Post-digital Landscape and Post-digital Culture

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Abstract: This paper investigates a type of "post-digital" practice that constructs "evidence" instead of "data" and relies on the "narrative-driven" instead of "data-driven" method to influence public opinions. This approach to digital landscape practice addresses the dilemma in the "post-truth era," in which public opinions are driven by emotion and empathy rather than objectivity and facts. The paper argues for a post-digital culture by cultivating a sense of criticality in designers towards data collection and data-driven methods. With these new conceptual frameworks in understanding data, objectivity, evidence and fact, landscape architects could play an important role in influencing public decision-making by constructing narratives that are needed when humanities are faced with unprecedented social and environmental uncertainties.

Keywords: Post-digital, landscape architecture, digital art, public opinion, decision making

1 Introduction

Seeing is believing. During the COVID-19 pandemic, visually disturbing slow-motion videos and carefully curated photographs spoke louder than spreadsheets, charts, and graphs to convince the public to wear masks (VERMA, DHANAK & FRANKENFIELD 2020). Climate change deniers ignore scientific data and research and focus on the more exciting conspiracy theories claiming climate change is a Chinese hoax (WONG 2016). Flat-earthers would fight to the death (in a literal sense) by elevating personal experiences above objective facts (HORTON 2020). In these examples, emotion and empathy rather than "objectivity" and facts drive public opinions and render data and numbers futile. This so-called "post-truth area" challenges the efficacy of digital landscape architecture practices, which have relied largely on data-driven and scientific methods to produce knowledge and inform public decision-making. What is our expertise as "digital landscape architects" in this post-truth world that values experience more than digital data?

This paper attempts to address this question by investigating a range of cases from digital art and urban design. These cases present different kinds of digital practices that challenge a mainstream sensing-processing-actuating workflow in digital landscape architecture (CANTRELL & HOLTZMAN 2015). Sensors are the backbone of the subsequent decision-making steps in the sensing-processing-actuating feedback workflow. Collected environmental data are always treated as objective facts. However, the cases presented in this paper provide another perspective to understand the objectivity of data and sensing practice. These designers and artists construct "evidence" instead of "data" and rely on the "narrative-driven" instead of "data-driven" method to influence public opinions.

This paper takes on a constructivist framework found in the field of Science, Technology and Society (STS) and reflects the notion of objectivity and fact (BIJKER, HUGHES & PINCH 1987, BIJKER 2010). By applying this framework in analysing digital practices, the paper eludes a "post-digital" paradigm. This paradigm posits "scientific objectivity" as a constructed concept and sensors as socio-technical artefacts. Sensing practices use instruments to encode the environment into culturally-specific facts. This argument does not doom the scientificity of

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digital landscape practices; instead, it liberates designers. It does not constrain but increases designers' agency in choosing how to represent the "objective world" with digital technologies to shape public opinions.

The paper will first analyse David Bowen's art installation to argue that sensors are socio-technical artefacts. They do not innocently "listen" to the environment but impose culturally specific epistemological frameworks in understanding reality. Sensors define what is real and what counts as facts. Then the paper uses three examples to explore a type of post-digital practice that bypass the discussion of data and objectivity. These practices merit new ways to consider and harness the paradigm shift in this post-truth world of experiences and empathy.

This paper relies on an art-critique approach, which may be less familiar to readers in the field of digital landscape architecture. The goal is not to introduce a workflow nor to provide a solution. Instead, with a constructivist analytical framework, the paper interprets the meaning of selected cases in our digital culture. The aim is to provide an alternative perspective to digital practices, generate debates and discussions among scholars, and cultivate a sense of criticality towards data and sensing practices within the field of digital landscape architecture.

