

Cracking Ray Tubes: Reanimating Analog Video in a Digital Context

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In the age of the digital copy and ultra portable, well-designed technological devices capable of capturing, receiving, generating and disseminating high-quality audio and video content at the click of a button, the cathode ray tube (CRT) exists as an obsolete, inefficient and utterly archaic piece of hardware. Having been out of production as consumer devices in the American market for years, and no longer accepted as donations at most thrift stores, the CRT monitor exists as a symbol of our rapid consumption/disposal-based society, an icon of technological obsolescence that can be found abandoned in warehouses, basements, alleyways, landfills and—occasionally—recycling centers.

Liberated from the bulky hardware of the CRT, the screen has come to permeate our daily lives in the form of smartphones, tablets, laptops, liquid crystal display (LCD) monitors, flat screen televisions—the list could go on—that offer clean and efficient platforms for consumption and production, labor and leisure, access to networked information and communication platforms for both uploading and downloading. Whether we are watching a television show, editing a video, navigating a road trip or posting a photo, our lives are mediated by networked screen culture. As efficiently and beautifully designed objects, these screens exist as hard/software systems within interfaces embedded with latent commercial and political structures enforcing functionality, immediacy, automation and cleanliness. With emphasis on the perpetually new, the tech industry has fabricated a sociocultural dependency on obtaining the most recent technological “innovation.” Although these devices suggest or even promise the availability for new creative potential—e.g. smartphone applications for consumer audio and video creation—every new generation often introduces reformatted or even increased restrictions through imposed interface functionality and, as Garnet Hertz and Jussi Parikka describe, “black-boxing” [1] of internal circuitry/source code by preventing user serviceability or alteration, ensuring that users are unable to fully comprehend a device’s functionality.

Within these devices of seemingly flawless functionality, errors, blips, distortions and glitches—moments in which the seemingly invisible interface fractures to reveal a latent code or pixel-based materiality—become particularly powerful. When a user witnesses a glitch within seemingly flawless user

interfaces, he is transferred from a state of passive consumption to one of active revelation and potential participation as the technology exposes its inner workings in material form. Glitch artists, through appropriation and activation of these errors and the purposeful misuse of devices, exploit inherent miscalculations of technology and expose not only the unexpected aesthetic materiality of digital malfunction, but also the social and political implications of modern digital technology.

In the context of supposed digital immateriality and the proliferation of screen-based consumption, the materiality of obsolete analog devices acquires a renewed power and potency, comparable to the digital glitch, that is capable of being aesthetically reappropriated to challenge technological, aesthetic, social and economic assumptions of the present. As new media and sound artists, we investigate the cathode ray tube not as a dead object of the past, but rather as a culturally valuable, emblematic product of our current material culture of obsolescence: a device that is capable of being revived and hybridized with advanced digital tools to generate genuinely new aesthetic experiences of latent musicality (Fig. 1), while simultaneously revealing repressed realities and rich potentials within contemporary technology that are often lost in the fetishization of the “new” within media studies and production.

ABSTRACT

This paper investigates the aesthetic potentials of analog and digital hybridized systems to generate genuinely new sonic and visual experiences. The authors discuss their use of the cathode ray tube as a technological and cultural platform for real-time performance in the context of digital screen culture and the digital glitch.

Fig. 1. Cracked Ray Tube performance, 2011. (Photo © Andy Rivera)



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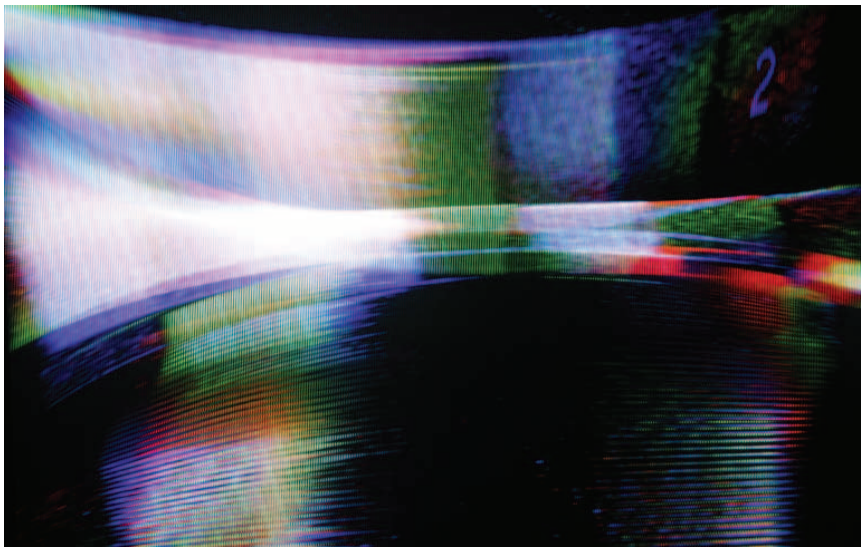


