

Material Films in the Age of Artificial Intelligence. Some Remarks on Automated Creativity in Contemporary Experimental Film

Christoph Seelinger

Introduction

In their book *AI for Arts*, authors Niklas Hageback and Daniel Hedblom (2021: 62) point out that film, contrary to literature and music, is a far more complex art from a technical perspective. Since in film the various forms of human creativity are interwoven to form a holistic work of art, it would currently still be impossible for an algorithm to generate a complete feature-length film on the basis of a short sequence, for example. The authors summarise that the production of films, at least superficially, has been greatly simplified by green screens and digital technology, but as with other art forms, technology has so far only been able to exploit a fraction of its potential possibilities: “The quality of the artwork still largely depends on the human artist, and so far it is hard to detect any distinct quality improvements vis-à-vis earlier less tech-equipped and tech-savvy generations” (ibid.).

In their brief section devoted to “moving pictures”, the authors implicitly talk primarily about exponents of commercial narrative cinema that realises (more or less) coherent narratives in an economic context with the help of human actors. Even a brief mention of independent films, which Hageback and Hedblom apparently understand as a sub-genre of general industrial filmmaking, occurs rather casually: “However, as for music, the advancements in technology have democratised film making, in that movies can be produced on quite small budgets, with less technical skills required, which has allowed for sub-genres, such as indie movies, to evolve and find an audience” (ibid.).

However, this largely ignores reflections on audio-visual aesthetic artefacts in the context of experimental films produced beyond dominating companies and dominating narratives, in which narrative elements are present at most in rudimentary or abstract form, and whose rhythms thus resemble those of musical or poetic works to a considerably greater extent. Accordingly, in the following article I will use two examples to present procedures with which artists of contemporary

experimental film adapt AI technologies and/or automated creative processes for their own aesthetic purposes and create an update of historical precursor forms like *cinéma absolu* or *cinéma pur* by means of algorithmically assembled digital images. The focus of my consideration will be the artists Vadim Epstein and Eva [Evi] Jäggle (alias *Einhorn sterberate*) with their major works “Ghosts” and “Inspirationsquellen”. In his 2021 short movie “Ghosts”, Epstein creates a kind of meditative material film of virtual space through the artful use of image-to-image translation GANs, while in Jäggle’s “Inspirationsquellen” from 2020, a (seemingly) randomly assembled cluster of virtually constructed rooms, objects and camera movements form the basis for the creation of very personal, rhizome-like intertwined parallel worlds. The fact that both Epstein and Jäggle have published their films in the public domain on the video platforms Vimeo or YouTube is only one aspect that identifies them as part of a counter-current against a prevailing blockbuster cinema in which technical innovations are first and foremost subordinated to the dictates of narrative and economic gain.

Ghosts of digital modernity

Istanbul-based multimedia artist Vadim Epstein states about his eight-minute short film “Ghosts”, which is just one of his countless projects, that it is “is the most complete and extended opus from the ongoing series, exploring complexity emergence, based on the feedback loops” (2021). In the same statement that Epstein attached to his video within the commentary section on Vimeo, he elaborates further on the process of creation:

Multidomain image-to-image transforming neural network StarGAN2 has been used here recurrently, reprocessing its own output without additional inputs. The models have been trained on both figurative imagery and abstract art, to enrich and intensify visual & semantic experience. Moreover, part of the training data was synthetic itself: few source datasets were generated with custom StyleGAN2 models, adding another layer of mediation to distance it even farther from the real.

What we eventually get is an ever-changing shape-shifting loosely controlled abstract flux, which appears more lifelike and expressive on its own, than obscure resemblance of the origin flesh, stuck in the neural convolutions (ibid.).