2 Sensors as Socio-technical Artifacts

We are in a paradigm of *mechanical objectivity,* in which we develop machines and routines of mechanical reproduction to remove subjective interpretation from research and let "nature speak for itself" (DASTON & GALISON 2007). Charting the history of 19th-century scientific atlas and representations, science historians Lorraine Daston and Peter Galison (1992, 2007) posits "objectivity" as a socially constructed concept. On the path to "truth-to-nature," scientists themselves became the biggest enemy, and sensors as automatic recording devices become paragons for the virtues of ideal observers – for they are "patient, indefatigable, ever-alert, probing beyond the limits of the human senses" (DASTON & GALISON 2007, 139). Many, therefore, believe sensor-generated data reflect the objective world and thus represent fact without human interpretation. However, the field of Science, Technology and Society (STS) and the social construction of technology (SCOT) movement since the late 1980s have asserted that technological artefacts, including sensing devices, and the "facts" that they produced are socially constructed (BIJKER et al. 1987, BIJKER 2010).

We shall consider artist David Bowen's art installation, "Tele-Present Wind" (2011). The installation consists of two parts. A series of 126 x/y tilting devices are distributed on an indoor gallery floor. Each device consists of a dried plant stalk connected to a tilt servo motor that can drive the stalk to tilt in any direction. The second part of the installation is a dried plant stalk connected to an accelerometer outdoors. As the winds blow, the exterior stalk sways, and its exact movement – both in intensity and direction – is detected by the accelerometer. This data is then transmitted to the devices in the gallery, and the gallery stalks replicate the exact, real-time movements of the sensor stalk. Thus, the wind is displaced, from outside into the gallery space (Figure 1).

The installation poses a series of questions about the nature of sensing and sensors. Wind speed and direction are commonly measured via anemometers. Anemometer outputs are vectors with which we describe wind at any location, at any time, with a combination of two values, one indicating the direction in degrees and the other reporting the speed of horizontal

airflow (in miles per hour or mph). If we analyse Bowen's sensing device, constructed of a dry stalk and an accelerometer, then what is sensed about wind? Alternatively, in Bowen's work, what constitutes a sensor? The actual "sensor" is an accelerometer, which measures acceleration on one, two, or three axes. Its output is a vector combining two values – direction, and magnitude in that direction (m/s2). Bowen used a two-axis accelerometer to record how fast and in which direction the wind tilted the stalk. Therefore, technically, the accelerometer did not sense wind directly, but instead evaluated the stalk's movement.

Fig. 1: Tele-Present Wind (© David Bowen 2011). Sensor (left) and actuators (right).

Compare Bowen's sensing device with a three-cup anemometer commonly used in environmental sensing. We find that there is, in fact, no difference between them regarding the transformation process. A cup anemometer consists of three hemispheric cups mounted on horizontal arms. When air passes the cups in any horizontal direction, the cups drive a vertical shaft to turn at a rate proportional to the wind's speed. Thus, counting the turns of the windcups over a set time interval yields a value proportionate to the average wind speed during that time frame. Hence, a cup anemometer itself does not directly measure wind speed; what it actually measures is how fast the shaft rotates. In both cases (the cup anemometer and Bowen's installation), devices can produce certain behaviours in response to wind – the rotation of a shaft or the tilting of a dry stalk. We interpret the phenomenon by reading the devices' behaviours.

Any type of sensing involves interpretation. Technology philosopher Don Ihde (1990) uses the hermeneutic relationship to describe one type of relationship formed between humans and technology. In hermeneutic relationships, we are involved with the environment via an artefact that provides a representation of the world. We must interpret its behaviour to gather information about the environment. In that case, sensors as socio-technological artefacts compress and black-box a set of interpretation protocols into one streamlined process. Ihde uses hermeneutic relationships to describe this type of mediation process, because the artefact must be "read".

Yet, in order to read, a set of protocols must be in place to accompany the specific design of a device. For example, in the case of a wind cup anemometer, the anemometer factor – the ratio of wind speed and shaft rotation speed – depends on the physical construction of the cups and arms. Further, an anemometer sampling frequency is dependent on how often we take measurements: a 1-Hz frequency anemometer counts the turns once per second, and a 0.1 Hz frequency counts the turns made in a 10-second time frame. Interpretation thus in-

volves specific designs of the devices and protocols that instruct us to read the device "properly". Construction of a sensing device also means standardising and formalising a wide range of protocols, procedures, and possible designs, with one working model. A digital anemometer streamlines and automates interpretation protocols by specifying measurement frequency and anemometer factor with circuit boards.

