11 JUNE 2025 09.00 - 11.00

Panel 56. The Good and the Beautiful: visualizing science in the (post)-digital age

Convenor:
Valeria Burgio, Università Ca' Foscari Venezia

Keywords: Data Visualization; Scientific Image; Visual Design; Technological Object

In scientific practice, visualization is one stage in a series of transformations that begins with a collection of data, samples and specimens and results in a spatial arrangement and representation of relationships between entities. This diagrammatization of nature, which Bruno Latour (1999) calls inscription, can take different forms - depending on the nature of the relationships established or imposed between the entities studied - and traverse different materialities - depending on the instruments and machines through which the collected samples transit and transform themselves.

The panel aims to open the discussion on the semiotic features of different forms of scientific visualization, questioning their role in mediating, separating and connecting the observer and the observed phenomenon. We call the participants to explore different types of technical devices analyzing the way in which they shape, discover and communicate scientific contents, whether through technologies of digitalization or through analogical techniques. This panel has the ambition to bring together the worlds of scientific research and that of information and visual design, semiotics and STS, to reflect together on the efficacity and heuristic power of data and scientific visualizations.

Therefore, we invite contributions that:

- think about the ways in which data visualization manifests itself, conveying, together with scientific information, cosmologies and structures of thought organization;
- think about the role of the interfaces in shaping, managing and exploring data, but also about their limits of homogenizing information and reducing differences;
- compare the different uses of visualizations, from internal use in scientific laboratories to external use for a pedagogical and popularizing function;
- investigate and collect case studies of technical objects and visualizations that refer to the materiality of the observed phenomenon, attempting to maintain its presence in ostensive, metonymic or imprint form;
- collect and reflect on examples from both design and science that also use data physicalization and embodiment of the observer to communicate scientific data;
- think about the aesthetic component of communicating scientific data, which goes beyond cognitive recognition, involving the senses and working on the emotions of the user.

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ID 170 - Brain as a visual metaphor

Sébastien Lemerle, Université Paris-Nanterre

Keywords: Brain science, brain visualisation, brain images, popular neuroscience, science exhibitions

Brain science has always been a science of visualisation. It has been based on practices and technical devices capable of rendering visible the invisible inside our skulls through sketches, maps, and later, electroencephalographs, CT scanners, or magnetic resonance imaging machines. It has also involved social groups who have had and still have the authority to see and make others see, "the people who interpret, rephrase, and reframe the facts for us (the mediators)" (Dummit 2004, 5): physicians, physiologists, neurologists, researchers in life and medical science, imagers. The act of showing and making see have not always produced images (think of anatomy lessons in hospitals) but the act of visualising and making images of

the brain is nevertheless central to the development and the legitimisation of this scientific field over the past centuries, from neurology to psychiatry and to neuroscience. As a result, brain images have produced, and continue to produce a "visual imaginary [which] has been one pathway along which neuroscience has been able to move out of the laboratory and into the territory of everyday life, and to play a role in the management of normal and problematic conduct." (Rose and Abi-Rached 2013, 55).

However, this imaginary is not univocal. This communication will tackle the issue of the multiple types of brain images and their layers of meaning. We will first evoke the intertwined social, technological, conceptual and cultural frameworks that led to the production of the brain images themselves, with examples ranging from Japanese brain maps of the 18th century to Ramón y Cajal's and Golgi's early 20th century drawings of neurons to modern computer-assisted images of neural networks. Particular attention will be paid to the question of contemporary laboratory equipment such as CT scanners and MRI machines which shape and homogenise brain data, sometimes in a problematic way, in order to produce specific images (Dummit 2004, Anichini 2018).

We will then look at the different meanings these images can take and the kinds of questions they can raise across their many social uses, from specialists' esoteric discourses to popular science and the cultural industries. A special case will be made of exhibitions which present pictures of the brain, formerly scientific images, for their aesthetic quality, as in Paris (BeautyBrain, université Paris Diderot, 2017) and Venice (It begins with an idea, Fondazione Prada, 2022) (Lemerle 2025). We will see the multiple meanings at work behind the signifier brain image, a metaphor for a wide range of ideas about the mind, the soul or the human being, from the labyrinth to the rigid framework of localised functions, to the plasticity and dynamism of an organ open to its environment, synonymous with freedom and creativity. In many social universes, this combination of the convincing power of the icon (Peirce 1992) and the cultural reach of the brain proves to be "the nail on which the universe hangs" (Blumenberg 2017).

