25] and N.G.O. [20], we have a limited understanding of the domain of data-vis activities. This raises many questions, such as: what is the design space of data-vis activities? What are the criteria to evaluate a successful activity? Can we define guidelines for designing data-vis activities?

The workshop will be organized in two parts. (1) presentations from submissions and (2) time for participants to elicit challenges and discuss novel solution to them.

3 Call for Submissions

This workshop will accept three types of short paper submissions:

Research refers to classical workshop papers with a scientific contribution in theory, reflection, application, evaluation, design, or implementation. Page length will be limited to 4 pages, using the standard IEEE style. Contributions can include: activities, learning material, learning goals, taxonomies, visualization guidelines, critical reflections on conducing visualization activities (teaching experience), evaluation strategies for activities, teaching approaches, ethical and critical considerations on activities and teaching.

Activities include procedures, reports and experiences about one or many teaching activities, e.g., protocol and material of activities including results and reflections. As part of the call, we will provide a template to report and explain an activity. Activities should be in PDF format and will be published in this format on the workshop website. This template will be subject to discussion by the workshop participants during the workshop.

Materials include new teaching material that supports teaching in general and which is ready for application (slides, visualizations of schema/diagrams/design spaces, cheat sheets [30], teaching tools), or targeted to support specific activities (physical visualization, sketching templates, programming tutorials). A *material* submission should not exceed 2 pages text plus appendix and supplementary material (e.g., graphics, videos, websites). The 2 pages should describe context, design decisions, associated or possible activities, and reflections or evaluations from their application. The actual material is to be included as supplementary material and can be presented as poster at the workshop.

Any submission—research, activity, or material—will be peer-reviewed, providing constructive feedback for the camera-ready version. All submissions will be published on and linked from our website. On submission, authors have to choose whether their a successful submission should be made archival or should only be available on the workshop website.

4 Schedule and Planned Activities

We envision this workshop as a full-day workshop which will combine paper presentations, discussions and hands-on activities. If we would need to make the workshop half-day, we would remove the paper presentations and would concentrat on the activities instead. However, we really think this workshop will help reflecting on the more wider topic of teaching visualization and to establish a new permanent stream within the visualization community. The workshop will be split into two parts, a *paper presentation and discussion* session and an *activity* session. The first session will focus on sharing research, presenting workshop papers and discussing advances and questions in visualization activities for teaching, reflecting and designing within different contexts. The activity phase will focus on a hands-on activities to categorize, create, and discuss data-vis activities methods.

4.1 Paper Presentations & Discussion

After a brief welcome, the first part of the workshop will start with a keynote which is meant to set the context and ideally highlight some challenges in the field (30min). A possible keynote speaker could be Prof. Dragan Gasevic (`https://research.monash.edu/en/persons/dragan-gasevic`), scholar in learning analytics with a background in analytics and pedagogy and currently collaborating with one of the workshop authors on visualization pedagogy. The keynote will be followed by participants presenting their submissions (5min talks). After all accepted submissions have been presented, we leave space for an open discussion on challenges and directions related to the topic of the workshop. Participants who presented will be part of a panel for the discussions. At this point, other participants can ask questions about the submissions.

4.2 Activity session

The activity sessions will provide space for workshop participants to invent and test new activities in a structured way. The goal of this second part of the workshop is to create, experiment, and bring people together. We will first warm up the activity session with a short data visualization activity, then explain the afternoon session and have participants identifying challenges they would wish to think activities for. For duration for every step, see Section 5.

4.2.1 Warm up activity

To warm up the audience a really short but popular data-vis activitieswill be run during 10 minutes with the audience, e.g., Santiago Ortiz' number-visualization exercise. [1]

4.2.2 Identifying activities challenges

This phase will ask participants to identify challenges in teaching, contexts, scenarios or teaching goals to which they want to design activities. This could include any problems during their data vis work (teaching, on-boarding data experts, designing a visualization, collectively analyzing data, etc.). Each of these activity challenges should be defined and written down on *challenges-template cards*. Cards will include fields such as name, challenge, context, task, audience, data types. These challenges cards will be hung on the wall.