By comparing Bowen's art installation with a scientific wind anemometer, we can thus say that a sensing device does not innocently "listen" to a phenomenon; it is, in essence, a socio-technological artefact containing streamlined interpretation procedures. Media historian Bernhard Siegert formulated the relationship between mathematics and cultural techniques: "The mathematical concept of the symbol is founded on the black-boxing of a history of cultural techniques, which in turn is a history of the articulation of the real" (SIEGERT 2018, 10). *Sensing is thus an idealised way to read environmental traces with rules and procedures, by naturalising and streamlining a history of interpretation techniques that distinguish what counts as fact from what does not.*

3 Post-digital Practices

With the premise that sensors are merely instruments constructed to idealise ways to read environmental traces, designers can reconceptualise sensing practices as ways to construct evidence and facts. This section alludes to three directions that merit further explorations by fellow digital landscape architects with three examples.

4 Autographic Visualisation

One example is the technique of *autographic visualisation* (OFFENHUBER 2019). Artist and researcher Dietmar Offenhuber challenges the binary understanding of the information transmission process with the public artwork *Staubmarke (dustmark)* (2018) in Stuttgart – a city affected by particulate matter pollution in Germany.

Fig. 2: Staubmarke, 2018 (© Dietmar Offenhuber)

Unlike most environmental sensing projects that start with data collection and then visualise data with web maps, Staubmarke constructs physical evidence of air pollution by turning people's attention to the patina on the city's surfaces. Using a technique called *reverse graffiti*, the installation crew strategically cleaned parts of the accumulated pollution on hard urban surfaces such as buildings, bridges, and retaining walls, creating clean patterns of different densities of dots. Over time, these graffiti dust marks will fade as particulate matters accumulate again on these surfaces (Figure 2). This art project suggests a different relationship between people and data. With digital data, there is always an extra step after data visualisation – interpretation. Our audiences have to interpret numbers or graphs within a cultural context. We need to learn to read before we understand what these numbers entail. However, through autographic visualisation, "data" become lived experiences – people *see* air pollution instead of reading it through numbers.

Many may argue this art project is not "digital. It may be "pre-digital" since there is no circuit involved. However, this is exactly the point to discuss this art project: must data be *digital*? Or what do we even mean by "digital" – given "digits" literally mean fingers – that is nothing "electronic" and "computational?" At which point must "digital practices" be "electronic" and "computational?" Or, doesn't "digital landscape architecture" become a self-sanctioning mechanism that excludes other ways of interpretation? The artist deployed a very much "computational" way to conceptualise the project – with clearly defined parameters to remove the dust from the surfaces, forming patterns that classify pollution into four categories and ensuring later dust accumulation to be interpretable in a quantifiable manner. The project is very much "digital" because it applied a kind of digital thinking to understand the physical world.

Data collection is often considered the process in which phenomena in the physical world are transformed into numerical representations in the "digital realm". We assume a conceptual divide between two spaces: real and virtual, physical and digital. This conceptual divide underpins today's digital practices, giving rise to the discussion of "hybridity." However, what if the divide itself is an illusory boundary that is more apparent in our minds than in reality? Indeed, in this art installation, data and phenomena clash. The urban surfaces become "sensors" that construct the evidence of air pollution over time. The boundary between the digital and the physical is challenged.

5 Positive Feedback and Emergent Behaviours

Cyborg Bloom (2017) is a cybernetic machine that challenges the illusory boundary between ecology and technology concerning emergent behaviours produced by various feedback loops between humans and machines in the shared environment (ZHANG 2017a) (Figure 3). Temperature and humidity, light, and infrared sensors produce data that drive the LED rings' behaviour. The installation consists of three kinds of responsive mechanisms. First, sunlight, temperature, and moisture decide the baseline behaviours, and the installation responds to its ambient environment. Second, a feedback mechanism exists between LED light and luminosity sensors. When LED pulses, the changing ambient light feeds back to light sensors, adjusting LEDs' pulsing pattern and intensity. This responsive mechanism is a positive feedback loop between the sensors and LED, which drives the machines to produce unpredictable, emergent behaviours. Finally, there is another level of responsive mechanism between people

and the installation. Because the installation exhibits unpredictable patterns, it draws people's attention to interact with it. This forms another positive feedback loop between people and the installation, and human factors contribute to the responsive environment (ZHANG 2017b).