The Generative Adversarial Network, or GAN, mentioned by Epstein is a machine learning model capable of generating data on its own. It consists of two competing artificial neural networks, one of which, the generator, has the task of generating

real-looking data, while the other, the so-called discriminator, is supposed to identify the generated data as real or artificial. Through constant learning and many iterations, the results are emancipating themselves more and more from their appearance as virtual reality. Accordingly, the generator produces data that the discriminator checks for artificiality on the basis of data sets taken from non-virtual reality. The aim of the generator is to sooner or later produce data sets that the discriminator can no longer distinguish from real data. First, the generator produces random data, (for example, an image). The discriminator, which was previously trained with real data, (for example pictures), tries to recognise whether it is real or artificially generated data. In a second step, the discriminator returns its results to the generator network. The generator then tries to generate new data more similar to the real data, which the discriminator checks again. Since the two networks are logically coupled and train each other, both are involved in a continuous learning process. With each iteration, the artificial data therefore becomes successively more akin to the real data (cf. Wiegand: 2018).

One of the most famous examples of GANs is probably the so-called “Meow Generator” by Alexia Jolicoeur-Martineau. The biostatistician and expert in statistics and machine learning from Montreal fed said Meow Generator with 10,000 photographic images of cats. After a short waiting period she received 9304 images of fictitious cats with 64×64 pixels resolution and 6445 images of fictitious cats with 128×128 pixels resolution – all of them, of course, purely fictitious animals that her GAN constructed from the given data (Jolicoeur-Martineau: 2017).

The typical areas of application of a GAN can therefore obviously be found in the fields of film and photography: It can be used to create missing backgrounds that look deceptively real – think, for example, of crowd scenes in blockbusters where a handful of extras are artificially stylised into a gigantic army. Other possible applications in film or image editing are the subsequent colouring of black and white shots, the generation of artificial voices or the creation of three-dimensional objects from sketches or 2D templates. Hageback and Hedblom also address the increasingly virulent phenomenon of deepfakes, which they call

the most interesting breakthrough this far with regard to moving pictures. Here artificial intelligence is used to project human appearances on moving pictures where they really do not exist. In a similar manner as it is possible to emulate a human's language, this technique, deploying a type of neural networks, generative adversarial networks (GAN), allows for replicating an individual's face with its idiosyncratic facial moves, or bodily movements. It means that an actor can be altogether replaced by another actor or let the algorithm adjust the face of an actor to make them appear younger

to better fit the role. Whilst these technologies today are expensive, the ongoing digitalisation will lower the price and open up for a broader set of users to deploy these technologies. Obviously, it raises the question of the future role of the actor, if at all required, and their price tags” (2021: 64).

While all of these applications aim to achieve the highest degree of photorealism, Epstein’s “Ghosts” can hardly be called lifelike, despite the artist’s own assertions. “Ghosts” consists of a constant flow of permanently changing images that Epstein has subsequently underpinned with atonal noise soundscapes. As a restless stream of incessant metamorphoses, they decouple themselves from any form of naturalistic representation both through their infinite transformations and through their primordial abstractness. The fact that the images Epstein has created with the help of his AI programmes constantly morph into one another means that they generate new kinds of visual meaning virtually every second, the sheer rapidity of which alone makes it incredibly difficult for the viewer to keep up with their restless transformations. All the images that Epstein has fed into his GAN network – cat heads, possibly as a reference to Jolicoeur-Martineau; structures remotely reminiscent of hair or fur; celebrity portraits; pencil drawings; paintings that per se possess a high degree of abstraction, such as those by Vasily Kandinsky in particular – do not form self-contained units as the final result of an artificial reproduction process. Rather, to take up Epstein’s river metaphor, their unsteady stream constantly blurs into an ultimately amorphous mass that oscillates between the vaguely recognisable and the completely unintelligible. Likewise, the largely atonal but homogeneous sounds by artists Alexander Kopeikin and Fractal Heads with which Epstein has synchronised his flood of images contributes to giving “Ghosts” the character of a meditative material film.