Fig. 2. *TV 06*, still photograph from CRT television displaying wobbled broadcast video, 2014. (Photo © James Connolly)

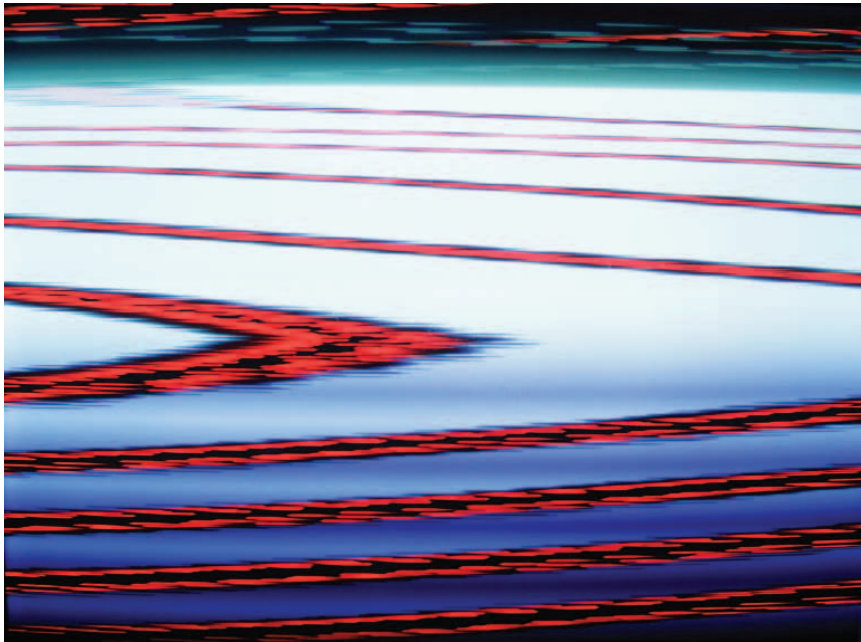


Fig. 3. *VGA 09*, still photographs of a modified CRT VGA computer monitor displaying sound bent into video, 2014. (Photo © James Connolly)

ANALOG VS. DIGITAL | SIGNAL VS. SAMPLE

The tube-based television and the analog signal it received were integral to the collective experience of historical events and popular culture from the 1930s until the first decade of the twenty-first century, when the CRT was surpassed in prominence by the LCD screen, and analog transmission was replaced by digital. Years into the flat screen's reign, the CRT has been stripped of its commodity value and is now an icon of the growing toxic e-waste crisis we face after decades of planned obsolescence. Vi-

sual white noise, flickering, fuzzy imagery, high-frequency buzzing and rolling video—artifacts of the CRT's materiality that were once a major part of our visual culture and collective subconscious—have been replaced by digital counterparts: broken and bleeding pixels, “no signal” screens, error messages and system crashes.

Whereas analog audio and video devices react to interference and noise organically, digital devices are often imbedded with control structures that disable information display when the device receives a signal it interprets as undesirable to the user. While an ana-

log signal is an organic flow of voltage and information, a digital system is a binary environment dictated by software often designed to make the medium as invisible as possible, ensuring a more flawless information consumption/production experience for the user. Many modern smartphones and tablets are marketed as versatile and creative tools, but their functionality is restricted to the possibilities arbitrated by the manufacturer's interface design. Modern screen devices have continued to increase in efficiency as less and less input is required by the user, resulting in the stifling of creative use. Digital progression has given rise to new tools for greater aesthetic possibilities, while simultaneously creating a culture of restrictive interfaces and preset “creativity,” provoking passive consumption and uncritical production.

