Artist's Article

Breaking the Circuit: Encountering Media's Entanglements with Environment and Behavior through an Energy Art Practice

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Abstract: Uncovering and exhibiting digital media's entanglements with energy, behavior and environment through artistic practice has been a decade-long quest for the author. Through three art projects the author describes his experiments with the energy consumption of media, lithium battery recycling, the Cloud and network connectivity. Arguing for critical artistic approaches, the author examines concerns of ecology and behavior as investigated by installation, by workshop, and by community participation, together forming an energy art practice.

Keywords: energy, digital media, behavior, e-waste, art, environment

Article Frontispiece: Light is History in Hakaniemi Market Square, Helsinki. (Photo: Samir Bhowmik)

“Media are finite, in the sense both that, as matter, they are inevitably tied to physics, especially the dimension, of time; and that their constituent elements – matter and energy, information and entropy, time and space, but especially the first pair – are finite resources in the closed system of planet Earth.” [1]

— Sean Cubitt

Digital acts have thermodynamic costs. In fact, as information manipulations, the digital acts of copying, measurement, erasure and feedback are all physical operations with energetic and material impacts [2]. This is the obvious but understated problem of the energy consumption of digital media, whether they be for searching information or making cryptocurrency. Today, it is poised to become the largest consumer of electricity only after homes and industry. The data center industry, the backbone of the internet consumes nearly 205 terawatt-hour, or around 1% of global electricity consumption [3]. Correspondingly, energy resources are extracted from dirty coal and nuclear. Lithium that powers mobile devices and tools is becoming the fastest growing extractive metal. The combined effect of energy and resource extraction and related e-waste has had an adverse environmental impact in the form of damaged landscapes and habitats.

From the environmental concern, one also cannot help notice the entanglement of a behavioral concern, that of affect. Today, media has increasingly transformed from being machines of communication to machines to manage and modulate behavior, affects, relationships, intensities and forces. This provokes a strange return of questions of behavior, technologies of behavior, and the prediction of behavior, of controlling and managing behavior [4]. One can easily infer that behavior and environmental are in turn also connected to the energy consumption of media. This shows in how digital content is consumed, how behavioral control has been commodified through social networks and streaming services, how portable devices are designed and used. Consequently, environmental issues become a coefficient of our daily energetic acts in the use of media technologies.

This essay takes these concerns of behavior and ecology as starting points that I address through my artistic works between the years 2012-2019. *Light is History* (2012), an energy art installation, *Community Power Bank* (2016), lithium battery workshops, leading up to *Circuit Breaker* (2019), a performance installation about the Cloud and connectivity. These projects aimed to provoke

reflection about media's energy use and resource dependencies. Through teamwork and collaboration other artists and designers were involved including members of local communities.

From these projects, I identify three approaches that together form an energy art practice. First, how public art brings the private domain of energy consumption of media to the public; Second, how through artist-led Do-It-Yourself (DIY) battery-recycling workshops creates the awareness of obsolescence and e-waste and finally, how community-participated installations might provoke reflection about connectivity and energy use. These examples are not supposed to be exhaustive methods of generating awareness of energy and waste of media but presented here to encourage discussions of an emerging crisis of media-led energy use and resource depletion.

<1> **Light is History**

During the early phase of my research, I found the theme of energy-use of media rare in scholarly discussions on the materiality of media technologies. On first glance, it was the awareness of media's impacts on ecology and environment that come about in the mid-2000s, when artist Garnet Hertz noted how "the ubiquity of computing and the rapidly increasing capabilities of microprocessors and consumer electronics created an explosion of obsolete media technologies in contemporary culture." [5] It was around then that Planned Obsolescence as perpetuated by Silicon Valley technologies come to the fore [6]. Images of e-waste dumped in the Global South and the energy-intensive and dirty nature of the so-called Cloud (energy-intensive data centers) soon appeared in mainstream media [7]. DIY practitioners, and artists rushed to recycle, hack, re-use, and re-purpose media, giving rise to a whole new generation of DIY practices. From artist Reed Ghazala's 'Circuit Bending' to Hertz's 'Critical Making', this 'DIY' turn signaled the decline of the fascination with new media and the consumer commodity phase and resulted in the growing focus on media's effect on the environment [8].

Thus, in between DIY practices and the emergence of critical scholarship of media technologies my first artwork *Light is History* came into being. The project was conceived and built in the context of *Trashlab*, a DIY community initiated and organized in Helsinki in 2012. The community aimed to explore practices in experimental art, design, technology concerned with material and electronic waste, and tackle this problem through creative projects.

Initially conceived as a light installation powered by a community's energy savings, *Light is History* evolved into an artistic DIY research object to explore the material, digital and energetic culture of the community members. The primary motives were to unravel the abstraction of energy measurements, to expose the concealment of measuring devices and infrastructure as ecological concerns. And, further, to anonymously visualize the private energy lives of a community, thus illuminating their behavioral patterns.