Historical predecessors such as the *Materialfilme* by Birgit and Wilhelm Hein from the 1960s and 1970s received their structure from the carrier system of the film itself, i.e. celluloid as the image carrier, the frame of the image, the speed of the camera. In their fundamental “*Subgeschichte des Films*”, Scheugl and Schmidt jr. point to the close connection between material film and abstract film: “Der Bildinhalt wird dabei nicht gleichgesetzt mit Filminhalt (wie beim narrativen Film), sondern ist gleichsam autarkes Gestaltungsmittel, das nicht nur vom Inhalt, sondern oft auch als Bild abstrahiert wird. Die ersten Materialfilme sind bezeichnenderweise auch die ersten abstrakten Filme” (1974: 584). – “The contents of the image are not equated with the content of the film (as is the case with narrative film), but are an autonomous means of design that is not only abstracted from the content, but often also as an image. Significantly, the first material films are also the first abstract films” (translation A.K.).

By repeatedly referring to their own physicality, elements that normally remain invisible, that are not counted as part of the content as technical realities, form the visual material that is woven into a more or less abstract composition. An example of this would be "Materialfilme II" by Birgit and Wilhelm Hein from 1976, which solely consists of multiple long shots of watercolours applied to the film material. The material itself was originally not intended to be viewed as a running film. Rather, it consists of parts of the beginning and end tapes of other films, whose scribbled notes and painted colour markings are merely an aid for the projectionists in dealing with the film material itself. Through the Heins' specific approach, however, the half-hour unrolling of the film tape becomes a quasi-contemplative viewing experience that finds its virtual echo in Epstein's "Ghosts". Epstein, too, explicitly refers to the raw material of his cinematographic vision, only in his case, of course, it does not consist of physical celluloid but of digital data sets. Another difference is the reception situation in which contemporaries saw "Materialfilme II". The Heins showed their films at festivals as classic cinema projections: the audience is in a dark room, delivered to the screen, as if enjoying a conventional feature film. Epstein, on the other hand, releases "Ghosts" in the virtual space of Vimeo, where a completely different, more individual sequential viewing practice prevails in comparison to the holistic cinema experience that the Heins (presumably ironically) still served.

At their core, however, both approaches to the artistic instrumentalization of automated creativity overlap insofar as both the Heins and Epstein relinquish control over their aesthetic artefacts from their own hands: In that the film material in "Materialfilme II" virtually stages itself, and that the visual feedback loop in "Ghosts" unfolds without Epstein's intervention solely as a dialogue between the generator and the discriminator of his StarGAN network, both works largely decouple themselves from the human world of experience and perception. In a certain manner, both films counteract the obsessions of Hollywood cinema as postulated by French philosopher Jean-François Lyotard in his normative programme of the "Acinéma" in 1973 through the ostentatious purposelessness of their images.

For Lyotard, film is first of all "the writing of movement" (2017: 33). Objects within the frame move, the lens moves, montage creates movement between shots. Learning the craft of (commercial, narrative, institutional) filmmaking accordingly means selecting from a broad spectrum of possible candidates for the role of cinematographic writing material those that, in relation to the images / movements that surround them, generate values that are in turn purely in the service of the diegesis. The organisation of movement in commercial cinema follows strict "rules of representation for localisation in space, rules of narration for the schematisation of speech, rules of the genre 'film music' for tonal time" (ibid.). Disturbing movements that threaten to defeat the desired effect of reality must be ruthlessly excluded, all that "what is fortuitous, dirty, confused, unsteady, unclear, poorly framed, overexposed"

(ibid.). Lyotard uses a lucid example to illustrate what for him constitutes his concept of “Acinéma”:

For example, suppose you are working on a shot in video, a shot, say, of a gorgeous head of hair à la Renoir; upon viewing it you find that something has come undone: all of a sudden, swamps, outlines of incongruous islands and cliff edges appear, lurching forth before your startled eyes. A scene from elsewhere, representing nothing identifiable, has been added, a scene not related to the logic of your shot, an undecidable scene, worthless even as an insertion because it will not be repeated and taken up again later. So you cut it out (ibid.).