Digital glitch artists confront these illusions of interface invisibility by provoking errors, revealing that our screen technologies are not the sterilized media devices they claim to be. As Kim Cascone describes, failure has the potential to remind us “that our control of technology is an illusion,” revealing “digital tools to be only as perfect, precise, and efficient as the humans who built them” [2]. Rosa Menkman defines the glitch as “an uncanny or overwhelming experience of unforeseen incomprehension” [3], an unexpected interruption to the natural flow of media, experienced through de/compression artifacts or system feedback [4], exposing a user to underlying digital, commercial and technological structures.

Menkman's concept of the glitch moment(um) is key to the critical potential of the glitch. She describes it as a twofold occurrence: “First of all, there is the moment, which is experienced as the uncanny, threatening loss of control, throwing the spectator into the void (of meaning). This moment then itself becomes a catalyst, with a certain momentum” and has the potential to “force new knowledge about the glitch technè and actual presumed media flows, onto the viewer” [5]. The glitch exposes digital infrastructure, thus interrupting passive human-computer interaction and enabling potential critical comprehension, engagement and artistic creation.

Since the proliferation of digital screens and the digital glitch, analog materiality takes on a new potency and meaning that contains revelatory elements of the glitch moment(um). The saturation of the efficient digital screen in daily life has programmed our ex-

expectations of what to produce and consume from technological devices. When hybridized with analog output devices, digital tools can generate unexpected aesthetic experiences that exploit our residual memories of the analog era while also confronting and revealing flaws within the assumptions of our digital tools and creative productions.

CRITICAL APPROACHES AND PRACTICES

As media artists and musicians, our creative method exists in proximity to what Garnet Hertz and Jussi Parikka describe in their essay “Zombie Media: Circuit Bending Media Archaeology into an Art Method” [6]. We incorporate techniques of media archaeology into our process through the use of CRT televisions and computer monitors, while going beyond a historical-oriented, archaeological focus to instead employ methods of digitally augmented instrumentation. Using the CRT as a platform for visual sonification and audio/video synthesis, our artistic practice takes advantage of the malleability of analog video (as explored by early video artists such as Dan Sandin with the Sandin Image Processor), while incorporating the precision of digital technologies.

Unlike contemporary computers whose functionality is obscured within the black boxes of solid-state hardware and proprietary software, CRTs can—albeit at the risk of electric shock—be opened, modified, hacked, cracked, bent and liberated from their television or computer monitor interfaces that dic-

tate consumer interaction. Whereas the digital sample has an apparent immateriality, an analog signal carries with it a literal interpretation of physical material within an electrical circuit. In addition to this, while digital environments require the apprehension of intricate coding languages within which to work, analog signals (such as those moving through-out the CRT) can be intuitively reconfigured and repurposed into real-time performance. The analog world functions as a pseudo-organic variability, an “in vivo” fluctuation that exists anywhere on an infinite plane between two voltage potentials. The malleability of analog materiality, rooted in its variable design, has a certain appeal to artists like ourselves who view this as a potential for fluid control of medium artifacts.

Our performance and installation systems consist of extensively hybridized analog and digital tools built to generate immersive synaesthetic experiences within open-ended interfaces. Sine waves (modeled after Nam June Paik’s Raster Manipulation Unit) synthesized through digital software activate hand-wound electromagnets attached to the electron guns of multiple CRTs, bending and “wobbling” the displayed imagery [7] (Fig. 2). The red, green, and blue pins of a video graphics array (VGA) cable are altered to receive audio signals ranging from the chaotic, semi-uncontrollable internal feedback of a sound mixer to digitally synthesized high-frequency waveforms generating vivid moments of video stillness (Fig. 3). Video transmission, enabled by the recently voided analog video spectrum,

is manipulated through handmade circuitry to exploit the artifacts of transmitted video and synthesize new imagery through broadcast distortion and video feedback loops. We utilize coded audio- and video-programming environments for more complex control and the precise generation of waveforms. Any electrical signal within the system has the ability to be interpreted as any type of output; audio signals are represented visually, video signals are amplified and sent to speakers.

We work to bypass interface restrictions in order to instigate chaotic audio and video outputs in CRTs through counter-intuitive reconfigurations of device communication networks. We bring digital processing into real time through analog hybridization using “malfunction” as a methodology and performative platform. The unexpected and uncontrollable signal becomes our instrument, generated not through scores and preset algorithms, but rather through the active exploration and in-the-moment curation of pre-discovered chaotic instances within our constructed systems. In our performances we work to attain elements of improvised music that, as Christoph Cox and Daniel Warner describe, insists “on the importance of the transitory moment” and creates a “genuinely democratic” utopian space, a “realm full of cooperation, coexistence and intersubjective exchange” [8]. In our case, these elements exist not only between performers, but also between the complex interconnections of digital and analog systems. Myriad electrical signals erupt from VGA and CRT television monitors, displaying themselves in a full spectrum of color, light and sound; all elements contain the material qualities of analog, but are reactivated in an unexpected way. The result allows a viewer to reconsider the possibilities of these obsolete analog devices and realize the potential contained within them when remediated through digital hybridization (Fig. 4).

