AR&AI
theoretical concepts

The Role of Drawing in Data Analysis and Data Representation

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Abstract

This paper discusses the role of Drawing in representing and designing new epistemological models during the current AI spread, especially in relation to new advanced tools available to scientists. The accelerated development of technologies for data visualization and immersive and augmented experiences consolidates shared workflows, while criticism and genealogies of such tools are too often left aside. Therefore, scholars have not only to develop new technological tools and applied methodologies but also to work on shared sets of theoretical concepts that are necessary foundations to designed contents. The history of representation – especially maps on one side, perspective on the other – provides most of the necessary common ground, which is much needed if we choose that it is still worth governing AIs as much as we can, instead of abandoning ourselves to 'the end of theory', which would imply the end of any meaningful scientific drawing made by and for humans.

Keywords
augmented reality, artificial intelligence, DataViz, heritage, interface design.

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"It's easy to forget that a lot of what we do as scientists comprises choosing how to represent our work. These choices are made not only for larger, public–facing events but also among ourselves at individual meetings, small conferences, and even in our emails. Ostensibly, in parallel, there's also the question of how much agency the scientist–qua–artist has over the work and its import" [1].

Immersive vs. Disembodied Representations

The many speakers and participants in the REAACH–ID Symposium showed several advanced applications of Augmented Reality and Artificial Intelligence in scientific research, especially in the fields of drawing and representation for cultural heritage and design, besides interdisciplinary exchanges aimed at building innovative tools for analyzing data and augmenting the user's experience while exploring information – be it for promoting or studying heritage, design approaches, etc.
A first rough classification of the theories and practices of representation, in relation to the new modes of production and communication of knowledge, would split common contemporary representational artifacts into two types, apparently antithetical. On the one side, immersive applications and interfaces, where perspective goes 'hyper' by taking the observer out of the frame of Alberti's window and into a virtual or augmented world. On the other, charts, maps, and diagrams, often looking much like traditional representations of networks: they are more and more non–perspectival, abstract, looking much like each other, their form more and more independent from that of the represented object, which often does not have a proper form itself (e.g., what does a pandemic 'look like'?).
The scientific bases of both types in the contemporary world can be found at the origins of the Modern era: the first coming from the western perspectival tradition [2] and the second from cartography but also from the many attempts to represent abstract theories or ideas – and their underlying systems of relations – onto schemes of growing complexity. The two paths are apparently disconnected, but they often draw from the same knowledge (the progress of geometry, optics, etc.) and sometimes they cross in 'places' such as, for example, memory theatres and, as it will be proposed at the end of this paper, potentially elsewhere today.

Theoretical and Representational Issues

The critical and theoretical literature on both of the aforementioned paths is growing [3]; but while the first takes advantage of its many connections with media studies [Grau 2003; Zucconi 2018, pp. 149-181], the second is still struggling to find its roots mostly on marginal grounds [Facchetti 2019]: despite the fact that we are more and more exposed daily to infographics and data visualizations when it comes to AI [D'Abbraccio, Facchetti 2021], we inevitably face the irrepresentable. Even our interaction with Internet and computers often appears mysterious, their responses being ruled by apparent randomness or by non–human wills. In our era, characterised by the availability of large amounts of data, machines, and algorithms capable of correlating them, one can easily yield to the temptation of proclaiming "the end of theory" [Anderson 2008] and give up building models that cannot compete with the ostensible objectivity of data and machinic intelligence. For instance, Google Translate has been using since 2016 a neural network developed by Google Brain to replace the previous statistical inference model. No more cross–references of texts, but a real intelligence: "not a set of two–dimensional connections between words, but a map of the entire territory […]. The map is thus multidimensional, extending in more directions than the human mind can hold. As one Google engineer commented, when pursued by a journalist for an image of such a system, "I do not generally like trying to visualize thousand–dimensional vectors in three–dimensional space. This is the unseeable space in which machine learning makes its meaning" [Bridle 2018, p. 148].
Yet we are very aware of how much we need visual representations of complex phenomena per se and how much we need them to rule those phenomena. During the first stag-