But it is precisely these waste products, which would be withheld from a commercial film, that Epstein and the Heins use to compose their material films. Interestingly, Lyotard’s essay also contains a metaphorical image that precisely describes the organising principle of Epstein’s “Ghosts” with its communicating AI units:

No movement, arising from any field, is given to the eye-ear of the spectator for what it is: a simple *sterile difference* in an audio-visual field. Instead, every movement put forward *sends back* to something else, is inscribed as a plus or minus on the ledger book which is the film, *is valuable* because it *returns* to something else, because it is thus potential return and profit (2017: 33).

The purposelessness of Epstein’s GAN experiments, their anti-pragmatic impetus, their offensive retreat into a pure L’art-pour-l’Art aesthetic lead to the fact that “Ghosts” has an inherent value that cannot be measured according to the monitory aspects of the commercial film business. What is interesting here is also the title of Epstein’s film: it seems quite intentional that we understand his ghosts of the digital age as ancestors of those that have haunted the various visual media since the beginning of technical modernity. From the ghost photography of the 19th century to the silent phantoms of early cinema, we have arrived at artificially calculated revenants that haunt extra-filmic reality through their deceptively real resemblance to it – with the irony, of course, that Epstein uses the photorealism of his GAN network to create ghostly images that, if anything, resemble fleeting chimeras.

Rhizomic labyrinths

A rather contemplative work by Birgit and Wilhelm Hein such as “Materialfilme II” stands in opposition to an early work by the couple such as “Rohfilm” from 1968, whose aggressive-destructive character Birgit Hein highlights as follows in her pioneering work on “Film im Underground”:

After the colour film 'Grün' in 1968 [...] [Birgit and Wilhelm Hein] created the extraordinarily aggressive 'Rohfilm' in 1968, which represented the destruction of the conventional visual world. Dirt, hair, ashes, tobacco, small pieces of film images, holes in the edges, perforated tape are stuck onto blank film. This is filmed off again, as only one projection is possible with the thick, stuck-on strip. During filming, the original occasionally gets caught in the film carrier, so the same image appears again and again, or film images melt under the intense heat of the projector, which only runs at very slow speed. The filmed piece is then subjected to various reproduction processes and projected and filmed over video, editing table, viewing device, in order to make the change clear through the reproduction process alone. Further film strips are once again glued together and filmed from different positive and negative strips, from 8 mm and 16 mm strips, which simultaneously show two different image sizes, 8 mm film is pulled through the viewing device without a shutter and filmed so that image lines and perforation holes, i.e. the strip as material, become visible. The film gives the impression of tremendous destruction. The images burst into individual pieces, into swirls of hugely enlarged dirt particles and image remnants. The aggressive sound heightens the effect and challenges the viewers to scream loudly to defend themselves against the film's superiority (translation A.K.; 1971: 149).¹

In its deliberate challenge of its audience's viewing habits, "Rohfilm" coincides with the hand-painted experimental films of the Basque painter José Antonio Sistiaga. His main work "... era erera baleibu izik subua aruaren...", created between 1968 and 1970 in work shifts of twelve to 17 hours per day, embodies a feature-length

1 "Nach dem Farbfilm 'Grün' 1968 [...] folgt [Birgit und Wilhelm Heins] Durchbuch zu einer eigenen Sprache mit dem außerordentlich aggressiven 'Rohfilm' 1968, der die Destruktion der herkömmlichen Bildwelt darstellt. Auf Blankfilm wird Dreck, Haare, Asche, Tabak, kleine Stücke von Filmbildern, Randlöcher, perforiertes Klebeband aufgeklebt. Dieses wird wieder abgefilmt, da mit dem dicken, beklebten Streifen nur eine einzige Projektion möglich ist. Beim Abfilmen verhakt sich ab und zu das Original in der Filmbühne, so erscheint dasselbe Bild immer wieder, oder Filmbilder schmelzen bei der starken Hitze des nur mit sehr langsamer Geschwindigkeit laufenden Projektors. Das abgefilmte Stück wird dann verschiedensten Reproduktionsprozessen unterzogen und über Video, Schneidetisch, Betrachtungsgerät projiziert und abgefilmt, um die Veränderung allein durch den Reproduktionsprozeß deutlich zu machen. Weitere Filmstreifen werden neu aus verschiedenen positiven und negativen Streifen, aus 8-mm- und 16-mm-Streifen, die gleichzeitig zwei verschiedene Bildgrößen zeigen, zusammengeklebt und abgefilmt, 8-mm-Film wird ohne Shutter durch das Betrachtungsgerät gezogen und gefilmt, so daß Bildstriche und Perforationslöcher, also der Streifen als Material, sichtbar werden. Der Film vermittelt den Eindruck einer ungeheuren Zerstörung. Die Bilder zerplatzen zu einzelnen Teilen, zu Wirbeln riesenhaft vergrößerter Dreckpartikel und Bildreste. Der aggressive Ton steigert die Wirkung und fordert die Zuschauer zu eigenem lauten Schreien heraus, um sich gegen die Übermacht des Films zu wehren."

