

please clarify statement

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I am just old enough to have experience with renting VHS tapes.

The rental VHS tapes had glitches in places where people often pause or fast-forward. For example, snowy visual glitches, or clipping audio. This glitching says something about how people watch a film and how this film has been in a number of homes. I also clearly remember the rule of having to rewind the video tape before giving it back to the VHS rental, in order to prevent future viewers of the tape of any spoiler alerts.

Glitching and failing VHS tapes are an example of something being undesirable at first, but then turning into a new desired aesthetic. At first, it's an accident, or a sign of something not working properly, due to misuse of the tape. Afterwards it can serve as an aesthetic tool. An example of this, is how film makers now make use of artificial film glitch in order to give narrative to a film.

In *Analog Nostalgia and the Aesthetics of Digital Remediation*, Dominik Schrey points out a note from Thomas Levin:

In the age of digital recording and playback, the sound of error has changed significantly [. . .]: The moment of the scratch is no longer the signal of malfunction but is instead the almost nostalgic trace of a bygone era of mechanical reproducibility, one can say that it has become auratic, and as such it suddenly becomes available for aesthetic practices of all sorts. (Schrey)

Growing up in a suburban town in the middle of the Netherlands - there was a lot of desire towards commodities that were only able to get in the big city. These desires mostly manifested through getting into skateboarding, which got me into filming. I wanted to use Mini-DV or Hi8 cameras because the old camera equipment would glitch and have unexpected colours on the footage. The footage would look like we were skating in the 90's and while watching our footage, it would bring up nostalgic feelings from skate video's we looked up to like *A Love Supreme* (1995) by Thomas Campbell.

The glitch is a short-lived interference or fault in a system. It is, in the era of perfect images, a touch of human character on our screen or through our speakers. The glitches remind us of our imperfect machines. They preserve our memory of playing cassette tapes until they would break, or DVD's displaying the scratches on their discs to us with square image snow, blending frames and unveiling the way they work.

With this thesis I want to present the phenomenon of the glitch in different categories in order to better understand my aesthetic interest. I think that glitching can have a number of different functions and roles. It crosses media, era's and - can happen deliberately or on accident.

Nostalgia

The London-based skateboard brand *Palace* gained a lot of attention with their use of VHS cameras for their skate video's. Which was highly uncommon in 2007. In an interview with *Dazed*, the owner Lev Tanju says:

DD: What led to you using VHS?

Tanju: I always used to buy VHS skate videos. When I started to film it was with industry-standard DV cameras, they kept glitching so I decided to dust off an old VHS camera I had bought off eBay a few years earlier and have a go with that. Instantly I just loved the way it looked. (Sotirchos)

Tanju says that he stopped using the industry standard DV camera's because they kept glitching. However, the VHS footage Tanju uses in his skate video's for Palace have a lot of glitching as well. Because DV and VHS are completely different types of camera's, the glitching looks different. I'd like to suggest that Tanju didn't start using the VHS camera because it would glitch less than the DV camera, but because the glitching looked nicer to him. It was an aesthetic choice and not a practical one.



Still taken from 'PALACE REEBOK LOOP' (2013).

The two horizontal streak glitches are common when using older VHS tapes or cameras. This glitching can either come from dirty tape heads on the camera, or from re-using old tapes. In an interview with *Free Magazine*, Tanju explains how he gets this unexpected glitching to happen:

WH: I noticed that some of the colours look different with some of them.

Tanju: Yeah that's because it's filmed on different cameras but also because when I capture it, I'll capture it on a certain tape. Like I've got this shit 'Henry the VIII' film and everything I film on top of that goes this weird green colour. So everything I want to make look a certain way I have to film over certain bits of the footage – same thing with like titles and graphics. Every time there's a glitch or something, none of those things are fake or made. (Derrien)

The choices Tanju seems to make for his video's seem heavily influenced by his nostalgia towards 90's skate videos that were filmed and produced on old equipment. In 2007, a time where HD camcorders became commercially available, a choice like this seems to be a search towards creating a more 'authentic' image.