es of the Covid–19 pandemic we behaved according to the imperative of 'flattening the curve', where 'the curve' was a graph looking like two Gaussians, one without protective measure, the other – smoother, contained under the 'Healthcare system capacity' line – with. And even though with AIs and Big Data the (unrepresentable) maps tend more and more to coincide with the (inaccessible) territories, the Event Horizon Telescope team spent years and deployed huge resources to process a static bidimensional image of the black hole at the centre of the Messier 87 galaxy, which became viral on social media just a few hours after it was released, on 10 April 2019 [4]. It succeeded largely because it looked like a photography.

These questions are crucial for many scientific disciplines, and the problematic folds of their unknown lands are calling for scholars of Drawing to act on the bases of their own knowledge. Consider the pandemic graphs and maps [5]: the more data speak clearly through their representations, the more they are insidious, to the point that they can be interpreted in totally opposite ways or confuted based on one or more steps during the phases of collection, sifting and visualization. In most cases, paradoxically, the representations that are more difficult to understand and decipher are also the most engaging for those who want to understand them in depth, because they force the viewer to activate a sort of critical awareness: they may not be adequate for quickly comparing trends – such as economic growth or the number of infections – but they work because they force us to pay attention to what is underneath. Common experience also shows that much of the work that careful use of these artifacts has to do, to find a thread to follow in such opacity, is in the reading of the texts that accompany visualizations, commonly found in scientific papers as well as in newspapers and magazines. Texts commenting visualizations are fundamental to understand and evaluate the choices made by scientists and/or infographic designers.

Drawing at the Intersection of Digital Humanities and Human Digitalities

The role of humanistic knowledge, therefore should be upgraded in data analysis and representation. Recently, the writer Helen Dewitt and the statistician Andrew Gelman published a short piece together [Dewitt, Gelman 2020] where they addressed the problem of what we could call 'DataViz criticism' [6]. The article refers especially to the proliferation of data visualizations at the time of the Covid–19 pandemic, to their potential and real "narrative" implications and to the lack of attention given by designers to the possible uses of such graphic artifacts. The two authors begin by comparing an old diagram drawn by Florence Nightingale on the causes of mortality during the Crimean War (1853-56) with a contemporary analogous and much simpler diagram, highlighting how the first is more difficult to read but also more 'engaging' for the reader, more suitable for drawing her to a critical–narrative dimension.

The role of Drawing, between technical and humanistic knowledge, can be therefore strategic non only when it comes to representing, but also for the structural and infrastructural configuration of the digital clones of reality, or 'digital twins', that are becoming bigger and more and more integrated with each other and with everyday life through interfaces and algorithms, and that are based upon data collected and processed by means of optical–perspectival devices. These data are getting more and more important to integrate and augment reality with synthetic information, which is provided by optical sensors, algorithmic observers and artificial intelligences. If a giant tech corporation should ever monopolize the database of worldwide real time optical scans, it would lead to a sort of diffused global panopticon of enormous power, controlling AR games, self–driving vehicles but also much more [Kelly 2019]. And this is just basically the same technology that scholars use when surveying a piece of cultural heritage to obtain a digital twin to preserve it, to promote it, to study it in detail, to plan and design possible interventions, etc.

Here is why Drawing must face the challenge not only to represent, but also to define and take part in the construction of new epistemological models: confronting the unfathomable complexity of AIs demands for new tools to build shared models and govern reality.

The alternative is to give up models and representations, to abandon science at the end of theory, to mere correlation among data [7]. Scholars are involved because they are familiar not only with technologies and workflows, but also with the optical, perspectival, geometrical and, more generally, representational knowledge that lies underneath, which is to say: with the very roots of the systems, infrastructures and interfaces that are shaping today's human interactions with the world.