sequence of film strips that were previously coloured in various ways. The total of 108,000 35mm frames, which were painted using a whole range of techniques and materials such as sand, soap bubbles and even a cardboard tube, result in an abstract painting that through the mobility of its images has come to life. The outcome is an uncontrolled but silent rush of colour and form, “a depiction of a cosmic circulatory system as well as the firing synapses of a galactic mind”, as Zinman puts it (2020: 1). In his poetological notes, Sistiaga himself uses a similar pathetic tone when he describes his film as an opportunity to “take the blindfold of rationalism off and enjoy the unknown”. (Quot. *ibid.* 2)

With its specific aesthetic of overtaking, Sistiaga’s film can certainly be seen as a model for our second example of automated avant-garde within contemporary experimental cinema, “Inspirationsquellen” by Eva (or Evi) Jäggle, which, like Epstein’s “Ghosts”, celebrates its premiere in digital space: While Epstein’s platform by choice is “Vimeo”, Jäggle publishes her films on YouTube. Most of the uploads on the Viennese artist’s YouTube-channel “Einhorn sterberate” settle at a running time of a few seconds / minutes and bear such cryptically absurd titles as “Bergsonistisch gedichtig in Kapitelinhaltsverzeichnisigkeit”, “Differenz und Wiederholung Vorwort. in ausufernder ausdrücklichkeitsannahme”, or “Logik des Sinns. 6. Serie der Paradoxa: Über die Serialisierung”.

As of today, the channel launched on 9 June 2016 has a total of 168 videos and just 68 subscribers. Most of the uploads are small digital gimmicks: Jäggle uses graphics programmes such as Blender or Autodesk to create representational 3D scenes, then covers them with various effects using Adobe After Effects and, above all, lets a virtual camera circle around them, through them, over them. By means of an automated montage that randomly links the prefabricated objects, camera movements and image elements, this basic stock of audio-visual artefacts constantly jumbled up in a deliberate messy way similar to Vadim Epstein’s “Ghosts”. Often, several designs seem to be combined with each other, i.e. several image levels are superimposed, mirrored in each other, resulting in a fascinating effect of overdetermination. Sometimes the tracking shots through Jäggle’s abstract-sterile digital worlds are accompanied by recitations of self-penned philosophical-poetic texts, sometimes they are accompanied by noisy soundscapes, sometimes they are silent.

So far, Jäggle has only once constructed a longer video from all these individual building blocks, which give the impression of loose, still unconnected fragments or loose ideas: The 21st May 2020 saw the release of her first feature-length film, the almost one-hour-long INSPIRATIONSQUELLEN, which, with currently 39 views, is one of the most rarely clicked videos on her channel. With “Inspirationsquellen”, Jäggle challenges traditional visual media with such a high surplus of semantic meaning that logic, coherence and meaningful connections between the single images collapse defenceless under the sheer flood of impressions. Since Jäggle is currently doing her doctorate at the University of Vienna on the “Kinematographieung der

Philosophie durch Deleuze", it stands reason to understand her work as a practical execution of the rhizome metaphor developed by Gilles Deleuze and Felix Guattari in the 1970s. In her master's thesis from 2017, also dedicated to Deleuze, Jäggle writes, as if trying to grasp her own video works, on the post-structuralist metaphor of the rhizome:

The rhizome wants to create as it develops, no structures are to be copied, the logic of the rhizome is to extend the lines of flight, to always find a way out that is as non-significant as possible, and a broken line can again become a point of connection or a singularity. If the crocodile looks like a tree trunk, it does not reproduce it but becomes it (translation A.K.; 2017: 96).²

Above all, Jäggle's opus magnum "Inspirationsquellen" can itself be understood as a rhizome that cannot be looked at from above, that can never be grasped in its entirety, that can only be followed in its details to see in it solely difference and repetition. In the words of Jäggle herself: (2017: 3).³ "The extreme points are not representable, the absolutely solid and the completely in-self-reflected or moved (Hegel) are both not representable, the moment one wants to grasp them, they have disappeared" (My translation).

The first thirty seconds of "Inspirationsquellen" are symptomatic of this strategy of visual volatility. On the soundtrack we hear an emotionless computer voice reciting a text presumably written by Jäggle herself, which, to put it simply, seems to be about the lyrical self's struggle with the overwhelming side effects of the digital world: "Bildschirme legen sich über mein Gesichtsfeld. Auf meinen Augen Schwere. Wenn ich die analoge Welt betrachte, durchzieht ein Schleier meinen Blick, nicht sichtbar. Unterschwellig beginnen sanft die Augen weiß zu rauschen, wo doch der Horizont sie entlasten sollte". – "Screens cover my field of vision. On my eyes heaviness. When I look at the analogue world, a veil crosses my gaze, not visible. Subliminally, eyes gently begin to rush white, when the horizon should relieve them" (My translation). A geometric structure made up of several cuboids and cubes rotates faltering under the superimposed film title. Describing the object in more detail fails

-
- 2 "Das Rhizom will erschaffen, während es sich entwickelt, es sollen keine Strukturen kopiert werden, die Logik des Rhizoms besteht darin, die Fluchtlinien zu verlängern, immer einen Ausweg zu finden, der möglichst nicht signifikant ist und aus einer gebrochenen Linie kann wieder ein Anknüpfungspunkt oder eine Singularität werden. Wenn das Krokodil einem Baumstamm gleich sieht, dann reproduziert es diesen nicht, sondern wird zu ihm".
 - 3 "Die Extrempunkte sind nicht darstellbar, das absolut Gesetzte und das völlig In-sich-Reflektierte oder Bewegte (Hegel) sind beide nicht abbildbar, in dem Moment, in dem man sie erfassen will, sind sie verschwunden"

solely because the original 3D model has been alienated in terms of colour afterwards and because many of its components elude human language, since they are purely abstract objects. Two dolphins in dorsal view can be seen, as well as huge adjusting screws and gear sticks. Fragments of Japanese anime and kitten comics are projected onto the flanks of some cuboids. All of this is brought together according to an almost surrealistic combination aesthetic that brings to mind Lautréamont's famous dictum about the chance encounter between an umbrella and a sewing machine on a dissecting table (1973: 234).

At another randomly picked moment at 9 minutes and 5 seconds Jäggle's voice reads on the soundtrack several texts simultaneously, in other words, the voice recordings have been overlaid in such a way that one can only clearly understand individual catchwords, at most a half-sentence, a Babylonian babble of voices that *in nuce* sums up the construction principle of the entire film: so many images, sounds, words, sequences of movements are piled on top of each other that their interplay evokes a rushing nothingness, the end of all semantics where its density is at its highest. On the pictorial level we are confronted with the same effect: Even if one only wanted to describe the still image at 9:05 according to art-scientific standards like a classical painting, one could spend days on it. The image content is reminiscent of a refrigerator door covered to the last corner with colourful stickers, postcards, private photos, where at some point one has begun to cover the already existing layer of pictures with a second, third, fourth one. At the bottom left, the artist's own eyes look at us in close-up. The Japanese cartoon character Sailor Moon lets herself be recognized, at least her upper body, standing at right angles to the picture frame. At the top right, a goat gif bleats, next to a comic bunny holding a carrot. The Fanta logo can be made out, a fox, a butterfly.

