tVISt: Data Visualization Beyond Planar Displays

Associated ANR Project https://www.aviz.fr/Research/TVISt

Advisors

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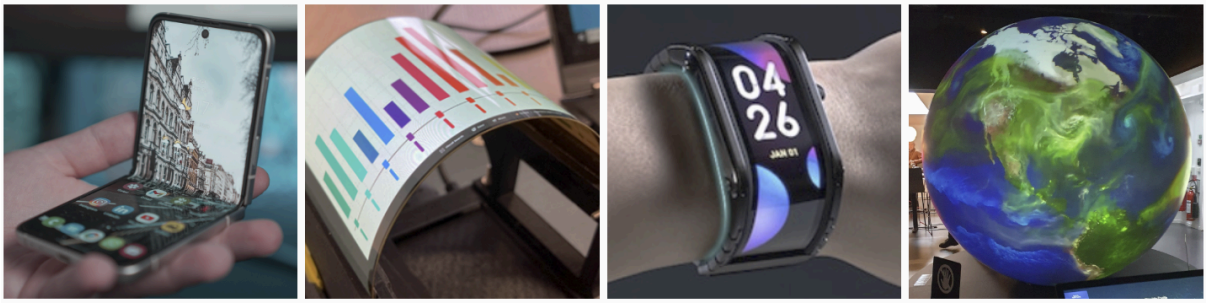
Location & Duration

- Location: Bât 660, Digiteo Moulon, Université Paris-Saclay, 91190, Gif-Sur-Yvette
- The duration will be 6 months (graduated internship / stage fin d'étude), start time will not be later than the end of March 2025. In order to start at this time, please contact us no later than the end of December 2024 because hiring procedures will take approximately 2 months to complete.

Funding

- About 600€ a month

Topic



The world is flat and rectangular when it comes to the types of physical screens that we use for representing data and making decisions. Display technology, however, is already evolving quickly: curved, bendable, and highly flexible displays, spherical displays, cubed displays, and even drone-based displays have emerged and are commercially available. These novel types of displays offer new ways to represent and explore data embedded in everyday environments, to communicate it, and share it. For a possible future in which non-planar displays will be ubiquitous, however, there are open questions about what visualizations should look like on these displays, how we would interact with them, and how people would engage with them. Non-planar displays, therefore, not only pose perceptual challenges for data visualization, but it is also yet largely unexplored which visualization

types work on them and how to create effective and appealing interactive data visualization experiences. As such, the potential and the challenges of these displays for visual data representation remain unexplored. This internship is part of a project that aims to escape from the “display flatland” that characterizes today’s research in visualization. It will establish foundations for how to engage with a future in which physical displays take on several different form factors and become truly embedded in our environments.

As part of this research there are multiple possible internship topics to choose from.

Internship 1: The first topic focuses on non-flat displays to be embedded in public spaces. These displays can show public information to inform passers-by or to communicate information to general audiences as part of an exhibit. Enabling technologies are larger display spheres, cylinders, or cubes, but may also extend to smaller e-ink displays embedded in the environment. The internship can either focus on the hardware, on the design, or on both. A hardware-oriented example topic would be to devise a public non-flat display to be displayed at the entry of our research building and observe how it is used. A design-oriented internship would be to pick one possible display form-factor (a sphere or a cube) and design several different prototype visualizations for some relevant types of data. In either case (physical display vs. prototype) we will focus on visualizing information related to the building or the people who work in it (data could be environmental, occupancy-related, or show information related to the outside such as the wait times in the cantine close by). This internship will be supervised by Anastasia Bezerianos and Tobias Isenberg.