In the familiar context of digital screen cultural consumption, our performative use of analog materiality is received in a way that is comparable to the moment(um) of the digital glitch. Our analog explorations, in fleeting and perpetually shifting moments of electronic visual noise, interrupt the passivity of the ritual of sitting before a screen, revealing the seemingly alchemic nature of analog materiality in the digital era. We push this momentum further by publishing all technical content about our system in the form of DIY tutorials and electronic

Fig. 4. Cracked Ray Tube performance at GLL.TC/H 2012. (Photo © Daniel Rourke, <machinemachine.net>)





Fig. 5. Video transmission workshop, 2012. (Photo © Kyle Evans)

workshops, allowing others to explore these aesthetics and take them further (Fig. 5).

CONCLUSION

Analog devices still hold artistic value in our binary world. Reactivating them through digital technology can create a combination of strangely familiar, yet genuinely new, results. The malleability of analog systems in combination with the possibilities of digital precision allows us not only to witness these new aesthetic possibilities, but also to consider and question the increasingly restrictive nature of modern digital interfaces.

Technology should not be approached as a system to work within, but rather as a starting point to creatively remix, restructure, rebuild and rethink: a point of departure for artistic creation. As opposed to viewing technology as a singular progression and blindly working within the structures of the perpetually new, we are interested in approaching our technological reality as a heterogeneous

amalgamation of material potentials. We do not abandon the CRT as a device of the past; we use it as a symbol of the capitalistic myth of value and technological progression, capable of being reappropriated for critical aesthetic and alternative creation. In short, a quote from the 1970 introduction to the periodical *Radical Software* regarding the social and political implications of our use of technological tools still holds true today, and can be applied to critical and artistic approaches to media practices:

Unless we design and implement alternate information structures which transcend and reconfigure the existing ones, other alternate systems and life styles will be no more than products of the existing process [9].

References and Notes

1. Garnet Hertz and Jussi Parikka, "Zombie Media: Circuit Bending Media Archaeology into an Art Method," *Leonardo* 45, No. 5 (2012) p. 428.
2. Kim Cascone, "The Aesthetics of Failure: 'Post-Digital' Tendencies in Contemporary Computer Music," *Computer Music Journal* 25, No. 4 (2000) p. 13.

3. Rosa Menkman, *The Glitch Moment(um)* (Amsterdam: Institute of Network Cultures, 2011) p. 30.

4. Menkman [3] p. 31.

5. Menkman [3] p. 31.

6. Hertz and Parikka [1].

7. Nam June Paik's Raster Manipulation Unit, or "Wobulator," electromagnetically distorted video images by modifying a CRT with an additional deflection coil.

8. Christoph Cox and Daniel Warner, eds., *Improvised Musics. Audio Culture: Readings in Modern Music* (New York, NY: Continuum, 2008) pp. 251–252.

9. "The Alternate Television Movement," *Radical Software* 1, No. 1 (1970): <www.radicalsoftware.org/volume1nr1/pdf/VOLUME1NR1_0002.pdf>. Accessed 2 January 2014.

Glossary

black-boxing—the intentional concealing of the internal functionality of electronic devices by the manufacturer.

glitch moment(um)—the initial potential that an unexpected or disrupting media experience has to transform a user's understanding of a technology.

technè—craft or skill, a system of making or doing something.

wobulating—the use of electromagnetic signal to redirect the electron beams inside a CRT, resulting in a bent image.

Manuscript received 2 January 2014.

James Connolly is a video, sound and new media artist, instrument builder, curator and educator. His videos and real-time performances undermine the interfaces and break through the computational instincts of digital and analog consumer devices, liberating their latent audio and visual materialities.

Kyle Evans is a computer musician, electronic instrument creator, real-time video performer and educator. His work ranges from music technology development to multimedia installation and explores relationships between modern and obsolete technologies through breaking and repurposing.