The term *analog nostalgia* was originally coined to address aesthetic practices exactly like these. It appears for the first time in a chapter of Laure Marks' book *Touch. Sensuous Theory and Multi-sensory Media* (2002); For Marks, analogue nostalgia expresses a 'desire for indexicality' and 'a retrospective fondness for the "problems" of decay and generational loss that analog video posed'. In her perspective, the phenomenon is not about the refusal of digital technologies, but more about the digital remediation of analogue aesthetics within the digital. Analogue nostalgia doesn't refer to the signal, but to its noise. It can be used as a strategy to enchant or enrich an image through defamiliarization. In turn, creating a more authentic image. (Marks)

The essence of this authenticity seems to lay in the signals that distract from the immediacy of vision, which create a counter intuitive authentic experience. Something being authentic or genuine, is in this case not about the pure experience of the signal, but about that which obscures it. And with the above given example of the Palace videos, the use of VHS equipment triggers nostalgia and authenticity with its viewers because of the glitchy, obscured vision. In turn, making it more 'alive'. According to John peel:

"Somebody was trying to tell me that CDs are better than vinyl because they don't have any surface noise. I said, "Listen, mate, life has surface noise" (Henshall)

Artificial Glitching

In *The long, twisted history of glitch art* (2015), Miles Klee explains:

The term *Glitch*, which may derive from Yiddish words conveying slippage, was popularized by NASA engineers and astronauts. *Into Orbit*, a 1962 account of Project Mercury, provides one of its earliest usages, courtesy of John Glenn, the first American to circumnavigate the globe outside its atmosphere. “Another term we adopted to describe some of our problems was ‘glitch,’” he explained. “Literally, a glitch is a spike or change in voltage in an electrical current,” an occurrence with extreme, unpredictable, and potentially fatal results. (Klee)

However, people’s associations with the phenomenon of glitching can differ, since there is the more ‘technical’ definition which I just gave, but also a more aesthetical glitching we know from computer art and musicians. The latter being more about using sonic or visual artifacts of glitching, or artificially creating them. This aesthetic, being defined by Rebecca Jackson as: “The glitch aesthetic exposes societal paranoia by illustrating dependence on the digital and fear of system failure.” (Jackson) was already used in 1956 by Nam June Paik with his work ‘MagneTV’.



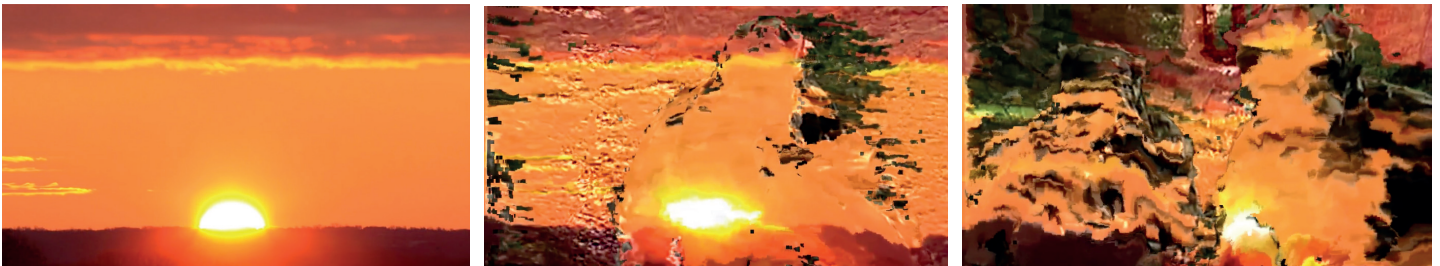
Still taken from ‘NJP magnet tv’ (2013)

The artist moves a magnet around on a television, twisting the horizontal lines that normally make an image, to go all over the screen giving options for endless image combinations. With this deliberate act of tweaking the images, he questions the significance of a machine like the television. A strong image in a time where the television set already was a center point in many households (Stephens).

