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Data, People and Society
2024

Visualizing Change: Harnessing Art, Data, and Advocacy for Cleaner Air and Healthier Communities

"The fog in London assumes all sorts of colors; there are black, brown, yellow, green, purple fogs, and the interest in painting is to get the objects as seen through these fogs."- Claude Monet, artist

"No one ever made a decision because of a number. They need a story." – Daniel Kahneman, psychologist, behavioral economist, and author

In an era marked by environmental crises and techno-solutionism[1], the presence of data-driven approaches to positive environmental impact is to be expected. While data has proven to be a powerful tool and the role of data visualization and advocacy in driving policy change cannot be overstated, assuming that data alone will lead to quick policy change oversimplifies the complexity of environmental challenges. This essay explores how the University of the Arts London (UAL) can harness data visualization and advocacy to address air quality issues effectively.

When interacting with CCI's air quality data, several variables must be examined. Not only do the sensors capture a variety of particles, but where the sensors are placed, both geographically and either inside or outside buildings, makes a difference in the numbers we are seeing. For this particular analysis, we will be focusing on the presence of particles of different sizes both inside and outside of CCI's classrooms across Greencoat, Peckham Road and High Holborn. This essay attempts to analyze the data through visualization and later views that analysis through a lens of policy formulation. Throughout this process, the close links between emotion and information literacy were considered, specifically how emotion forms a part of critical thinking and therefore must be included in information literacy to generate learning, and engagement and be a catalyst for change[2].

To accomplish this, the data is visualized in two main ways. The first is a large line graph where the concentration of three different-sized particles can be seen to evolve through a month time for historic morning and nighttime readings. This first visualization conveys information in a more traditional and scientific approach. The second seeks to generate public engagement and generate an emotional or sensorial link to the air quality around the city. Using p5, the second visualization draws out a system of particles, resembling a constellation moving around through space, the sizes of the particles are visually represented. This second visualization captures the morning and nighttime variables at a specific moment in time by creating two versions, a darker

[1] Techno-solutionism refers to the act of reducing complex and complicated issues down to a simple set of metrics that are easily solved by technology or data.
[2] Information Literacy, Skills of a Conspiracy Theorist. AKO Storytelling Institute, 2024.

version for the nighttime data and a lighter version corresponding to the daytime data. The color selection corresponds to the typical lumity of respective pm and am data.

A series of insights can be drawn from the visualizations. From the line graph depicted below, we can see three types of particles being shown. Each line represents the amount of different-sized particles per cubed meter. Immediately, it is easy to recognize that there seems to be a larger concentration of larger particles (PM10) and a lower concentration of smaller particles (PM01). Apart from this, when hovering over the graph, we can see whether the reading being shown is a nighttime or a daytime reading which also lets us determine that readings at night usually have a much higher concentration of particles of all three sizes. Now, since CCI's sensors are placed both indoors and outdoors, we will not be looking at that variable specifically. We will assume that the readings are higher at PM than AM and that there is a higher concentration of larger particles in general.