Internship 2: This topic focuses on mobile data visualization with non-planar displays and visualizing data commonly found on mobile devices. Enabling technologies are, in particular, new foldable or bendable devices or small handheld non-planar displays
such as hand-sized display cubes or spheres. The internship could be hardware-oriented where the student builds small mobile non-flat displays (e.g. inspired by past work). Alternatively, the internship can be design-oriented where the goal is to design visualizations that take advantage of the non-flat characteristics of existing technology such as foldable phones or the WOW cube. Finally, another option is to run perceptual user studies to understand the effects of using non-flat displays on how well people can understand data represented with unusual form factor displays. This project will be supervised by Petra Isenberg and Raimund Dachselt (University of Dresden).

Other internship topic ideas in the space of the ANR project can be discussed. All topics can lead to a future PhD position funded by the ANR project (depending on the student’s performance).

Requirements

- We are looking for someone interested in this topic, motivated, and with a background in visualization and/or human-computer interaction.

Plus:

- Some data analysis experience (Python, R)
- Experience working with display hardware
- Experience with empirical user studies

- Experience programming data visualizations
- Interest in a future publication

How to Apply

- Send e-mail with a motivation letter, CV, as well as marks and transcripts to Petra Isenberg (petra.isenberg@inria.fr), Anastasia Bezerianos (anastasia.bezerianos@universite-paris-saclay.fr), and Tobias Isenberg (tobias.isenberg@inria.fr).
- For any questions, send them to the same e-mail addresses or come to the lab.

Related Works

- [P1] A. Bezerianos and P. Isenberg. “Perception of visual variables on tiled wall-sized displays for information visualization applications”. In: IEEE Trans. Visual. Comput. Graph. 18.12 (2012), pp. 2516–2525. DOI: 10/f4fv59.
- [P2] T. Blascheck, L. Besançon, A. Bezerianos, B. Lee, and P. Isenberg. “Glanceable visualization: Studies of data comparison performance on smartwatches”. In: IEEE Trans. Visual. Comput. Graph. 25.1 (2019), pp. 630–640. DOI: 10/gg8qt3.
- [P3] T. Horak, S. K. Badam, N. Elmqvist, and R. Dachselt. “When David meets Goliath: Combining smartwatches with a large vertical display for visual data exploration”. In: Proc. CHI. ACM, 2018, 19:1–19:13. DOI: 10/mbwp.
- [P4] P. Issartel, L. Besançon, T. Isenberg, and M. Ammi. “A tangible volume for portable 3D interaction”. In: Adjunct Proc. ISMAR. IEEE CS, 2016, pp. 215–220. DOI: 10/gshn2s.
- [P5] R. James, A. Bezerianos, and O. Chapuis. “Evaluating the extension of wall displays with AR for collaborative work”. In: Proc. CHI. ACM, 2023, 99:1–99:17. DOI: 10/mb4t.
- [P6] Y. Jansen, P. Dragicevic, P. Isenberg, J. Alexander, A. Karnik, J. Kildal, S. Subramanian, and K. Hornbæk. “Opportunities and challenges for data physicalization”. In: Proc. CHI. ACM, 2015, pp. 3227–3236. DOI: 10/gg9fw7.
- [P7] K. Klamka and R. Dachselt. “Bendable color ePaper displays for novel wearable applications and mobile visualization”. In: Adj. Proc. UIST. ACM, 2021, pp. 6–10. DOI: 10/gm5z7g.
- [P8] K. Klamka, T. Horak, and R. Dachselt. “Watch+Strap: Extending smartwatches with interactive StrapDisplays”. In: Proc. CHI. ACM, 2020, 72:1–72:15. DOI: 10/k8k7.
- [P9] B. Lee, R. Dachselt, P. Isenberg, and E. K. Choe, eds. Mobile Data Visualization. Chapman and Hall/CRC Dec. 2021. DOI: 10/kjkm.
- [P10] M. Sereno, S. Gosset, L. Besançon, and T. Isenberg. “Hybrid touch/tangible spatial selection in augmented reality”. In: Comput. Graph. Forum 41.3 (2022), pp. 403–415. DOI: 10/gqq53j.