Instead of glitching indicating mechanical parts of a machine literally not working, the contemporary glitching indicates data not working. Instead of magnetic VHS tape breaking down, it’s about frame drops occurring in over shared GIFs. In a way, the glitching has become more difficult to achieve, since the decay, or time of breaking down of a machine is less apparent. If an element of a digital camcorder breaks, it’s likely to completely not turn on anymore. You either throw it away or get it fixed. There is less of a grey zone between objects being completely working or broken. Corey Johnson explains this more clearly:

“That’s sort of the problem with the digital revolution for glitch artists today. With formats like HDMI, it’s all or nothing. The signal is either crystal clear, or it’s not coming through at all” (Priestman)

An example of contemporary glitching is datamoshing. Datamoshing describes the process of manipulating the data of digital video in order to change its visuals. It gets rid of full picture frames and only keeps the frames that tell the pixels where to go. What ends up happening, is that pixels of the video keep moving based on another part of the video, ‘moshing’ the visuals together. Below are screen shots from a datamosh clip made by Dave Hughes for *Adult Swim* (2011):



The previous example of the ‘MagneTV’ creates glitches because an element, a magnet, is added to a device. With datamoshing, the glitching is achieved through taking away elements from the video; the taken away full picture frames. This contemporary way of creating glitch is in its motivation similar to its pioneers; it wants to show the inner workings of an object. The artists working with them want to see the ephemeral of the spontaneous glitch and find ways to capture and present them, turning these glitches into objects. Exposing the machine that seems to do this impressive job of showing video.

However, there is an important distinction to be made here between the two different types of glitch artists. There are glitch artists; they try to paradoxically trap the untrappable, ephemeral glitch moments purely created by a machine without any control of the outcome. (like Paik's MagneTV). Then there are the glitch alike artists; mimicking ephemeral glitch experiences through processes like data bending and deliberately messing with technology (like Dave Hughes' DataMoshes) In the article *Glitchbreak*, Iman Moradi exposes critique towards the latter:

In a sense, I would suggest the production of the vast majority of glitch artwork is very much an act of rogue taxidermy, rogue taxidermists more often than not create monstrous assemblages of animals that don't have live counterparts. Similarly I'd say that glitch artists or designers are creating works that can barely be called glitches, they're not necessarily monstrous, they can be quite tasteful and aesthetically charming to a point, and we can agree they are design explorations or artistic and creative explorations of a process driven nature, but in as far as a relationship with the glitch stands, they offer a mere aesthetic imprint of a pure unadulterated glitch and very little will change that. (Moradi)

He states that the problem with glitch-alike art is that it lacks the ephemeral, mystical quality of a real glitch. It could never pass or elude anyone to think it is a true documentation of a machine not working and therefore it's merely aesthetical. I partly agree, but I think glitch-alike art serves a whole different purpose than trying to come off as real glitch. Glitch-alikes, have within them our voice against the perfect machines that we ourselves built. It shows a desire towards the human character of our obsolete machines.

Just like the rogue taxidermy Moradi himself mentions. The point of the taxidermy is not to elude anyone into thinking they have a real animal in their home, but more to serve as a reminder of living animals, the beauty of nature and so forth. The paradox being, that these animals have most likely been hunted upon by humans.

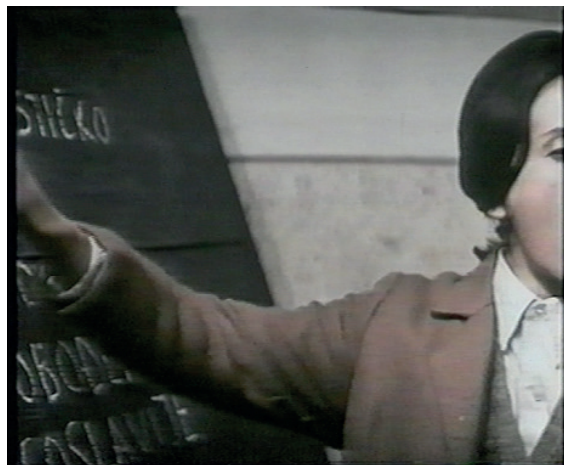
So, is there even content to glitches and glitch-alike works? In *The medium is the message*, Marshall McLuhan states that the content of any medium is always another medium:

The content of writing is speech, just as the written word is the content of print, and print is the content of the telegraph. If it is asked, "What is the content of speech?," it is necessary to say, "It is an actual process of thought, which in itself is nonverbal." (McCluhan)

In this sense we could say that the content of glitching is a desire towards imperfection, and showing human character.