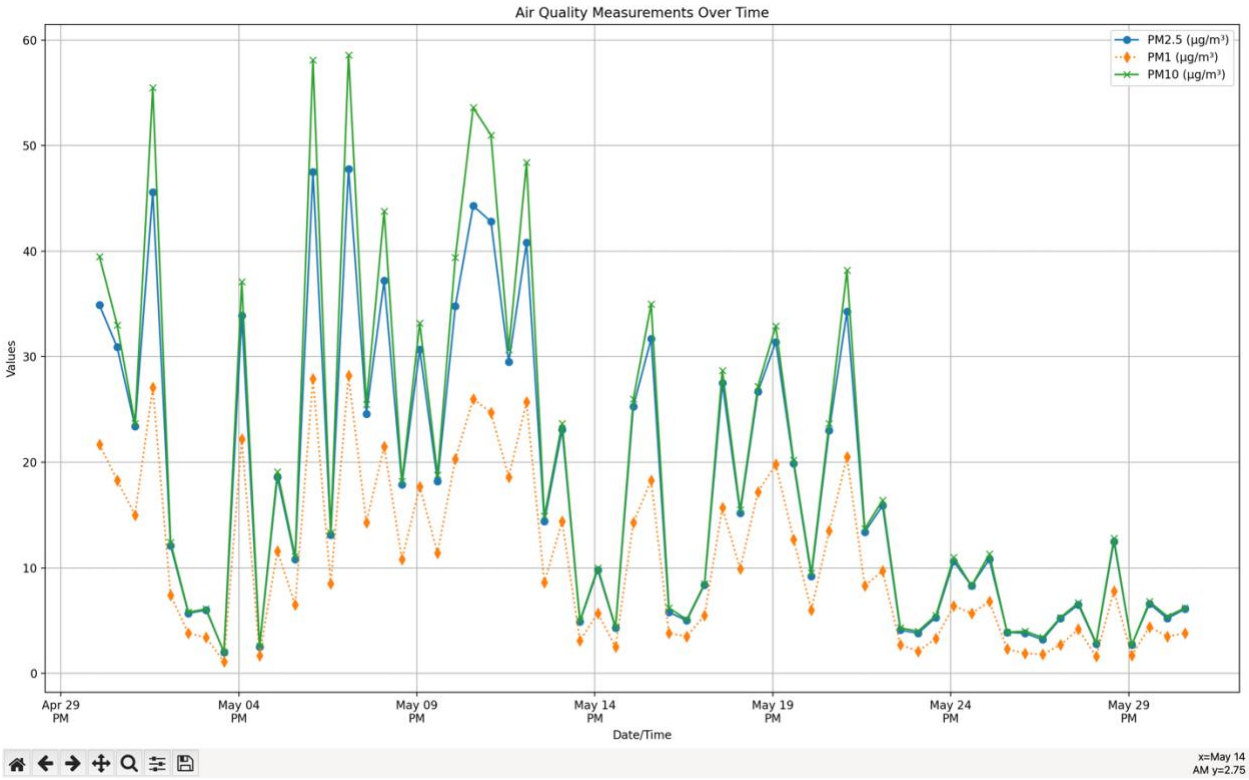

Figure 1. Line graph of particles over time

In our second visualization, we get a sense of the air quality at a specific moment for a specific day and a specific night. This visualization gives us a sense of the quality of the air that we breathe. If we could visually see these saturated webs of particles in the air around us, would we change our consumption habits and take air pollution more seriously? Would we refuse to leave

our houses past 8 pm for fear of breathing in dirty air? Once again, we see that there is a larger concentration of larger particles and a much larger concentration of particles during the night.