Fig. 3: Cyborg Bloom, 2017 (© Zihao Zhang)

Norbert Wiener coined the term "cybernetics" during his war-time research for "antiaircraft predictors" (GALISON 1994). Then Wiener introduced this concept in his book *Cybernetics: Or Control and Communication in the Animal and the Machine* (1948/2019). Cybernetics quickly became a transdisciplinary field, studying the feedback mechanisms among biological and technical entities. It laid the theoretical foundation for today's intelligent machines, including the most advanced AI systems. However, most engineering applications utilise negative feedback machanism to design control systems, leaving the application and implication of positive feedback loops and emergent properties under explored. In recent years, some landsacpe architects started to study the implication of cybernetic principles in design and focused on how different entities, including intelligent machines, animals, plants, interact with each other and co-produce outcomes that are beyond prediction and control (LYSTRA 2014, ZHANG & LIU 2020, ZHANG 2021, CANTRELL, ZHANG & LIU 2021). *Cyborg Bloom* thus provides empirical evidence and merits other types of exploration.

6 From Sensors to Digital Companions

Ostenda illuminata is a public installation prototype for networked public spaces (EL KHAFIF, MONDSCHEIN & MURILLO 2021). It concerns the relationships between humans and machines (Figure 4).

The sensors, LED lights, microcontrollers, and power sources are housed in architectural structures made of light-conducting acrylics. The installation can respond to the ambient environment through the feedback mechanism between sensors and actuators. The team uses the Latin name, *Ostenda illuminata*, to evoke a plant analogy as if the machine is a digital species that live and evolve within the urban environment. "*Ostenda*" means to "reveal" or to "make clear", and "*illuminata"* means to "enlighten." The team hopes this digital species can reveal the process of data acquisition that is always hidden from the public and teach people the phenomena beyond all-too-human ways of perceiving and knowing. The team has embraced and stretched this plant metaphor to develop a family of six digital species – including "trees", "shrubs", and "mosses" – that can respond to the environment in slightly

Fig. 4:
Ostenda illuminata, 2020
(© Networked Public Space;
(Photo source: Tom Daly)

different ways. Together, the team hopes to use the installation to represent a "digital ecology" in the networked public spaces in "smart cities."

This project brings the relationship between people and intelligent machines to the centre of sensing practices. In most "smart cities" imaginations, intelligent machines are conceptualised as a layer of control mechanism on top of a city; urban processes can be optimised through this control layer. In a way, a "smart city" is a black-boxing process that hides data acquisition and information processing from everyday life. However, this project regards intelligent machines as active agents or actors that co-evolve and co-produce urban spaces. These types of urban installations give data acquisition and information processing a "body", turning invisible, virtual processes into embodied experiences.

Donna Haraway (2003) and many feminist anthropologists use the notion of "companion species" to highlight the co-production and co-evolution between humans and nonhuman species in the shared environment. With this notion, we may understand these public digital installations as a type of "digital companion species" that co-evolve with people and elucidate phenomena beyond our all-too-human ways of knowing, constructing "facts" that shape the public opinion through experiences rather than numbers and charts.

7 Conclusion and Discussion: Towards a Post-digital Culture

By applying an STS constructivist framework in analysing sensing practices, this paper reaches a somewhat post-modernist conclusion: sensing involves developing protocols and rules that naturalise a series of cultural techniques that encode the environment into ones and zeros. Thus, environmental sensing constructs a network of various instruments. Each instrument embodies a specific history of cultural techniques of interpretation, coding the environment into a "datascape" based on which decisions are made.

