

Synesthetic Machines

Emerging forms in sound modulated light

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1. INTRODUCTION

Synesthetic Machines is an art research project in an expanding field that examines sound and visual elements to create a cohesive sensory experience. This form of artistic expression is deeply rooted in the reutilization of obsolete media and the development of hybrid instruments, which combine analog and digital technologies. The purpose of this essay is to explore the concept of synesthetic machines and their role in the creation of audiovisual art. The content delves into the implications of planned obsolescence and the resurgence of obsolete media. It explores how tools, once integral to scientific research, have found a new life in real-time audiovisual performances. Additionally, it assesses how these practices contribute to environmental sustainability. By examining media archaeology, we uncover how past technologies can inform contemporary discourse and inspire us to rethink aesthetics. This essay also investigates how artists repurpose older forms of media for creative expression, thereby challenging capitalist notions surrounding technological progress. Finally, I discuss the potential for synesthetic experiences within audiovisual art through hybrid instruments that facilitate real-time performances, creating a dynamic interplay between sight and hearing. In light of the present state of research, I need to ask: How can one use obsolete media to create a hybrid instrument for durational work in a cross-sensory system that situates complex synesthetic forms?

2. OBSOLETE MATTER

The term 'obsolete media' often surfaces in discussions pertaining to the utilization of outdated analog technologies for use in contemporary art contexts. It provides a critical lens through which we can scrutinize the pervasive ideology of planned obsolescence that is intrinsically incorporated into every machine manufactured in our current era. Garnet Hertz and Jussi Parikka discuss the life cycle of technological products and argue that this cycle provides opportunities for artists to reuse these abandoned machines in their work. (Hertz and Parikka 2012)

The concept of built-in obsolescence is the practice of designing products with a predetermined lifespan deeply embedded in our consumer culture. Sean Cubitt in his article Decolonizing Ecomedia eloquently points out that, "this is not only the waste produced by the built-in obsolescence required to generate new debt for new sales of new equipment but the endemic structural waste produced by typical structures of capital" (Cubitt 2014: 280). This describes a cycle where products are designed with a predetermined lifespan to ensure continuous consumption. This concept has profound implications for our economy and environment, prompting a growing need for sustainable alternatives and policies that discourage such wasteful practices. Integration of obsolete electronics as an artistic methodology goes beyond examining historical aspects and extends to the exploration of discarded electronic waste to

address technological obsolescence while also investigating its environmental consequences. What does it mean to engage with technology that is already imbued with the scheme of premeditated obsolescence?

Utilizing older forms of media enables the exploration of how past technologies can be used to examine their socio-historical context. Media theorist Jussi Parikka in his book "What is media archeology?" talks about the potential of media archeology in the 21st century as "arts and humanities discipline that investigates non-human temporalities and does not succumb to individualizing stories of heroes, but wants to address those material and cultural contexts and forces that are beyond our control" (Parikka 2013: 167). This resonates with my thinking process, which wonders of ways with which to engage material remains, both old and new, to unravel the intricate connections between technology, power structures, and cultural practices. Obsolete technology is not just about making use of what is available; it is a deliberate choice that carries symbolic meaning and artistic value. Parikka accents significance of Wolfgang Ernst's view on reverse engineering as a method for understanding the intricacies of media with the approach of "amateur engineer who opens, checks physically, tests, and experiments to learn how media function" with "provisional way to write the missing manual" (Jones 2018: 3) to support "artistic goals set out for the design of a media-archaeological performance system" (Holzer 2019: 6). I approach my own practice as an ever-evolving process in which I deconstruct, scrutinize, and experiment with outdated technologies within performance systems.

Trading in obsolete and second-hand goods was a mode of survival for me and my family in post-war Bosnia. As we sifted through discarded TVs, oscilloscopes, game consoles and video mixers, I wasn't just seeing defunct electronics. I was seeing canvases and tools with which to create something new. This trade became my first artistic practice that came out of the need for basic financial stability, inadvertently pushing me into the world of video art. The motivation behind utilizing obsolete media does not stem from a sense of nostalgia, but rather aims to reconsider aesthetics by examining the capabilities of obsolete media and computing advancements to address the significance of the past and the potential for now. In his book "Deep Time of the Media", Zielinski explored similar ideas that resonate: "we shall encounter past situations where things and situations were still in a state of flux, where the options for development in various directions were still wide open, where the future was conceivable as holding multifarious possibilities of technical and cultural solutions for constructing media worlds." (2006: 10) This statement emphasizes that history should not be seen as a stagnant reservoir of information, but rather as a dynamic wellspring that can continuously inspire and inform contemporary discourse.