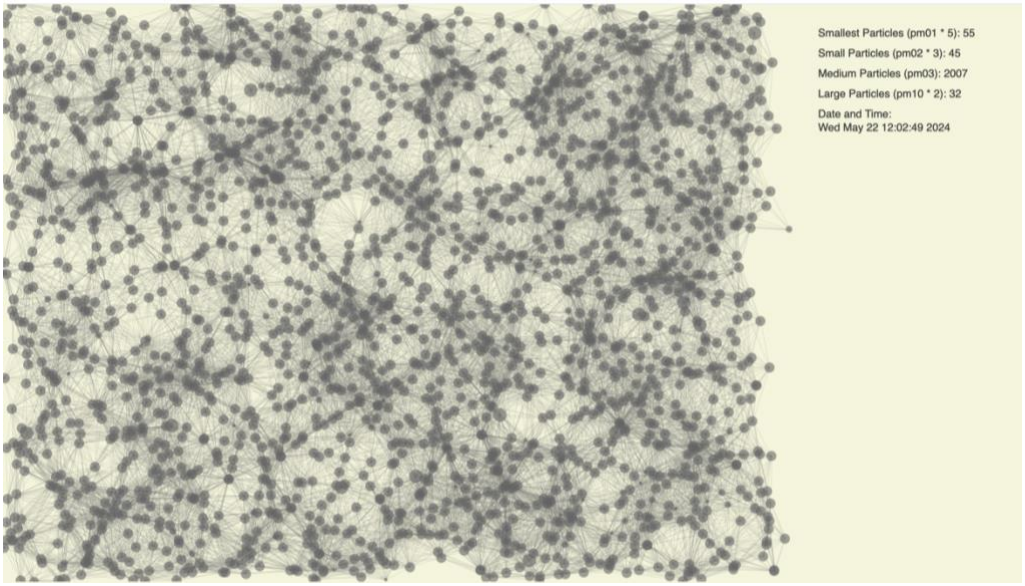

Figure 2. Concentration of particles AM

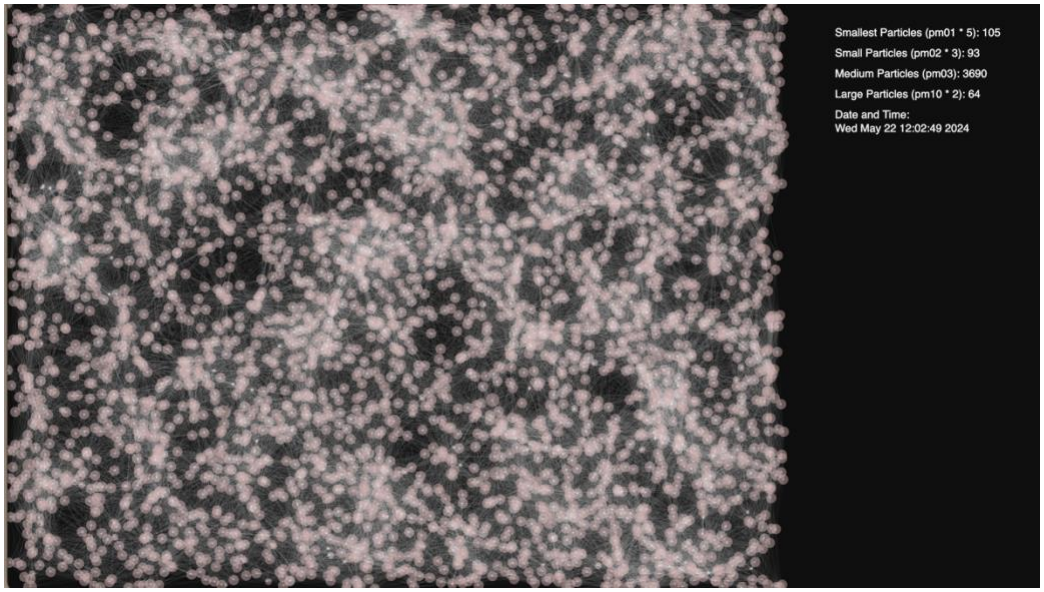

Figure 3. Concentration of particles PM

When looking at these two visualizations, we get a sense that there is an “extra” in the nighttime, darker visualization. Something we’d like to scrape off. If we wanted a visual more similar to the morning time visualization of particle webs we would need to “scrape off” exactly 1690 particles.