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ID 303 - The visual and narrative dimension of Winogradsky's columns in art and science: a microcosmological approach

Valeria Burgio, Università Ca' Foscari, Venezia

Keywords: Visualisation, microbiome, microcosm

In environmental microbiology laboratories, alongside digital techniques such as metagenomic analysis of the genetic heritage of microbes, cultivation and analogical visualisation techniques are making a comeback. Within these analogical techniques (also known as 'wet'), in addition to cultures based on the isolation of a single species, there is a growing interest in mixed cultures that combine different species, different chemicals and, consequently, different ways of producing and consuming energy. This mixed culture technique is called "microcosm", a concept central to ecology, as it involves studying the environment by putting a "piece of nature" in a bottle. This paper aims to analyse the visual and communicative component of the microcosm, in the light of the increasing spectacularisation and monumentalisation of that form of microcosm that is Winogradky's column. In our opinion, Winogradsky's column can be read, in terms borrowed from design theory and semiotics, as a form of autographic visualisation where colours and position in space signify biochemical reactions and alternative forms of respiration. It is no coincidence that Winogradky's column has also entered the artistic sphere, thanks to the work of New York artist Anicka Yi, to offer itself as a microcosmological model of coexistence and mutuality between humans and nonhumans.

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ID 376 - Trees and Vectors: Knowledge Design between Language and AI

Niccolò Monti, Università di Torino; Université de Paris 8

Keywords: Artificial Intelligence, Visual semiotics, Data visualisation, Explainable AI, Linguistics

This proposal articulates a comparative approach to how visualisation methods have been employed in linguistic-semiotic theories, on the one hand, and artificial intelligence, on the other, detailing the extent to which the former have served as epistemic precedents and benchmarks for the latter and with the aim of advancing a set of answers in favour of AI interpretability.

The design of knowledge is central, whether in the context of linguistic units or data points; and, furthermore, several mapping techniques used in data science – such as word embeddings – reveal analogies between modelling semantic structures and organizing information. However, insufficient attention has been given to the genealogy of such designs. Arborescent models may seem unrelated to abstract, harder-to-visualize objects like high-dimensional vector spaces, yet both share underlying criteria of interpretability. Many AI model depictions today owe much to visual conventions established in linguistic systems, suggesting a shared visual habitus. This will be particularly evident in examples of tree-like and distributional structures – such as those formulated within Chomskyan generativism or within probabilistic linguistics – which foreshadow the normative and performative assumptions behind much AI data visualisation.

After all, a central challenge for deep learning today concerns the opacity of neural models – how difficult it is to determine what they "know", how they internally represent the information encoded in their training data, and by what means this knowledge can be extracted and displayed. This challenge has motivated the use of prompt engineering as a strategy for reducing epistemic complexity, offering AI developers and users a conversational interface to interact with models. Yet, this issue is not new. In the early days of cybernetics and circuit theory in the 1940s, systems automating tasks such as calculation, decryption, and even language production were often conceptualised through an internal-external framework, exemplified by the image of the black box.

Building on these interpretative relationships as well as on the precedents drawn from linguistics, we enter the domain of explainable AI (XAI) – the effort to develop models that are more transparent and interpretable, for instance through improved interfaces; or else, as in our main focus, the effort to develop new epistemic tools and methods that allow for a better visual interpretability of such models. This final point underscores the urgency of fostering a more open and equitable understanding of AI technologies through diverse visual approaches – just as linguists concerned with system interpretability have done. If successful, this endeavour could encourage more interdisciplinary and transversal scientific collaboration in this scientific field, while also bridging the growing epistemic gap between developers and consumers.