Finally, let us look at the end of the film. At minute 58 and 20 seconds, you can hear on the soundtrack: "...dass ich gar nichts sagen kann. Das, was ich sagen kann, verfault schon in meinem Munde und ich könnte nie das sagen, was ich sagen möchte..." – "...that I can't say anything. What I can say is already rotting in my mouth and I could never say what I want to say..." (my translation), uttered by Jäggle apparently in conversation with a second person, whose voice, however, is too far away from the recording device for one to clearly understand her rebuttals. This dialogue is accompanied by a calm ambient soundscape. Like the words, the images also fail (or rot): In the final shots of the film, just like Jäggle's off-screen monologues, the images do not reach a satisfactory conclusion. Motifs layered on top of each other, interlocked, optically puzzling each other through accidental overlapping, repetitively running through the entire film, are what we encounter in the last seconds as well: The artist in a transparent full-body suit, smeared with paint, assuming strange poses, performing mysterious, potentially ritualistic gestures; a golden portal like from a vintage adventure video game, behind which the virtual camera races along a gallery of scurrying canvases; a hand leafing through a book, mirrored several times; a cen-

trifuge slowly rotating around itself in the upper left of the image; a goldfish swimming by; the desktop background of Jäggle's laptop, the trashcan icon prominently highlighted. The stream of images breaks off abruptly, Jäggle denies us credits or any other kind of culmination or conclusion. Her film, like Deleuze's rhizome, is a labyrinth without end or beginning.

Bibliography

- Hageback, Niklas / Daniel Hedblom (2021): *AI for Arts*. London: Routledge.
- Hein, Birgit (1971): *Film im Underground*. Frankfurt/Main / Berlin / Wien: Ullstein.
- Jäggle, Eva Maria (2017): "Deleuze' unausdrückbarer Ausdruck, der den Inhalt mit sich reißt. Das Unverfügbare der Differenz-Figuren verkoppelt sich zu einer Ausdrucksmaschine und bedingt das Disparate des Stils. Eine künstlerisch- strukturelle Wechselseitigkeit von Sprache und ihre Auswirkungen auf den Sinn". Master thesis, Universität Wien. <https://phaidra.univie.ac.at/download/o:1334795> (15 December 2022).
- Jolicoeur-Martineau, Alexia: "Meow Generator". Online: <https://ajolicoeur.wordpress.com/cats/> (15 December 2022)..
- Lautréamont (1973) : *Oeuvres complètes*. Paris: Gallimard.
- Lyotard, Jean-François (2017): "Acinéma". Jones, Graham / Woodward, Ashley (ed.): *Acinemas. Lyotard's Philosophy of Film*. Edinburgh: University Press, 33–42.
- Scheugl, Hans / Ernst Schmidt jr. (1974): *Eine Subgeschichte des Films. Lexikon des Avantgarde-, Experimental- und Undergroundfilms*, Vol. 1. Frankfurt/Main: Suhrkamp.
- Wiegand, Andreas (2018): "Eine Einführung in Generative Adversarial Network (GAN)". Online: https://cogsys.uni-bamberg.de/teaching/sem_m2 (15 December 2022).
- Zinman, Gregory (2020): *Making Images Move. Handmade Cinema and the Other Arts*. California: University of California Press.

Film- and Videography

- Einhorn sterberate (2020): "Inspirationsquellen". 21th May. YouTube. [Online Video]. <https://www.youtube.com/watch?v=v3zVXQ8Bmpc>. (15 December 2022).
- Epstein, Vadim (2021): "Ghosts". 15th October. Vimeo. [Online Video]. <https://vimeo.com/633172534>. (15 December 2022).
- ... era erera baleibu izik subua aruaren ... (1970): Dir. José Antonio Sistiaga. Not commercially available on DVD.

“Materialfilme II” (1976): Dir. Birgit & Wilhelm Hein. *Materialfilme 1968–1976*. Edition Filmmuseum München 54, DVD 2012.