4.2.3 Voting and grouping on challenges

During this phase participants are invited to present their challenges cards. In the follow up of the presentations, a quickly discussion of the grouping for challenges will be engage. Then, dot stickers will be distributed to all of the participants in order to vote on their favorites challenges. Based on their votes participants group themselves into teams (the size of the group will be depending on the number of participants).

[1] https://visual.ly/blog/wp-content/uploads/2012/07/poster75and37.pdf

4.2.4 Creating & discussing activities

Each team will work on designing and creating novel activities based for the chosen challenge(s). Activity templates, the same as for Activity-submissions, will be distributed among the teams to help them define and formalize their activity. The template will contain fields such as time line, step by step description, material list, goals, data, list of shareholders, roles, etc.

4.2.5 Testing the activities

Each team will split in people instructing other groups in an activity (at last 2 group members), and the people experiencing other group's activities. Depending on the time remaining at this stage, roles of facilitators and participants may be flipped during several iterations so that every participant has the chance to participate in at least one other activity.

4.2.6 Reflection and discussion

After experiencing, all groups gather again and discuss three aspects: *i)* observations on the activities run by their own team and how the own activity can be improved; *ii)* observations and impressions on the activities run by others teams for feedback; and *iii)* discussing, critiquing and improving the data-vis activities template.

4.2.7 Discussion and Wrapping-up

Discussing the activities will lead into a more general discussion on open challenges for teaching data visualization and a research agenda opportunities and challenges of data-vis activities beyond this workshop.

5 Intended Schedule

In the following we have outlined a tentative schedule for this full-day workshop.

- 09:00 —09:10 (10 m.) **Opening and outline**
- 09:10 —09:40 (30 m.) **Keynote and discussion**
- 09:40 —10:30 (50 m.) **Paper presentations I (5min slots)**
- 10:30 —10:50 **Coffee Break**
- 10:50 —11:40 **Paper presentations II**
- 11:40 —12:30 **Open discussion about challenges**
- *12:20 —14:20* ***Lunch Break***
- 14:20 —14:25 **Afternoon opening**
- 14:25 —14:35 **Warm up Data Vis activity** (see Section 4.2.1)
- 14:35 —15:50 (75 m.) **Groups: creating & discussing (see Section 4.2)**
- 15:50 —16:10 **Coffee Break**
- 16:10 —16:55 (45 m.) **Groups: running and testing.**
- 16:55 —17:15 (20 m.) **Groups: reflection time**
- 17:15 —17:45 (30 m.) **Wrap-up discussion**
- 19:00 **Voluntary Workshop Dinner**

6 Pre-Workshop Organization Timeline

The timeline for the workshop organization is as follows:

- April 4, 2020: **Call for Participation**
- July 4, 2020: **Submission Deadline**
- July 25, 2020: **Reviews Collected**
- August 3, 2020: **Author Notification**
- August 17, 2020: **Submission Camera Ready Deadline**

We plan to advertise on the respective mailing lists for ACM CHI, IEEE VIS, DRS, ACM DIS, Digital Humanities, Art+Design, Tableau. We also plan for inviting people personally such as: Catherine D'Ignazio, Raoul Bhargava, Dominikus Baur.

7 Intended Outcomes & Contributions

We think this workshop will be a unique experience to lay out the challenges people have with data-vis activities, sketch a first research agenda, and highlight the opportunities of data-vis activities for the community. During paper submissions and activity creation we collect activities and a corresponding activity template for describing and sharing visualization activities. We plan for a website summarizing data-vis activities teaching material and pointers to external teaching material.