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ID 540 - The role of mediators in data visualisation: The case study of the Grounded AI map

Matilde Ficozzi, Aalborg Universitet

Keywords: data visualisation, knowledge mediation, public engagement

Data visualisation emerges as a scientific practice for translating expert knowledge in more accessible ways, bridging the gap between research institutions and broader audiences. However, scientists must be cautious, as visualisations can oversimplify or misrepresent information, inadvertently widening this gap (Drucker, 2021). This is particularly visible in network visualisations, which, while invaluable for exposing relational structures and driving analysis, often remain inaccessible to non-expert audiences (D'Ignazio, 2017).

We propose reframing visualisations as knowledge mediators-tools that do not simply transmit information but transform it. This solution entails designing encounters that allow diverse audiences to inhabit and explore knowledge spaces. Visualisation, in this sense, becomes a mode of translation and negotiation, a way to redistribute the epistemic labour of making sense of the world. This approach lets us see visualisations not as simple representations but as spaces where knowledge can be materialised and accessible through mediation.

Our case study presents a public exhibition featuring the "Grounded AI Map", which analyzes millions of scientific articles, transforming them into annotations summarizing the most important topics around artificial intelligence (Munk et al., 2024). Such a visualisation takes the form of a 100 m^2 floor mat, inviting audiences to physically engage with scientific knowledge. The mediation between the viewers and the visualisation is facilitated by integrating LLM-powered bots, with the role of acting as digital companions. These bots are not merely translators but interlocutors, engaging visitors in dialogic confrontation that reframe the data in relation to their situated perspectives (Jensen et al., 2021). Through this, we synthesize and annotate over 2 million documents, balancing the fidelity of irreductionist representation with the interpretability afforded by reductionist techniques. The visualisation allows audiences to zoom in and out, shifting between granular and synthetic understandings of the data.

To deepen this engagement, we developed digital companions – LLM-powered bots – that function as translators and elicitation tools. These bots actively invite audiences into dialogue, mediating between the complexity of the source material and the situated interpretations of the audience. By eliciting responses and fostering exchanges between visitors, the bots transform the exhibition into a participatory space, where knowledge is co-constructed rather than passively consumed (Rodighiero et al., 2022).

To evaluate the exhibition as a mediating device, we employ a framework for quali-quantitative data collection and analysis. First, quantitative exploration of user interactions with the digital platform uncovers patterns of navigation and engagement with the data. Second, qualitative observation of spatial and social interactions within the exhibition captures how publics inhabit and make sense of the space. Finally, open-ended interviews with selected participants explore how visitors interpret, reprocess, and reappropriate the exhibited knowledge in their own terms.

This approach allows us to interrogate the conditions under which scientific knowledge becomes accessible and the ways in which visualisation can enact new forms of public epistemology. By emphasizing the aesthetics, materiality, and politics of visualisation, we contribute to ongoing conversations about critical and experimental modes of knowledge mediation.

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ID 548 - Mapping Climate Culture and Science Visualisations on YouTube: A Longitudinal Analysis

Jake Allcock, The University of Sheffield

Keywords: Science Visualisation, Climate Change Communication, Algorithms, Digital Platforms, Multi-modal Analysis

Scientific visualisation transforms raw data into compelling, spatial representations that bridge the gap between observation and understanding. This study invites exploration into the semiotic dimensions of such visualisations, and how they mediate, separate, and connect the observer with complex phenomena. My research, situated at the intersection of climate communication, digital media, and visualisation studies, examines YouTube as a dynamic site for the inscription of climate change information. By interrogating how this platform's algorithmically mediated visual content shapes public discourse, I contribute to a nuanced understanding of scientific visualisation in the digital age.

My study addresses three interrelated research questions: (1) What videos and channels are prioritised by YouTube's search algorithms (2) How do the most visible English-language videos frame climate change thematically, integrating scientific data with emotive and aesthetic cues? (3) How do content creators navigate YouTube's algorithmic landscape to produce content that is both scientifically robust and widely accessible?