By delving into the past with an open mind and a desire for new revelations, we can uncover valuable insights that contribute to our current understanding. This approach aligns with Deleuze and Guattari's notion of the rhizome which rejects hierarchical and linear modes of thought in favor of a network-like structure where knowledge spreads and connects in multiple directions. "There is neither imitation nor resemblance, only an exploding of two heterogeneous series on the line composed by a common rhizome that can no longer be attributed to or subjugated by anything signifying" (1980: 10). In the following discourse, I will discuss hybrid systems that are both open and adaptable. These systems can offer countless options and results, all decided by the users themselves. Instead of setting a fixed path, the goal is to give users tools to create their own paths based on their personal experiences. The ever rhizomatic nature of these systems allows for an intricate tapestry of interconnected patterns.

Originally crafted for a specific purpose, obsolete technologies have proven to possess latent qualities when repurposed as a conduit for creative expression. During the 1960s Desmond Paul Henry converted modified bombsight analogue computers (a technology primarily used in World War II bombers to calculate the precise release of bombs onto their targets) into drawing machines to produce abstract, curvilinear artworks. This approach, intended for significantly different tasks, allows these devices to be liberated from their former functions. Robert Henke's body of work consistently employs old technology, repurposing it in innovative ways to create audio-visual installations and performances. An essential example is CBM 8032 AV project, where 1980's Commodore computers are being utilized to generate synthesized sounds and complex visual composition on its monochrome monitors as an "exploration of the beauty of simple graphics and sound" (Henke 2023).

In similar manner, early analog video was a central aspect of the live video performances with collective "Fa11out" and continued to implement obsolete technologies, co-establishing "Phase Space", an interdisciplinary studio and do-it-yourself (DIY) space that used discarded broadcast equipment with software-based processes for real-time performance implementations. Garnet Hertz points importance of DIY mindset: "every discipline used to be a DIY practice, and if we want new disciplines, we need to keep pushing ahead with DIY trajectories" continuing "DIY approaches are useful in disrupting things—whether with technology, with organizations, or through larger culture." (2023: 264-265). Working in an open collective setting helped me to understand the importance of collective DIY practice plays within sociocultural contexts. Reflecting on how best to do this project while also contributing back to the art and technology communities that have been instrumental in supporting my work led me to further objectives - sharing knowledge through contributions. This approach aligns with the philosophy of art communities such as Phase Space, Vancouver Hackspace and ongoing Precursor Lab.

This perspective encourages me to embrace the notion of DIY electronics outside of conventional electronic art framework. By harnessing the power of surplus resources and bending them to our creative will, we unlock new realms of possibility while simultaneously challenging capitalist notions surrounding technological progress. It is essential to consider the conceptual and aesthetic roles that obsolete media play. It is crucial to consider how electronics are physically embodied within an artwork. Revealing the circuit-bent internal guts of an instrument in a gallery setting goes beyond mere documentation; it evolves into an (art)work on its own. Similarly, a photograph documenting the process of circuit bending a machine represents a (art)work in progress rather than just evidence of progress. These instances underscore the importance of physicality in electronic art and highlight how objects carry their own expressive potentialities, further enriching our understanding of this medium.

Moh Zaarei writings in sonic art on importance of "audiovisual materialism" expands the traditional notion of how we perceive art: "Whether it is electromechanical machinery and robotic contraptions, industrial, scientific, and lab equipment, everyday objects, or organic matter, removing these physical materials from such works would alter their fundamental essence" and "the fact that the visual properties contribute towards the dramaturgy of these artworks as meaningfully as the sonic properties" (2020: 363). Electronic instruments are not just physical materials entities being manipulated by performers; they carry their own inherent characteristics and potentialities which can influence a performance in unexpected ways. Derek Holzer writes on the importance of didactic and embodiment in his work: "I encourage the reader to consider the performance of this reenactment as an iteration through an entire historical process" instead of "focusing only on the material outputs of this action" (2022: 6). The performer's embodiment within these material constructs is furthermore crucial because it defines their role in relation to the constructed instrument. The physicality associated with handling or manipulating these materials forms an integral part of a performer's identity within an artistic work.