Preservation

In her essay; *Politics of the archive*, Hito Steyerl mentions how the archive of a film museum in Sarajevo became heavily damaged during the war in the 90's, and forced employees to make VHS copies of archived film material in order to preserve it. She makes mention of a screening she visited, in which she noticed the screened film was a cropped version of the original she saw earlier. This crop was brought on by the employees that filmed the original screening with a VHS camera which has an aspect ratio of 4:3, so it automatically made a crop of the wide-screen original. This example of glitching may be visually less obvious than, for example, the VHS glitching touched upon earlier, but if "Glitches are headaches—technology coming apart at the seams" (Klee), I'd like to say that a film with its resolution, content and visual appearance being taken apart and changed by outside influences is a fitting example.



Still taken from *Politics of the archive* (Steyerl, 2008)

The reason is the rather dramatic lack of funds for this institution in a post-war situation of rampant privatization. Proper equipment for professional transfers is not available. The cropping of the image refers to this economical and political scarcity, to the situation of a state within so-called transition. The original state has been cropped just like the letters spelling its name on the blackboard. The original word Jugoslavije, written in chalk, has been reduced to ...slavije, the words liberation and antifascist are hardly legible. The cropping of the image thus refers to a political cropping that replaced the unfulfilled values of modernism with particularist practices. (Steyerl, 2008)

This accidental cropping of this video work due to outside influences, bring me to a phenomenon called *Technology lock-in* (Mises Wiki). *Technology lock-in*, describes a situation in which the market decides on a certain technological standard due to outside influences, even though they know they are better off with an alternative. These 'lock-ins' can cause society to be stuck with inferior

technology. The particular glitch in this work may visually be less 'noisy', it's only a crop of its original, but makes a significant change in the way we remember this work in collective memory, since it's original got lost in the war. It has to serve as the new 'locked in' inferior placeholder. Hito Steyerl also touches on this in *In Defense Of The Poor Image*:

The poor image is an illicit fifth-generation bastard of an original image. Its genealogy is dubious. Its filenames are deliberately misspelled. It often defies patrimony, national culture, or indeed copyright. It is passed on as a lure, a decoy, an index, or as a reminder of its former visual self. It mocks the promises of digital technology. Not only is it often degraded to the point of being just a hurried blur, one even doubts whether it could be called an image at all. Only digital technology could produce such a dilapidated image in the first place. (Steyerl, 2009)

The work *Various Self Playing Bowling Games* (2008) by Cory Arcangel also deals with preservation and glitching, but in a different, more in control way; Arcangel presents a selection of 6 bowling games with modified controllers which only enables them to throw gutter balls in a never ending loop. Everything the games promises in terms of rewarding the player with performing well, is denied because of this frustrating element that the controllers are hacked to only roll gutter balls.

The games are from the early 2000's and are far removed from the hyper realistic character design which we have now in video games. The characters and the bowling courses are primitive in its early-3D-polygon design and because the games are on an endless loop, they get a certain zombie characteristic over them. Part of a work like this, is the artist deciding that this particular piece of digital/disposable culture is worth preserving. Not in its perfect shape, but in a way in which we collectively remember the experience of playing these clunky games. Glitchy, mind numbing and frustrating. The difference with the previous example being that this preservation happens because of an autonomous decision.



Image taken from 'Self Playing Sony Playstation I Bowling' (Arcangel)

A sonic example of dealing with preservation and glitching is the work *Disintegration Loops* (2002) by William Basinski.