However, this type of analysis and conclusion were very common in early STS studies. Their goal was to reflect on 20th-century technology determinism and prove that socially constructed technologies are laden with culturally specific values (BIJKER 2010). As part of the post-modern movement in the second half of the 20th century, these types of STS analysis

present harsh criticism and shocking counter-narratives that, to an extent, devalued scientific thinking and grew the seed for today's post-truth dilemma. The darker side of this post-modern epistemology confuses opinion with expertise – anyone can have opinions about anything, and they are all equally true (COLLINS 2009).

The post-digital landscape practices should build on this realisation but bypass the scepticism inherited in the constructivist framework. Science sociologist Harry Collins (2009) argues that we cannot live by scepticism alone. Post-digital practices thus provide a way to respond to this post-truth dilemma; we should not only critique but also provide alternatives to normalised environmental sensing, which has failed to influence public opinion driven by experiences and emotions. The challenge for the next generation of landscape architects is to construct experiences that connect people to the dynamic, living nonhuman realms (MEYER 2008, 2017). In the examples presented in this paper, designers accept sensing as coding and use ad hoc "instruments" to "encode" the reality into self-evident experiences and construct "facts" of environmental concerns.

Through constructing experiences, examples in this paper provide ways to rethink and expand landscape responses to urging social concerns such as climate change. Object-oriented philosopher Timothy Morton (2013) has conceptualised climate change as a "hyperobject" that extends beyond human access in both space and time. This is one major challenge for building a culture that is willing to decarbonise itself because it is hard for individuals to relate "a turning of car key" to the changing climate "out there" (MORTON 2013). From this vantage, constructing experiences and facts with sensing practices becomes crucial for connecting us with phenomena beyond human access. Those "sensing stations" in the examples become self-evident material manifestations in the physical world. They translate environmental dynamics into tangible and relatable experiences, thus influencing public opinion through "manipulation" rather than "persuasion."

One caveat is to temporarily forget the negative connotations associated with the term "manipulate". French philosopher François Jullien (2004) compares two kinds of political strategies: persuasion versus manipulation. A conventional data-driven approach can be understood as a persuasion strategy that the designers try to present data and facts to *persuade* the audience (communities) into supporting their thesis. However, in doing so, designers simultaneously enter an antagonistic relationship with the audience, and there will always be circumstances rising to undermine designers' plan of action (JULLIEN 2004). One example is the failure of Alphabet's Sidewalk Lab and their "smart city" project in Toronto. Despite numerous "community engagement meetings", which, in reality, were meetings for the teams to *persuade* the locality of the benefit of their "genius" plan, the community were simply distracted by the more emotionally disturbing "fact" of the violation of the privacy through sensing (WYLIE 2019). In contrast, in the examples presented in the paper, designers and artists did not rely on collecting more data but on constructing "facts" to "manipulate" public opinion. Without antagonism, designers hope to influence the public "from upstream" by inspiring a culture that is willing to see more (JULLIEN 2004).

What is building a culture? We need to recall Don Ihde's discussion about our hermeneutic relationship with technologies (IHDE 1990). When thermometers were invented and adopted, society as a whole needed to gradually grasp what "20°C" means physically. Forming this hermeneutic relationship with thermometers requires a culture, or to use another STS concept, a socio-technical ensemble in which the society and technologies form a seamless mesh.

Today, scientific communities and industry still drive technology innovation. New terms, tools, and techniques are introduced every minute, and new data are generated every second. When industry trow out eye-catching concepts like "NTF" and "metaverse", society lacks the ability and concepts to grasp the meaning of these new phenomena. Today's technological innovation tears a gap in the socio-technological mesh. Before society can form a hermeneutic relationship with a new piece of technology, it becomes outdated. Thus, ultimately, what is needed in a "post-digital culture." We need a culture that looks beyond the frenetic "digital enthusiasm" and is willing to understand what lurks behind this so-called "digital revolution."

Building a culture is more than STEM (science, technology, engineering, and mathematics) education, which is gaining popularity across different sectors. Instead, we need to shift our attention from teaching the tools and methods to why and for what purpose we build certain tools and adopt certain methods. From this vantage, citizen science and DIY culture hold promises in democratising technological innovations. More digital landscape architects should play an irreplaceable role in building a "post-digital culture", enlightening the public about data and the environment and closing the gap on the socio-technological mesh.

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