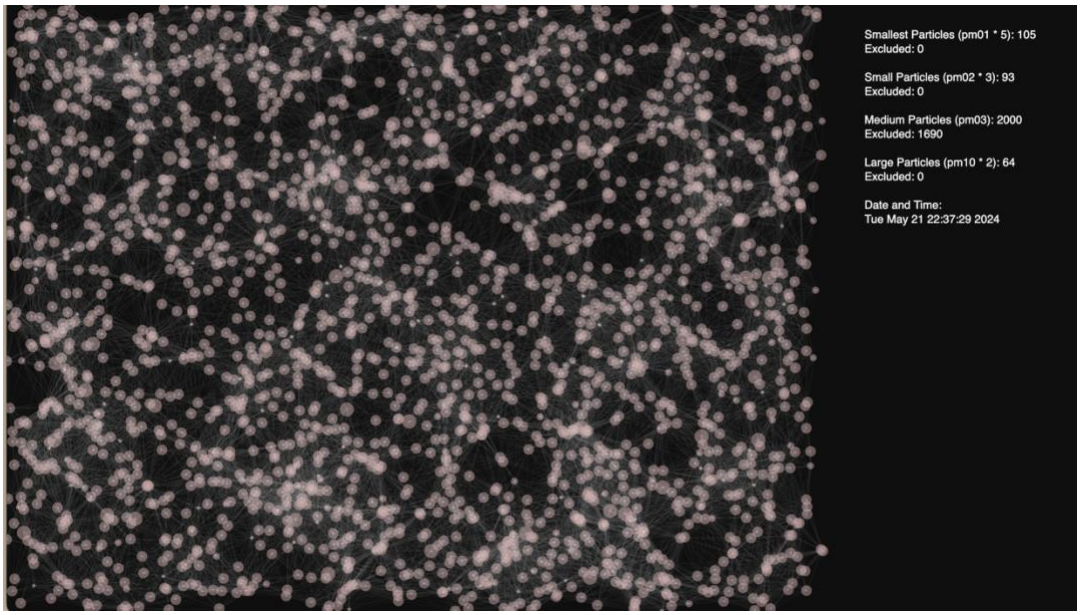

Figure 4. Concentration of particles PM, excluding 1690 particles

Since 2017, air pollution concerns in London have been gaining traction. For a city with a terrifying history of air pollution[3], you'd expect to see more advocacy campaigns on the dangers of air pollution and the importance of maintaining decent air quality. According to London's Mayor, London's population will be exposed to NO_2 and $PM_{2.5}$ concentrations above the recommended WHO air quality guidelines by 2030, with Black and diaspora communities residing in areas with the greatest air pollution and therefore being disproportionately affected by air quality indicators. Because air pollution cannot be seen, awareness of its existence is particularly relevant.

Research conducted at the University of California found that Communication regarding air quality can mitigate the negative impacts of air pollution by raising awareness and mobilizing public support for policies aimed at reducing air pollution and improving environmental health literacy. Evaluating the alignment of current communication strategies with these objectives can guide future initiatives to enhance public health related to poor air quality. According to the researchers, the type of communication is key and if the mass public is to be engaged, the communication cannot rely on academic and technically-heavy approaches. "Specific opportunities to improve air quality communication include improved translation of the science of air quality. For example, while current reports include the levels of specific pollutants or oversimplification that "air quality is poor," residents and experts in this community prefer non-technical explanations of poor air quality"(Ramírez, 2019).

As a leading educational institution, UAL has a vital role to play in addressing environmental challenges within its campus and influencing broader societal change through meaningful advocacy. UAL's commitment to sustainability must extend beyond rhetoric to rhetoric to concrete actions and advocacy efforts that inspire meaningful policy change. Taking advantage of UAL's strengths in creativity, communication, and design, the university could serve as a transporter of key messages, translating academic research on air quality into clear messages that could be

[3] In 1952, the great smog of London brought the city to a near standstill and caused thousands of deaths due to the toxic air.

understood by the wider audience. A key example of this approach is Rachel Carson's "Silent Spring".

The publication of the book raised widespread public awareness and concern. environmental issues. Carson's engaging storytelling and extensive research made the intricate scientific subject of pesticide toxicity accessible to a broader audience, sparking public discourse and activism. It played a pivotal role in shaping environmental policies in the United States by contributing to the ban on DDT and the establishment of the Environmental Protection Agency (EPA) in 1970. The EPA was tasked with regulating pesticides and safeguarding human health and the environment. "Silent Spring" is often recognized as the catalyst for the modern environmental movement, inspiring a new generation of activists and conservationists to advocate for stronger environmental safeguards and to highlight the interdependence of human health and the environment. Overall, "Silent Spring" was revolutionary because it brought environmental issues into the public consciousness, challenged prevailing attitudes toward pesticide use, and ultimately led to significant changes in policy and regulation aimed at protecting human health and the environment.

Another historical example of how visualization through art, coupled with advocacy efforts, can shed light on important environmental issues is Monet's paintings. A recent study published by Proceedings of the National Academy of Sciences claims to have proven a theory that air pollution inspired the painter Claude Monet to create the fogy paintings of London that ignited the Impressionist movement. Between 1899 and 1901, Monet created nearly one hundred depictions of the Thames River in London. He painted views of Waterloo Bridge and Charing Cross Bridge from his room at the Savoy Hotel, and the Houses of Parliament from Saint Thomas's Hospital across the river. Monet continued working on these paintings until 1903, explaining to his dealer Durand-Ruel that he couldn't send a single completed canvas: "I cannot send you a single canvas of London... It is indispensable to have them all before me, and to tell the truth not one is finished. I develop them all together." In 1904, this collection along with thirty-six others were exhibited at Durand-Ruel's gallery in Paris.

