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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 has become the fastest growing extracted metal. The combined effects of energy generation, resource extraction and e-waste has had an adverse environmental impact in the form of damaged landscapes and habitats.

From the environmental concern, one also cannot help but notice the entanglement of a behavioral concern. According to cultural theorist Erich Hörl, 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 might infer that behavior and the environment 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 using media technologies.

This essay takes these concerns of behavior and ecology as starting points 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; and *Circuit Breaker* (2019), a performance installation about the Cloud and connectivity. These projects aimed to provoke reflection about digital media’s energy use and resource dependencies.

From these projects, I identify three approaches that together constitute what I call an energy art practice. First, how public art installation brings the private domain of energy consumption of media to the public; second, how artist-led Do-It-Yourself (DIY) battery-recycling workshops create 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 to encourage discussions of an emerging crisis of media-led energy use and resource depletion.

Light is History

During the early phase of my research, I rarely encountered the theme of energy-use of digital media in scholarly discussions. On first glance, it was the awareness of media’s impacts on ecology and environment that came 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] Thereafter ‘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

nature of the so-called ‘Cloud’ soon appeared in the 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, Fablabs and Maker Spaces. Hertz provides methodological examples through the works of artists such as Reed Ghazala who explored the artistic potential of black-boxed technologies, Natalie Jeremijenko in the tactical use of technologies for social change, and the archaeological use of outdated technologies by Tom Jennings. From Ghazala’s ‘Circuit Bending’ to Hertz’s ‘Critical Making’, this ‘DIY’ turn signaled a decline of fascination with new media and the consumer commodity phase resulting in the growing focus on media’s effect on the environment [8].

Thus, between DIY practices and the emergence of critical scholarship of media technologies, my first collaborative artwork *Light is History* came into being. The project was conceived and built in the context of *Trashlab*, a DIY community organized in Helsinki in 2012 that explored artistic practices concerned with material and electronic waste. 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 its community members. Our primary aims were to transform the abstraction of energy measurements (kilowatt-hours) into a publicly recognizable form, and to visualize the energy use of community members, thus illuminating their behavioral patterns.

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

Taking the form of an assemblage of LED lights and glass display cases or vitrines in a busy market square, the installation presented the energetic lives of sixteen participating families. Energy meter readings reported by the participants were collected online and the energy saved was made available for powering the installation on a daily basis. The lights were programmed for brightness and intensities based on these energy savings. Each vitrine, repurposed from discarded electrical meters, displayed a domestic energy artifact such as a laptop or a radio along with a personal narrative. 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, *Light is History* foregrounded the private domain of energy consumption of media into the public space. 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]. Participants were encouraged to save energy and share their energy data in the form of light. Addressing the ecological concern from an issue of personalization and choice, the project also problematized the assumptions between what was private or public such as energy or infrastructure.

Fig. 2. A repurposed electrical meter as a vitrine with a personal narrative (Photo: Samir Bhowmik)

From the interviews and feedbacks, we noticed reporting energy use created awareness among the participants about the energy consumption of media. They realized that a considerable amount of personal energy data was processed and controlled by energy companies. In addition, the interviews revealed the energetic significance of the appliances, light fixtures, and media technologies in their homes. Participants changed their daily routines to save energy to power the installation. During the project they became engaged with the installation, especially in reporting their energy data (as revealed from the daily energy data logs) and relationships with their electrical and media artifacts. Overall, one could notice a behavioral change in the participants - a growing comprehension of energy-intensive media, the composition of energy data, and the sprawling infrastructure of energy generation and distribution.

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. A key component of communication infrastructures, the battery itself cannot be considered a medium for dataflows, but without which media cannot operate nor exist. Yet, the entire area of Lithium battery development, obsolescence, messy chemistries and waste has been overlooked in media studies. Although, one might run into a plethora of DIY battery projects, documentaries and news clips online, rarely we come across critical literature, artworks or experiments about Lithium batteries [10].

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 battery 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 [11]. Thea Riofrancos also writes about this environmental damage caused by lithium extraction zone in Chile to water resources, farming and local biodiversity [12]. Studies show the extraction processes of both Lithium and Cobalt present huge environmental and health hazards. Recycling technologies are yet to catch up, especially re-extracting the prized minerals remain a vexing problem [13].