Fig. 1. Light is History installation in Hakaniemi Market Square. (Photo: Samir Bhowmik)

Taking the form of a monolithic assemblage of LED lights and display vitrines in a busy market square, the installation presented the energetic lives of sixteen participating families. The lights were programmed for brightness and intensities based on their daily energy savings. Each vitrine, repurposed from old electrical meters, displayed a domestic energy artifact such as a laptop or an audio system, along with a personal narrative. Together, they represented the energetic life of the participating community to the general audience on the market square. During the installation, the families were invited to gather on the square and discuss the implications of their acts of saving and publishing their energy use.

As a public art installation and an infrastructure, *Light is History* foregrounded the private domain of energy consumption of media into the public sphere. It thus offered a collective platform in the spirit of making things visible the so-called 'electrosphere' of the home and placing it in the urban domain [9]. It catalyzed the participants to save energy, to publicly share their energy data in the form of light, as opposed to the abstracted values of kilowatt hours. Addressing the ecological concern from an issue of personalization and choice, it also problematized the assumptions about what was private, and what was public such as energy or infrastructure.

Fig. 2. A repurposed electrical meter as a vitrine in Light is History (Photo: Samir Bhowmik)

Reporting energy use created awareness among the participants about the energy consumption of media. They realized that considerable amount of personal energy data was processed and controlled by energy companies. In addition, it revealed the energetic significance of the electrical appliances, light fixtures, and media technologies in their homes. Participants changed their daily routines to save more energy to power the installation. During the project they became deeply engaged with the installation process, especially in reporting their energy data and relationships with their electrical and media artifacts. Overall, one could notice a behavioral change in the participants - a growing awareness of energy-intensive media, the indecipherable nature of energy information, and the sprawling infrastructure of energy generation and distribution.

<1> Community Power Bank

One of the understated problems of digital media has always been the nature of energy that goes into powering media infrastructures. This extends to the energy-intensive portable media devices powered by variations of Lithium batteries. Although the battery is a key component of communication infrastructures, by itself it cannot be considered a medium for dataflows, but without which media cannot operate nor exist. Yet, the entire area of battery development, obsolescence, messy chemistries and waste has been overlooked in scholarly studies. Not much literature nor experiments can be found about batteries that are so critical to digital media.

Elements such as Lithium dug out of the earth today form the energetic backbone of handheld and portable media, including over a billion smart phones. Not only Lithium, but also the supporting minerals of the energy industry such as Cobalt, Nickel, Manganese or Graphite are all extracted at a

considerable price to the environment. In *Finite Media*, media theorist Sean Cubitt discusses the extraction of Lithium and its environmental consequences. As he notes, this extraction is not only energy-intensive, but also billions of gallons of precious water used in the refinement processes impacts local economies [10]. Studies show the manufacturing processes of both Lithium and Cobalt present huge environmental and health hazards and recycling technologies are yet to catch up, especially re-extracting the prized minerals remain a vexing problem [11].

Thus, in the spring of 2016, my attention turned to Lithium batteries that power handheld media of smartphones, tablets and laptops. I investigated the battery's energetic entanglements within its formative history, subsequent technological applications, current extraction and fabrication to toxic landfills. Why and how hardware came to conceal the battery and how software today merely provides a surface tweak. Thus, I traced the battery's contemporary life-cycle in the energy economy: from mining to extraction to recycling that present formidable challenges to the environment [12].

By recycling Lithium batteries through DIY workshops I aimed to bring the issues of energy, e-waste and the environment to the foreground. This resulted in an energy art project 'Community Power Bank' (CPB) to co-construct portable power storage systems based on discarded Lithium batteries. The workshops were held at the Museum of Photography and at the Open Source Circular Economy (OSCE) Days in Helsinki. The aim was to build community 'power banks' by recycling Lithium batteries into portable battery packs.

Fig. 3. Dismantling of discarded laptop battery packs during a workshop at the Museum of Photography Helsinki (Photo: Justin Tyler Tate)

In the various workshops participants were guided to safely dismantle batteries, test, identify and recover functional cells. They learned how to design various cell arrangements to create variable voltage power banks used for charging media devices and other USB charged technologies. Within the workshop groups, participants recycled batteries and worked together to build power banks. This included the learning and understanding of the methodologies to build open battery systems. These workshops fostered a community discussion around recycling Lithium batteries, while teaching applicable skills. The project thus facilitated a dialogue about e-waste and environmental concerns among community participants.

Fig. 4. *Left*, soldering of circuit for a power bank during a battery workshop; *right*, a power bank constructed during a workshop. Photo Credits: Justin Tyler Tate.

To tinker with black-boxed technologies such as Lithium batteries is not only a provocation against consumer practices and technology companies but also carries the potential to lead to new knowledge and understandings of media and the environment. Similar to the manipulator of consumer electronics, the battery artist, recycler and re-purposer also “traverses through the hidden content inside of a technological system.” [13] As artistic tinkering, it is a hands-on approach, to understanding the political economy of Lithium batteries, thus addressing an ecological concern.