Employing a multi-method, longitudinal design over a six-month period, I depart from traditional snapshot analyses to capture the evolving nature of YouTube's content recommendations. First, using YouTube's API and data tools such as RankFlow, I collect bi-daily data on video rankings, metadata, and search results. This "hierarchy of visibility" allows me to quantify how algorithms rearrange the digital landscape of climate change content over time, using metrics like Rank-Biased Distance scores to assess fluctuations and persistence of video prominence.

Second, I conduct a qualitative multimodal analysis of the top-ranking videos to dissect the layers of inscription inherent in their titles, thumbnails, and video content. Recognizing that YouTube videos are composite artefacts – merging written and spoken language, moving images, and graphic elements – my approach reveals how scientific data is visually and narratively reconfigured. This analysis demonstrates how aesthetic and semiotic choices not only convey information but also embed cultural cosmologies and ideologies about climate change.

Third, semi-structured interviews with independent content creators provide critical insights into the "algorithmic dance" these creators perform. By examining how creators adapt their strategies to meet the demands of YouTube's visibility algorithms, I uncover the tensions between maintaining scientific integrity and achieving broad audience engagement. These interviews highlight the creative challenges and adaptive practices that underlie the production of visualising scientific climate communication.

By focusing on YouTube my research foregrounds the transformative role of digital technologies in the inscription and dissemination of scientific knowledge. It demonstrates that visualisation in scientific practice is not merely a static representation of data but a dynamic process shaped by technological interfaces, algorithmic interventions, and creative agency. In doing so, my work re-examines the efficacy and heuristic power of scientific visualisations, urging a deeper engagement with the materiality, aesthetics, and semiotics of data-driven representations.

This project reveals that digital visualisations of climate change are complex, multifaceted inscriptions that influence public perception and policy debates, making it imperative to understand their design, function, and transformative impact in our rapidly evolving digital landscape.

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ID 738 - Designing Embodied Human-Data Intra-actions

Seçil Uğur Yavuz, Libera Università di Bolzano – Freie Universität Bozen
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Keywords: data visualisation, embodied experience, human-data interaction

Since ancient times, people have tried to record and visualise data in meaningful ways. For example, the Quipu necklaces (or "talking knots") is a sophisticated information system created by different cultures in the Andean regions to track agricultural resources, historical events, and even taxes. Moving fast forward, nowadays data have become intangible and core to many industries as a resource to be extracted, storaged, and analysed. Beyond extractivist perspectives, data can also be a resource to shed light on the environmental crises and their interconnectedness with the human-led actions within our epoch of Anthropocene. As the consequences of these crises become more evident, visual representations of quantitative scientific data can help people understand causes and consequences by depicting facts through representational visual symbols. However, these representations lack experiential qualities which limit the extent to which people can grasp their complexity and interconnectedness. We wonder: How can we produce, collect, and analyse data in more experiential, collective, and hopeful ways?

In 2017, Lupton coined the term "data sense," to bring to the fore the "embodied, affective and material nature of engaging with and learning from data" (pp. 1603-4). Relatedly, Karyda et al. (2020) defined "data-objects" as artefacts that can be used "for individual and collective reflections through a physical portrayal of data." An increasing corpus of work focuses on first-person experiences with digital data (e.g., Homewood, 2020), while others bring forward the materiality of data addressing how embodied experiences with data can help people relate to the matter at stake (e.g., Jansen et al, 2015, Offenhuber, 2024). Aligned with this body of work, in this abstract we present the Intra project (2023-ongoing), a design research engagement that leverages on data to help people recognise intra-actions with living and non-living beings in their environments. In so doing, the project goes beyond visual and tangible representations of data and towards embodied data experiences. The project poses an alternative perspective on data visualisation, highlighting the possibility of tracing and representing data through bodily and material means. Through turning invisible phenomenons, such as microplastics, heat, water-footprint, etc, into embodied experiences, the project explores alternative ways of engaging with data through auto-ethnography, design probes and designing interactive installations. Starting from the intra-action concept coined by Barad (2007), this project investigates new forms of designing relationalities within the world that is continuously altered, enhanced and augmented with digital technologies. This abstract addresses the methods and tools developed during the project to experience data through bodily and material means while creating tangible traces of data to reflect on environmental issues.