The researchers stated: "Our findings suggest that paintings from the [19th century] reflect changes in the visual environment associated with increasingly polluted atmospheres during the Industrial Revolution." They also observed that the atmospheric haziness depicted reached its peak at different times between Monet's paintings of Paris and Turner's depictions of London. Environmental activists and organizations have drawn upon Monet's London series to highlight the impact of industrialization on air quality and human health. These paintings have been featured in exhibitions, educational materials, and campaigns focused on environmental conservation and pollution reduction. Most recently, an exhibition titled "London Fog: A City in Crisis" was held at the Museum of London in 2017. Alongside Monet's works, it showcased various historical artworks, photographs, and documents depicting London's Great Smog of 1952. This event aimed to raise awareness about air pollution issues and its historical impact on the city's population.

UAL has been active in attempting to generate a positive impact on the city's air quality. Apart from the air quality sensors that were installed in 2023, in 2019, students enrolled in the BA (Hons) User Experience Design program at the University of the Arts London were presented with an opportunity for air quality activism and advocacy. They collaborated with a researcher from Imperial College London's Centre for Environmental Policy to create engaging projects aimed at raising awareness about air pollution. Together with their teaching staff, they co-developed a brief focusing on the challenge of making data about air pollution more accessible and engaging to the

public. The students were tasked with exploring experimental forms beyond traditional User Interface and information design to address this issue. With advancements in air pollution modeling, there is now a greater opportunity to accurately inform the public about the health risks and environmental impacts associated with air pollution. Through this collaboration, students had the chance to creatively influence people's attitudes and behaviors toward air quality, potentially leading to positive health outcomes.

UAL is uniquely positioned to fight air pollution through advocacy, critical representation, and visualization of air quality and engagement campaigns. There are a few specific things UAL could begin to contribute to their community:

- **Integrate Air Quality Education into Curriculum**: Incorporate air quality awareness, data literacy, and environmental health into relevant courses across disciplines, encouraging students to engage with real-world environmental challenges through their projects and research.
- **Advocate for Policy Change**: Actively engage with local authorities and policymakers to advocate for stronger environmental regulations, cleaner transportation options, and urban planning strategies that prioritize air quality and public health.
- **Enhance Data Transparency and Community Engagement**: Ensure transparency in air quality data collection, analysis, and reporting, and actively involve the university community in understanding the data and participating in initiatives aimed at improving air quality.
- **Promote Alternative Transportation**: Encourage the use of alternative transportation methods among students and staff, such as biking, walking, carpooling, or using electric vehicles, by providing incentives, infrastructure support, and educational campaigns.

To implement the previous points, UAL should seek inspiration from the extensive research that has been done across the fields of psychology, neuroscience, and behavioral studies supporting the effectiveness of strategies in creating compelling and actionable data-driven narratives. The following points illustrate key findings from a compilation of 10 studies:

- **Storytelling:** Research in psychology has demonstrated that narratives activate multiple regions of the brain and can lead to better comprehension, memory retention, and emotional engagement (Green et al., 2006; Mar et al., 2011).
- **Visualization:** Studies in data visualization have shown that well-designed visual representations can improve understanding and decision-making (Heer & Bostock, 2010; Kosslyn et al., 2006).
- **Clarity and Simplicity:** Research in communication studies emphasizes the importance of clear and simple language in conveying complex information effectively (Fischhoff et al., 1981; Paas & Van Merriënboer, 1994).
- **Relevance:** Studies on persuasive communication suggest that messages are more persuasive when they are personally relevant and connected to the audience's values and experiences (Petty & Cacioppo, 1986; Eagly & Chaiken, 1993).
- **Interactivity:** Research on interactive media has shown that interactive features can enhance engagement, understanding, and learning outcomes (Mayer, 2009; Moreno & Mayer, 2007).
- **Transparency:** Research on data credibility and trustworthiness emphasizes the importance of transparency in data reporting and communication (Metzger et al., 2010; Stvilia et al., 2007).

- **Emotional Appeal:** Studies on emotion and decision-making suggest that emotional appeals can influence attitudes, intentions, and behavior (Slovic et al., 2007; Lerner et al., 2015).
- **Call to Action:** Research in social psychology and persuasion has demonstrated the effectiveness of clear and actionable messages in motivating behavior change (Cialdini, 2001; Petty & Wegener, 1998).

If the world needs creativity, then those who pride themselves on it should unleash it on the world.

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