<1> **Circuit Breaker**

Obviously, energy in its multiple scales of generation, supply and consumption, and its deep connections to media needs further research. While information may not be matter nor energy, as Norbert Wiener famously proclaimed, digital manipulation of information does have energetic costs

[14]. It is clear, that at both ends, of the server (data center) and the client (battery-powered portable devices) energy and infrastructure are the common threads. The infrastructure of the internet is powered and sustained by a multi-scalar infrastructure of energy. Power plants supply energy to data centers, while batteries supply energy to mobile devices. In a keynote delivered in Potsdam in 2016, Cubitt argues against constant connectivity, describing how entire regimes of software and hardware operations, human behavior, capital, supply-chain networks, mines, toxic waste are constantly put into motion every time a digital image is circulated on the Internet [15]. In fact, as media theorist Jussi Parikka says, eventually it is the earth's metals, minerals, and fossil fuels that are operationalized as media and media infrastructure [16].

One might recall Timo Arnall's *Internet Machine* (2014) a multi-screen film shot in a data center that exposed the Internet's invisible infrastructures and its material and energetic underpinnings [17]. Or, Nicole Starosielski's book *The Undersea Network* that unraveled the submarine cables forming the backbone of the Internet where natural environments become the infrastructure for connectivity [18]. Similarly, *Signal Traffic*, a volume about media infrastructures, showed how people's use of the Internet in rural Zambia is punctuated by variable access to electricity and water; how mobile networks in Israel-Palestine are fraught with territorial disputes and dominance of state power [19]. It was at this time, I started pondering about constant connectivity and its environmental impacts. I wondered whether artistic methods could question the ubiquitousness of connectivity and address the related materialities. Could dis-connectivity remind us of our choices? Could a community-participated installation persuade us to think every 'click' has an energetic footprint and every break in the circuit saves a piece of the earth?

The resulting installation in MAA-Tila Gallery in Helsinki took the form of a panel of customized 'coal' meters and indicator light switches linked to a distributed network of online participants. As the artist, I performed as a technician, overlooking the operations of the installation. Each meter remotely measured the data transfer (combined uploads and downloads) of an online participant and translated and displayed it into coal consumption as per energy use. The community consisted of an anonymous group of twenty online participants connected to the installation. For five days during the festival, the installation monitored the energy consumption of participant data transfers.

Fig. 5. The Circuit Breaker in MAA-Tila Gallery Helsinki (Photo: Emma Suominen)

Individual network connectivity depended on an upward threshold of maximum data transfers. Once the upwards limit of thirty grams of coal consumption was reached, the participant would be kicked off the system. Three megabytes of data transfer was considered to be equal to the consumption of a single gram of coal. The meter was calibrated to an upward limit of thirty grams, or ninety megabytes of data usage. These calculations were based on several published studies on the electrical use of data transmission [20]. A green light button signaled ongoing data transfers, and a red light showed the ceasing of the connection. Upon pressing of the green light button, the connected was restored. During the project, 6 terabytes of data transfer took place consuming over 2000 kilograms of coal burnt for energy generation.

Fig. 6. The individual meters of the Circuit Breaker. (Photo: Emma Suominen)

By placing online behavior through a community-participated installation, and an environmental agenda, the project drew attention to the materialities and infrastructures of connectivity. Participants were influenced by the quantity of their daily online data transfers and attempted to

limit their browsing activities to reduce energy consumption. Awareness of energy use of connectivity broadened during the installation exhibition. It also provoked critique and reflection about the social and energetic impact of our constantly connected digital lives.

<1> Conclusion

As it turns out, media's regime of energies that sustain it are also the regimes that shape affect. Media is not only entangled with energy but also with human bodies, furthermore in the modulation of human and community behavior, and ultimately the environment. Thus the concerns of ecology and behavior are intertwined in media in a continuous feedback loop. Media normalize behavior, such that they become relatively unnoticed, invisible and internalized, just like the energy that powers it, just like the environment that sustains it. But, there exists the potential for disruption of that normalization, which can occur during instances of a power failure or dis-connectivity, when one becomes aware of the earth.

I believe that examining the effects and affects of media demands an attention to energy, and in turn a focus on the resources of the earth vis-a-vis the body. Provocations and speculations from an energy art practice becomes a way to uncover and address the energetic materialities. Such a practice needs to combine DIY methods with community workshops, participated installations with performance on a case-by-case basis.

As seen in my projects, critical approaches have the potential to influence behavior of individuals and community towards media and the environment. To address the daunting issues of our era, one cannot simply present histories and narratives, but by provocations and speculations, by participation and engagement, perhaps even through dis-connectivity and breakdown. In this endeavor, we must also bridge scalar abstractions of kilowatt-hours with kilobytes, energy readings with web analytics. Then only can we comprehend that media are finite.

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