3. MEDIA SYNESTHETICS

Synesthetic correlation refers to the relationship between the auditory and visual elements where sound and visuals are driven from one signal to create a cohesive audiovisual experience: "in a territory in which signal is simultaneously heard and seen; every sound is a form in motion, every form a sound. The connection cross-wired consists of sound to light, manifesting the sensory crossover of modalities." (Whitelaw 2008: 261) By connecting audio signals to the horizontal and vertical inputs of the analog oscilloscope, we can create complex forms that are synchronized with the music being played. The identical signal that we connect to an analog oscilloscope is connected to the left and right speakers. Using sound synthesis we can generate complex Lissajous images. The Lissajous figure, a pattern formed by the intersection of two perpendicular sinusoidal curves, was investigated by Jules-Antoine

Lissajous in 1857. Lissajous utilized a narrow stream of sand flowing from a compound pendulum's base to generate these curves.

The Lissajous figures were used in oscilloscopes to create visual representations of sound waves. Since the 1950s, filmmakers such as Mary Ellen Bute, Norman McLaren, and Hy Hirsh began repurposing these laboratory devices for imagery in their works (Holzer 2019: 22). In the late 1930's Mary Ellen Bute pioneered the concept of "seeing sound" through her experimental films, where she used an oscilloscope - a tool that employs a cathode ray tube to illustrate electronic signals - to convert audio signals into visual patterns, creating a synesthetic experience. Using sound modulation we can turn figures into complex visual forms. And vice versa, by converting the image we can generate intricate sounds. Together these audiovisual forms are used to compose durational work in performance and installations.

Emerging forms in real-time performance allow seamless fusion of visual and auditory elements, creating a synesthetic experience that affects perception. Using high computing power and programming, these merging forms can be manipulated in real-time, allowing for a more responsive and adaptive performance environment. This contributes to the narrative or emotional impact of the performance. The concept of "perceptual organization" was initially recognized as a significant issue by the Gestalt school in the 1920s with focus on the perception of emerging forms as a whole: "the perception of the whole was radically different from the perception of its components" (Rock & Palmer 1990). This perspective emphasizes the interpretation of emergent forms as complete entities through unfiltered perception of cross-sensory experiences. This state is experienced when one is involved in the process of deciphering or interpreting language. The language materializes as observed.

Synaesthesia, as described by Youngblood in "Expanded Cinema", is a vital tool in the realm of cinematic expression. Youngblood introduces kinaesthesia, the experience of sensory perception: "It's not "what we're seeing so much as the process and effect of seeing: that is, the phenomenon of experience itself, which exists only in the viewer" (Youngblood 1970: 97). It is not a simple sum of its parts but rather a unique entity that transcends the individual perception. The potential of synesthesia in artistic expression is to highlight "the artistic experience in the perceptual systems of the listener/viewer themselves." (Holzer 2019: 27). Artist expression lies not only in creating multi-layered artworks but also in prompting viewers to question and explore their own perceptual systems further. It emphasizes that perception is a highly individualized process and encourages us to delve into our understanding of sensory experiences.

Oscilloscope and laser displays use beams to draw light on the same principle. While an oscilloscope performs within a confined space, lasers operate in an open area. Ronald Pellegrino was one of the early adopters of laser technology, which allowed for the integration of audio and visual elements in live performances. In 1983 he wrote on significance of audiovisual elements in the fields of psychoacoustics and psychooptics: "the connections between frequency and pitch, amplitude and loudness, waveshape envelope and timbre, and the myriad levels of interaction among those basic variables" to "examines the intrinsic nature of the dimensions of physical stimuli for sound and light and how these dimensions are physically received, psychologically focused, and mentally organized". (Pellegrino 1983: 120) It emphasizes the need to explore and comprehend the synesthetic nature of sound and light stimuli dimensions for understanding cross-sensory perception

Following a brief break in 1980, audiovisual laser performances reemerged in the 2000s, largely thanks to the efforts of artists Robin Fox and Edwin van der Heide. In "Mechanical Synesthesia", Fox uses advanced laser projectors to generate complex geometric patterns that evolve with the music. This visual aspect of the performance is not merely a representation of the sound, but rather an integral part of it. The lasers are voltage controlled in real-time by the sonic frequencies, creating an intricate interplay between sight and hearing.

Jerobeam Fenderson's work in this field has been defining, pushing boundaries using computing software programming. His album "Oscilloscope Music" released in 2016 is considered one of the most influential works in this field. Composed entirely for oscilloscopes, it offers a synesthetic sensory experience where each music composition simultaneously generates its own unique set of visuals. One such significant contribution comes from the Vector Hack Festival - an event devoted to audiovisual art with an emphasis on vector graphics. The festival was organized by Derek Holzer and Ivan Marusic Klif with the aim of uniting artists, academics, and tech enthusiasts from across the globe. Numerous artists who participate in Vector Hack utilize open-source software for their work which they share publicly. This aligns perfectly with the values that I hold, emphasizes collaboration, transparency, and decentralization.