Thus, in the spring of 2016, my attention turned to Lithium batteries, especially its energetic entanglements within its formative history, subsequent technological applications, current extraction and fabrication to toxic landfills. I examined why and how hardware came to conceal the battery and how software today merely provides a surface tweak in the form of battery monitoring apps [14]. Thus, I traced the battery's contemporary life-cycle in the energy economy with attention to the processes ranging from mining to extraction to recycling that have environmental implications.

By recycling Lithium batteries through DIY workshops, we aimed to bring the issues of energy, e-waste and the environment to the foreground. This resulted in a 'Community Power Bank' (CPB) project to co-construct portable power storage systems from discarded Lithium batteries. We organized workshops at the Museum of Photography and during the Open Source Circular Economy (OSCE) Days in Helsinki. Our goal 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 workshops we guided the participants 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 allowing them to learn and mutually understand the methodologies to build open battery systems. The workshops also fostered a discussion around technological culture and recycling. 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: 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.” [15] By building open battery systems with community participation we succeeded in dismantling the black box of the lithium battery. As an artist, tinkering with batteries allowed me to comprehend the political economy of Lithium extraction, thus addressing an ecological concern.

Circuit Breaker

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 has energetic costs [16]. At both ends, of the server (data center) and the client (portable devices), energy and infrastructure are 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, 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 [17]. 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 [18].

One might recall Timo Arnall’s *Internet Machine* (2014), a multi-screen film shot in a data center exposing the Internet’s invisible infrastructures and its material and energetic underpinnings [19]; or, Nicole Starosielski’s *The Undersea Network* unraveling the submarine cables that constitute the backbone of the Internet, where natural environments become the infrastructure for connectivity [20]. 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 [21]. It was at this time, I started pondering about constant connectivity and its environmental impacts. I wondered whether artistic methods could question the ubiquity of connectivity and address the related materialities. Could dis-connectivity remind us of our choices? Could a community-participated installation persuade us to think that every ‘click’ has an energetic footprint and a break in the circuit saves a piece of the earth?

The resulting installation I constructed for MAA-Tila Gallery in Helsinki took the form of a panel of DIY customized ‘coal’ meters and indicator light switches linked to a distributed network of online participants. As the artist, I performed the role of 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 comprised an anonymous group of twenty online participants connected to twenty meters on 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 upper threshold of maximum data transfers. Three megabytes of data transfer was considered being 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 [22]. A steady green light button on any individual meter showed ongoing data transfers of a community participant, and upon reaching the upper limit of connectivity, a red light represented the ceasing of the connection. Once the limit of thirty grams of coal consumption was reached, the participant would be kicked off the system. Switching on the green light button restored the network connectivity. 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. In my role as the technician-artist, I gathered feedbacks from both online participants and exhibition audience during the installation. From the daily network logs and comments, we found participants were affected by the quantity of their daily online data transfers and attempted to limit their browsing activities to reduce energy consumption. Visitors to the exhibition could also witness the operations of the installation and engage in informal discussions. The installation demonstrated that network connectivity has energetic costs, and people are willing to discuss and consider adjustments to their constantly connected digital lives.

Conclusion

In my quest to uncover and exhibit digital media's entanglements with energy resources and data, I became aware of its increasing involvement in the modulation of human and community behavior, and ultimately the environment. From my experiments it appears that the concerns of ecology and behavior are intertwined in media in a continuous feedback loop. Media normalize behavior, so they become relatively unnoticed, invisible and internalized like the energy that powers it, like the environment that sustains it. But the potential for disruption of such normalization exists, which can occur during instances of a power failure or dis-connectivity, when one becomes aware of the earth.

Examining the entanglements of media demand an attention to energy use, human behavior and in turn a focus on the resources of the earth. Provocations and speculations from an energy art practice offer approaches to reveal 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, these 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 elicit responses by participation and engagement, perhaps even through dis-connectivity and

breakdown. In this endeavor, we must reconcile 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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