The *Disintegration Loops* is a series of four albums by American avant-garde composer William Basinski released in 2002 and 2003. The recordings consist of tape loops that gradually deteriorated each time they passed the tape head, the unexpected result of Basinski's attempt to transfer his earlier recordings to digital format. In the 1980s, Basinski recorded from found sound sources, shortwave radio, and delay systems, influenced by musicians such as Steve Reich and Brian Eno. Years later, while transferring the recordings from magnetic tape to a more reliable digital format, Basinski found that the tape had deteriorated enough that when it played, the magnetic tape would deteriorate and fall off. He allowed the loops to play for long periods as they deteriorated further, with increasing gaps and cracks in the music and holes in the actual tape. The completion of the work happened at the same time of the 9/11 attacks in New York. Basinski and his friends witnessed the attack from a Brooklyn rooftop while listening to the piece. Basinski grabbed his camera and documented post-attacked Manhattan and set the composition to the footage. The film and the music were eventually released as a box set. In a way, serving as a dirge for the victims of the 9/11 attack. (Richardson)

Swarm Circulation

The imperfect, tweaked media has no more original source to link back to. It has been taken apart since its first upload and has been degrading ever since. The frame drops in bootlegged blockbusters indicating wrong render presets from home computers. Conscious or unconscious - the 'read only' PDF stolen and OCR'd, re-written and full of mistakes, re-uploaded somewhere only for another person to find it and mistake it for the original.

The original file is lost, can't be opened, has missing links to files on long lost hard drives. The only thing left are the simulations of these originals. The way people remembered them, or decided; this is the way we should remember them. Game Cube bowling games and other obsolete media fall victim to these decisions. The source material of media is not a fixed starting point, but the last form in which it was decided to be preserved.

When I started getting into torrenting on my fathers' computer, I quickly experienced how many files were of poor quality. Some didn't even live up to their filename, I remember that a lot of music I was downloading from LimeWire wasn't the music, but instead a sound advertisement of someone imitating Bill Clinton saying: "My fellow Americans I would once again like to say that I did not have sexual relations with that woman, I did however go to a ifreeclub.com well they offer hundreds of free products"

A file of the song 'Bring me to life' by *Evanescence*, was uploaded to LimeWire as a 'bring_me_to_life.wma' and is often marked as notorious for being the most well-known disguise for this obscure advertisement. In turn, users of LimeWire started sampling and memeing the advertisement. (Frankalliance)

This sound advertisement from some sketchy download site, was found and re-applied by its users. The swarm-circulation became full circle. The audio clip of this advertisement now serves as a reminder of peer-to-peer networks, *Evanescence* and bootlegging. I think this audio advertisement, and especially it's re-appropriation, can be considered as glitching, since audio glitching is described as "The glitch-wave is characterized by the deliberate use of sonic artifacts that would usually be considered unwanted or interruptive." (Wikipedia)

I had the same experience with downloading videos. Nine out of ten times I would get bootleg CAMRIP (Das) versions of the films I downloaded. These CAMRIP films were made by people who would sneak cameras into movie theaters, film the screen, and then distribute poor copies of the screening. There would be a lot of noise, especially visually, since a lot of distortion would happen due to the difference in scanning frequency between the film on the screen and the camera. This scanning frequency distortion appears because the frame rate of the screen is usually different then the frame rate of camera's (60fps). The distortion can consist of black lines on the screen or a flickering image due to the difference in perception of the phosphor dots between a camera and the human eye.

Aside from the scanning frequency, there are other disrupting factors at play with bootlegged copies. For example, whether or not the movie is subtitled during the screening, if the camera is pointing from an angle at the screen and the poor sound quality from the camcorder microphone.