Between Perception and Scientific Analysis: Metaphors and –scapes

As human beings, we probably need conceptual tools such as metaphors to deal with complexity [Bridle 2018, pp. 2-10]: after all, it's exactly what we do every time we use a desktop computer, open a folder, and edit a file. Today's systems of power are often described by and modelled upon scopic regimes, as we have said about the potential of the digital twin of the world [Kelly 2019] and as we know very well from Michel Foucault [Foucault 1975], Martin Jay [Jay 1988] and the last episode of Adam Curtis' documentary series Can't Get You Out of My Head (BBC 2021). In fact, we are used to find metaphors coming from optics almost everywhere: transparency is a myth of modernist architecture as well as of interaction designers [8], but we claim it also from finance, economy, politics, at every scale. Catoptrics has been used by post–modernists to critique Modernism's faith in transparency and to subvert it. And dioptrics may provide useful references to better understand and design today's world with a critical attitude [Bergamo 2019], together with other optical notions such as, for example, that of parallax [Anderson 2018].
It is up to Drawing also the ambitious and relevant task of connecting and interweaving the paths of the two big categories with which this paper began: god eye's maps and human eye's perspectival views. Some of the possible meeting points can be found in '–scapes'. Not only in the much–debated notion of landscape, which after von Humboldt merges the subjective perception of the observer with scientific collection and observation of information [Farinelli 2003, pp. 40-53]. But also, for example, in the many possible representations of soundscapes [Bergamo 2018] and in sound maps, which should start addressing the problem of placing perspectival and time–dependent audio field recordings onto interactive visual maps. And in datascapes, researched in the Nineties by the artistic collective Knowbotic Research and today by Ryoji Ikeda: abstract visualizations of digital data become a sort of artificial immersive landscape, engaging the viewer and, at the same time, potentially providing her with new visual metaphors, new tools to represent what exists and design what will come.

Conclusions

Technology has evolved, the world has changed, but we are still the same species that tried to visualize and organize such a complex thing like memory in machines that worked like modern theatres, after all.
Drawing always played a major role in modeling knowledge. This paper tried to explain why the technical achievements it is deploying while facing the current challenges should be connected with the historical and critical background provided by the genealogies of perspective and maps: this much needed approach could lead to innovation in representation in today's world, and it is up to the Drawing scholar.

Notes

[1] George Wong in Frumkin Rebekah (2019). What the Scientists Who Photographed the Black Hole Like to Read. In The Paris Review online edition, www.theparisreview.org, (10 March 2021).

[2] We could think about Paolo Veronese's frescoes at Palladio's Villa Barbaro as pictorial devices to "augment" the architectural experience of the owner and inhabitant and to "immerse" him in a virtual extension of the outer landscape, but the genealogy of this approach could go back in time much more, passing through Pompeii and up to cave paintings.

[3] A book about the genealogies of both is e.g. Arcagni 2018.

[4] See https://eventhorizontelescope.org/press-release-april-10-2019-astronomers-capture-first-image-black-hole (10 March 2021).

[5] Some media designed their own, as in the case of The New York Times; others, the most, drew from renowned research institutions; expert users could also rely on more sophisticated online tools that allow to compare and filter data according to the answers they needed to retrieve. See https://ourworldindata.org/coronavirus (10 March 2021).

[6] This phrase is not found on their article, but I think that it describes in synthesis what is at stake here.

[7] Which may lead to aberrations, such as nonsense and funny correlations between the number of people who drowned falling into a pool and the films Nicolas Cage appeared in. See the website Spurious Correlations: http://www.tylervigen.com/spurious-correlations (10 March 2021).

[8] A good interface is one the user doesn't realize it's there, according to most and especially after Donald Norman. See Norman Donald (1998). The Invisible Computer. Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution. Cambridge (Mass.): The MIT Press.

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