8 Possible Keynote Speakers

1. Dragan Gasevic, Monash University
2. Catherine D'Ignazio / Lauren Klein / Raoul Bhargava
3. Wesley Willett, University of Calgary

9 Tentative PC List

1. Jason Dykes, City, University of London
2. Jan Aerts, University of Leuven
3. Yuri Engelhart, Twente University
4. Jon Schwabish, Urban Institute
5. Jeremy Boy, UNDP
6. Nathalie Henry Riche, Microsoft Research
7. Fanny Chevalier, University of Toronto
8. Isabelle Mireilles, Northeastern University
9. Marian Dörk, University of Applied Sciences Potsdam
10. Daniel Keefe, University of Minnesota
11. Wesley Willett, University of Calgary
12. Niklas Elmqvist, University of Maryland
13. Charles Perin, University of Victoria
14. Petra Isenberg, Inria
15. Bettina Nissen, University of Edinburgh
16. Lyn Bartram, Simon Frazer University
17. Anastasia Bezerianos, Inria
18. Enrico Bertini, New York University
19. Melanie Tory, Tableau Research
20. Romain Vuillemot, École Centrale de Lyon
21. Petra Isenberg, Inria
22. Bhargava, Rahul, MIT Medialab
23. Kyll Hall, Temple University
24. Sarah Goodwin, Monash University
25. Jagoda Walny, National Energy Board Canada

10 Organizer Bios

Samuel Huron, samuel.huron@cybunk.com
(`https://perso.telecom-paristech.fr/shuron/`)
Samuel Huron is an associate professor in Design and ICT at Telecom Paris Tech. His research focuses on creating and studying new tools to democratize dynamic information visualization authoring and by studying design methods apply to research. For his work on "Constructive Visualization" he received the 2015 best doctoral dissertation award from IEEE VGTC Pioneer Group. He designed and conducted many different workshops focus on visualization and physicalization during the last 5 years [11, 12]. Before, he was the lead designer of the Institute of Research and Innovation of the Pompidou Center.

Benjamin Bach, bbach@ed.ac.uk
(`http://benjbach.me`)
Benjamin is a Lecturer (Assistant Prof.) in Design Informatics and Visualization at the University of Edinburgh. His research designs and investigates interactive information visualization interfaces to help people explore, communicate, and understand data across media such as screens, mixed reality, paper, and physicalizations. Benjamin is involved in teaching four courses on data visualizations at the University of Edinburgh, targeting different audiences and levels, including one online course for professional development

for which is co-leading (together with Uta Hinrichs) funding of more than £160k, including the creation of activities and material. In the past, Benjamin has been working on Cheatsheets [30], comics [3], and comic workshops [28] for data visualization for data visualization and is currently working on understanding users and support them in learning interactive tools.

Uta Hinrichs, uh3@st-andrews.ac.uk
(`http://utahinrichs.de/`)
Uta Hinrichs is a Lecturer at the School of Computer Science at the University of St Andrews, Scotland, specializing in visualization and HCI. She received her PhD in Computer Science with specialization in Computational Media Design from the University of Calgary, Canada. Heavily drawing form fields outside of Computer Science (e.g., Design, Literary Studies, and Information Sciences), Uta's research is driven by the question of how to facilitate insightful, pleasurable and critical interactions with information in physical and digital spaces. As a visualization researcher and educator Uta has been involved in a number of interdisciplinary collaborations connecting the field of Visualization with research and practices within the sciences and humanities. As part of this, Uta has gained experiences on how to engage people with visualization as a thinking process within and outside the academic context.

Mandy Keck, mandy.keck@tu-dresden.de
(`http://www.visual-search.org`)
Mandy Keck is a post-doctoral researcher at the chair of Media Design at Technische Universität Dresden and lecturer at the University of Applied Science in Dresden (FHD). Her research and teaching is focused on data visualization, visual search interfaces, visual analytics, and interaction design. During her PhD, she developed an interface construction kit for visual exploration interfaces [14] that supports teaching and also the analysis and reuse of information visualizations. Mandy has many years of experience in the research of information visualization in different cooperation projects with academic and industrial partners that focused on multidimensional visualization methods and novel interaction techniques.

Jonathan C. Roberts, j.c.roberts@bangor.ac.uk
([click-for-homepage])
Jonthan is a professor in Visualization at Bangor University. He is the creator of the Five Design-Sheet method [22], and lead author of the book Five Design-Sheets: Creative Design and Sketching for Computing and Visualization, Springer Nature, June 2017. His research spans heritage, archaeology, oceanography, pedagogy, lexicography, and social networking domains, and for many years has encouraged researchers to develop multiple coordinated view systems. He is a keen advocate of sketching and low-fidelity design, and promotes more design thinking in teaching.

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