The picture above is taken from the cinema premiere of the movie 'TPB AFK The Pirate Bay Away From The Keyboard'. A blogger named Aram Bartholl decided to ironically bootleg the film and share it via torrents and on YouTube:

OMG!! Last friday I sneaked with my cam into the theater at Berlinale film festival (thx for the ticket @sinkdeep :))) and I did a CAM BOOTLEG of the world premiere!!! of TPB AFK 'The Pirate Bay Away From Keyboard' documentation. The torrent below includes the full film (PERFECT QUALITY!!) + intro by the festival and the q&a with the director of the film Simon Klose after the film. This is a super exclusive release by FFFFFAT_CR3W – ALWAYS THE LATEST AND THE BEST SHIT !!! You won't find the film anywhere else!! We were the first!! YESS!! (Bartholl)

In this case, the glitching is partly deliberate and partly on accident. There is a desire to pirate a certain movie, and to avoid copyright laws, people decide to film a screen so that it's not a 'true' copy of the movie. In doing so, the different framerates, bad audio and poor camera set-ups, as seen above, cause glitching since a cinema experience is not meant to be captured with a camcorder.

Distribution of these bootlegs, create a new alternative archive for people that can't access the 'official' resolution of a film. The difference with a normal archive being, that people can download the files to their own computer. These films can be re-watched as many times as the viewer decides. Because the viewer now also has access to its source file, it allows them to edit and change the film if they want to. When the viewers decide to become distributors and re-upload their edited file for other people to download, what ends up happening is that a number of files will be posing as the same film, and new viewers don't know which file comes closest to the original film. Resolution in this case, becomes a class division.

The circulation of poor images creates a circuit, which fulfills the original ambitions of militant and (some) essayistic and experimental cinema—to create an alternative economy of images, an imperfect cinema existing inside as well as beyond and under commercial media streams. In the age of file-sharing, even marginalized content circulates again and reconnects dispersed worldwide audiences. (Steyerl, 2009)

Concluding

With this research I tried to better understand my interests toward glitching. Maybe now, I am more confused about what is and what isn't glitching, and maybe this text isn't about trying to find definitions for it. But writing this text, and researching references, it definitely helped me understand my interests a bit better.

Glitches are reminder of our obsolete technology. The technology that is often described as more human. These glitches balance out our human imperfections to the perfect technology we're dealing with. They stand for the always present (in)significant outside noise, moving through different era's and media. These glitches, at first undesirable, are now useful for reference and narrative.

Often written off as only an aesthetical shallow filter, they are in fact a portrayal of our human reaction of trying to keep up with technology. In a world of 'perfect' images, the imperfect glitch creates new visual bonds and class relations between users of technology.

Works Cited:

- Arcangel, Cory. "Self Playing Sony Playstation I Bowling."
Cory Arcangel's Official Portfolio Website and Portal, 2019
<http://www.coryarcangel.com/things-i-made/2008-008-self-playing-sony-playstation-i-bowling>. Accessed 18 Oct. 2019
- Bartholl, Aram. "TPB AFK ILLEGAL CAM BOOTLEG at world premiere!!!"
F.A.T., 2019, <http://ffff.at/tpb-afk-illegal-cam-bootleg-at-world-premiere/>. Accessed 15 Dec. 2019
- Campbell, Thomas. "A Love Supreme"
1995, uploaded by beatdowncritical, 2012, <https://www.youtube.com/watch?v=0IFBrv1zSac>. Accessed 20 Nov. 2019
- Das, Shravan. "What is CAMRIP, DVDRIP, HDTTS, HDTV, HDTVC, Web-dl & other releases?"
Techhulk, 2019, <https://www.techhulk.com/camrip-dvdrip-hdtts-hdtv-review/>. Accessed 19 Dec. 2019
- Derrien, Arthur and Will Harmon. "Palace Skateboards' Lev Tanju Interviewed."
Free Skateboard Magazine, 2018, <https://www.freeskatemag.com/2018/02/22/palace-skateboards-lev-tanju-interviewed/>
Accessed 5 Nov. 2019.
- Frankalliance. "r/BlackPeopleTwitter - My fellow Americans."
Reddit, 2016, https://www.reddit.com/r/BlackPeopleTwitter/comments/57t4a6/my_fellow_americans/. Accessed 15 Dec. 2019
- "Glitch (Muziek)."
Wikipedia, 2019, [https://nl.wikipedia.org/wiki/Glitch_\(muziek\)](https://nl.wikipedia.org/wiki/Glitch_(muziek)). Accessed: 15 Dec. 2019
- Henshall, Marc. "Surface Noise. How Vinyl Speaks to Our Desire for Authenticity."
Sound Matters, 2019, <https://www.yoursoundmatters.com/surface-noise-vinyl-our-desire-for-authenticity/>. Accessed 19 Dec. 2019.
- Hughes, Dave. "Adult Swim Promos - DataMosh."
Vimeo, uploaded by dave hughes, 2011, <https://vimeo.com/24830743>. Accessed 7 Dec. 2019.
- Jackson, Rebecca. *The Glitch Aesthetic*.
Georgia State University, 2011, Abstract, pp.1, https://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1081&context=communication_theses. Accessed 6 Dec. 2019.
- Klee, Miles. "The long, twisted history of glitch art."
The Kernel, 2015, <https://kernelmag.dailydot.com/issue-sections/features-issue-sections/12265/glitch-art-history/>. Accessed 6 Dec. 2019.
- Marks, Laura. "Analog Nostalgia" *Touch. Sensuous Theory and Multi-sensory Media*.
University of Minnesota Press, 2002, pp.152, https://books.google.nl/books?id=7Qoc9bAtKgcC&printsec=frontcover&hl=nl&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false. Accessed 11 Sept. 2019.
- McCluhan, Marshall. "The Medium Is The Message" *Understanding Media; The Extensions of Man*.
1964, pp.1
- Moradi, Iman. "Glitchbreak."
Organised.info, 2011, <http://www.organised.info/writing/glitchbreak/>. Accessed 6 Dec. 2019
- "NJP magnet tv."
YouTube, uploaded by pkmuzak, 2013, <https://www.youtube.com/watch?v=L-TsvjJAfmg>. Accessed 1 Dec. 2019.
- "PALACE REEBOK LOOP."
YouTube, uploaded by Palace Skateboards, 2013, <https://www.youtube.com/watch?v=dfxdwl1PSXg&t=224s>. Accessed 5 Nov. 2019.
- Priestman, Chris. "The Creepy Beauty Of VCR Errors."
Kill Screen, 2015, <https://killscreen.com/previously/articles/vcr-errors/>. Accessed 6 Dec. 2019.
- Richardson, Mark. "The Disintegration Loops."
Pitchfork, 2012, <https://pitchfork.com/reviews/albums/17064-the-disintegration-loops/>. Accessed 1 Dec. 2019
- Schrey, Dominik. *Analogue Nostalgia and the Aesthetics of Digital Remediation*.
University of Freiburg, 2014, pp. 35, <https://www.researchgate.net/publication/304862785>. Accessed 10 Sept. 2019.
- Sotirchos, Dimitra. "PALACE: Tres Trill Video Premiere."
Dazed Digital, 2011, <https://www.dazeddigital.com/artsandculture/article/12131/1/palace-tres-trill-video-premiere>. Accessed 5 Nov. 2019.
- Stephens, Mitchell. "History of television."
nyu.edu, <https://www.nyu.edu/classes/stephens/History%20of%20Television%20page.htm>. Accessed 18 Dec. 2019.
- Steyerl, Hito. "35mm to VHS" *Politics of the archive*.
eipcp, 2008, <https://eipcp.net/transversal/0608/steyerl/en.html>. Accessed 2 Dec. 2019
- Steyerl, Hito. In Defense Of The Poor Image.
E-Flux, 2009, <https://www.e-flux.com/journal/10/61362/in-defense-of-the-poor-image/>. Accessed 18 Oct. 2019
- "Technology Lock-in - Mises Wiki, the Global Repository of Classical-Liberal Thought."
Mises.Org, 2011, wiki.mises.org/wiki/Technology_lock-in. Accessed 20 Dec. 2019.