4. HYBRID INSTRUMENTS

Given the current state of accessibility and open-source resources, we are in a position to learn how to create our own systems within every sphere of life. Open communities are empowering individuals to craft their own systems rather than relying on mass-produced items. The knowledge we gain from understanding existing mechanisms is enabling us to design our own systems. Holzers's intention resonates with me to: "create a live, audiovisual performance which explored a direct, non-symbolic, and synesthetic relationship between sound and image through the use of 'obsolete' media technology"

(Holzer 2019: 20) This approach supports the design of own system based on obsolete to compose durational works. Recent thrift of Mr. Christmas discarded decorative toy allowed me to understand the fundamental principles underpinning the functioning of laser technology and motivated me to design my own hybrid instrument.

Designing personalized instruments is not just crucial for artistic uniqueness; it's essential for advancing human creativity itself: "the highest creative power in the human-machine art collaboration does not come from 'turning the right knobs' of an interactive composition engineered by someone else"... "but from designing a system to reach the kind of results you envision for yourself". (Holzer 2019: 48) This approach empowers artists with autonomy over their creative process. It stimulates innovative thinking by challenging artists to design systems that align with their creative vision, rather than adapting their ideas to fit within the constraints of pre-existing systems. This holds particular significance in my role as an audiovisual artist, where I need to communicate through both auditory and visual means. The challenge lies in mastering the integration of these two mediums.

When Holzer talks about an open and didactic system, he is asking viewers to consider the "act of composition as the construction of a system to produce results" rather than an "itemized list of what those results should be". (Holzer 2019: 46). We need to encourage the process of creation as a system in which different elements interact and evolve, leading to various possible outcomes. In this process, creation does not merely need to be a finished product. Instead, there are values in the exploration, discovery, and unpredictability involved in the creative process. Using a hybrid instrument, we have the opportunity to draw freely with light, much like wielding a paintbrush. Controlling the electrical voltage through sound opens up an infinite variety of shapes that can be altered, combined, and moved in specific time rhythms. This has expanded the scope of forms and led me to reflect on the potential of hybrid control systems.

Synesthetic Machines are hybrid instruments that can facilitate synesthetic experiences using one signal. These hybrid instruments are a blend of technologies from different eras, combining obsolete analog with modern digital systems. Analog machines represent sound modulations, while computers are used to inject digital signal control. The dynamism and luminosity are presented by analog light beams, whereas the accuracy and reproducibility are offered by digital numerical control. Hybrid instruments represent a new approach to composition, one that is system-based rather than focused on producing a single predefined result. They allow artists to create dynamic systems while performing. The use of dynamic systems in real-time compositing for the emergence of complex forms. With these instruments, users can access complex forms while also allowing for random accidents and

imperfections to occur. This immediacy with hybrid instruments provides an opportunity to develop a repertoire of audiovisual forms and establish a language for creating durational work.

5. DISCUSSION

My family's subsistence largely depended on the flea market, where we engaged in trading discarded hardware in post-war Bosnia. This forced circumstance allowed me to repurpose technology, using it in my first performance challenging the capitalist notion of planned obsolescence. This served as a catalyst for my entry into the world of video art.

A recent thrift of discarded and defunct decorative laser toys allowed me to understand the fundamental principles of laser technology, and motivated me to design my own hybrid instrument. Needless to say, as this excavation was the main reason for writing this essay, the synesthetic experience of sound-modulated light was the reason to pursue my studies. Using sound modulated light, I noticed immediacy and fluidity in this emerging form that I could never access by using digital video software.

As laser technology is privileged and expensive, it was serendipitous to find a toy laser at Value Village. The process of this excavation is shared online on the Vancouver Hackspace forum available to anyone interested in achieving the same. I see this 'unwritten manual' as a return to the community aligning with DIY and open-source principles. The manual serves as a foundation for future development in creating synesthetic work implementing laser technology. It's important to note that ILDA protocol for controlling lasers is privileged to companies who are selling these technologies. Using this manual, one can hijack that protocol and use a cheap laser to access privileged technology at no cost, or maybe around \$15, depending on the bargain.

Apart from creating synesthetic durational works, I see potential in using lasers for installations. In my practice, I see this as an expansion on previous work; re-enactment of releasing light out from a cathode-ray tube box, exploring architectural space. This research re-evaluates understanding of synesthetic audiovisual forms within the context of custom hybrid instruments used in real-time performances.

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