C
THOMAS RUFF'S GENERATED PHOTOGRAPHS AND THE LIMITS OF REPRESENTATION

In the late 1990s, Thomas Ruff initiated the disembodiment of the photographic image and the deconstruction of its referentiality with the *nudes* and the *jpegs* series. Digital technologies played a paramount role in that process. Throughout the 2000s, the investigation of the medium will be carried much further, producing two series, which increasingly dissolve the two-dimensional image and radically question the nature of photographic representation: the abstract *Substrat* series and the computer-generated, non-figurative *Zycles.* In the first, Ruff has modified manga images to such an extent that only vivid color fields remain visible (Fig. 135), graphically translating its visual sources into psychedelic patterns. In the *Zycles*, he has generated algorithmic curves related to mathematical trajectories used to model planets' trajectories (Fig. 136), producing his most abstract "photographs" to date. If these series were not interpreted in the body of work of a renowned photographer associated to a documentary tradition, they would probably not even be considered photographic. While being technically different and diverging in terms of referentiality – the first uses appropriated material, the second reflects upon the mathematical formalization of astronomical movements of celestial bodies –, the key feature of these two image series lies in their abstract and thus seemingly non-referential character.

1 ICONOCLASM AND ABSTRACT PORNOGRAPHY: "SUBSTRATS"

Genesis

The *Substrat* series initiated in 2001 includes eighty-three works up to this date.[162] The photographs result from the superimposition of multiple manga images, found on the Internet, whose color values have been manipulated to achieve a painterly, abstract "psychedelic effect."[163] The outcome of an additive technique combines superimposed layers, which are submitted to digital filters, extrapolating hues, colors and shapes. According to Ruff, the process had been discovered while working on the *I.m.v.d.r.* series: while editing the interior shots of Haus Tugendhat (Czech Republic), he superimposed "two or three" shots and twisted the colors to produce an unnatural effect.[164] *h.t.b. 10*, for instance, results from the combination of *h.t.b. 05* and *h.t.b. 07*.[165] The process has been further developed in the *Substrat* series, combining numerous layers – the image of the work process reveals that Ruff experiments with at least eighteen layers – and emphasizing the vivid colors of *anime* or *hentai* imagery.[166] All photographs approximately bear the same color palette, based on red, green, violet and yellow hues, present in various graduations.[167] Even though low-resolution images are used, various smoothening filters are applied in order to hide the pixelated structure of the images, which produces an image that looks blurry or out of focus. Unlike the *jpegs*, the pixel grid or the compression algorithms are not visible in the *Substrates*.

While "manga images" are almost systematically brought up by Ruff himself or commentators, their exact nature and origin are never alluded to nor discussed.[168] Although the series has been exhibited in several major shows of the artist throughout the 2000s, the same information is retold repeatedly, without further investigation. A short documentary film on the artist reveals their origin, though. The focus on Ruff's work process shows that he has used erotic images of feminine manga characters for the series (see Fig. 137) disabling their suggestive content through superimposition and manipulation and

162 Carolyn Christov-Bakargiev (ed.), *Thomas Ruff*, op. cit., p. 98.

163 Helga Meister, "Das Bild ist schön," *K-West*, op. cit.

164 Ibid.

165 See for example Martin Søberg, "Theorizing the Image of Architecture. Thomas Ruff's Photographs of the Buildings of Mies van der Rohe," transcript of *Architectural Inquiries Conference*, Göteborg, 2008. Available at http://www.americansuburbx.com/wp-content/uploads/2012/09/Soeberg_Theorizing-the-Image-of-Architecture.pdf, accessed on June 27, 2018.

166 The terminology "manga" generically stands for Japanese comics (and by extension cartoons) and its reception in Europe in late nineteenth century is commonly associated with the circulation of Hokusai engravings. The word "hentai" is used in the West to describe erotic or pornographic mangas, although its meaning in Japanese (literally "perversion," "anomality" or "transformation") has no sexual connotation. "Anime" is the contemporary American equivalent for manga. See for example http://en.wikipedia.org/wiki/Hentai, accessed on March 14, 2018.

167 Only the edition 2009 *Substrat Blue* (four color stone lithograph, 62 × 60 cm, edition of 100) limits the color palette to blue and green hues.

168 Manga images or cartoons are for example mentioned in the interview of Thomas Ruff by Max Dax, in *Spex. Magazin für Popokultur*, reproduced in Carolyn Christov-Bakargiev (ed.), *Thomas Ruff*, op. cit., p. 72 or in Helga Meister, "Das Bild ist schön,", *K-West*, op. cit.

opposing the omnipresence of pornographic material on the web with this iconoclastic approach. Except in that documentary film produced for television,[169] the source images have hardly ever been mentioned by the historiography. Ruff or the interviewer do not specifically reflect upon the erotic character of the source either. While the systematic recourse to erotic imagery cannot be established, Ruff's didactic use of his work screen in the documentary film – the previously discussed *h.t.b. 10* is visible on the Photoshop interface behind the erotic manga character – suggests the orientation of the series he intends to disclose. By inscribing the Substrats in the continuity of the *nudes*, Ruff positions the series in his oeuvre and contributes to a coherent critical and art historical discourse.

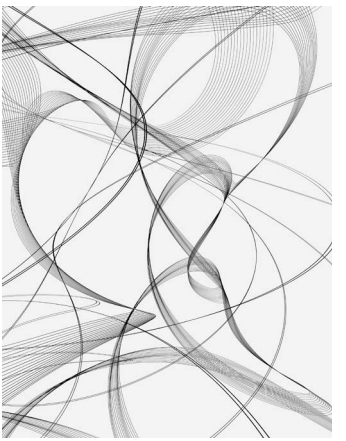

Fig. 135: Thomas Ruff, *Substrat 23 III*, 2003 (254 × 166 cm)
Fig. 136: Thomas Ruff, *Zycles 3085*, 2009 (pigment print on canvas, 266 × 206 cm)

Superimposition and visual culture

The *nudes* series addressed a whole industry: its codes, its circulation system and its categorial construction. Though explicitly pornographic, it depicted no particularly extreme practices, which probably gives insight into the pornographic material consumption of a wide majority of users. Manga imagery, although it has become popular in recent years, is rather a niche product, consumed by teenagers and associated with geek culture. The erotic character of the source images – a subcategory of manga imagery – thus corresponds to a specific, technophile, predominantly male audience, and also reflects a sub-category of the pornographic industry. But while the nudes are sexually explicit, the *Substrates* are abstractions, and even when the origin of the images is known, no visual correspondence can be found. The curves could be associated with feminine body shapes, even though a clear correspondence can hardly be stated. The breast-looking shape at the bottom of

169 *Kultur 21. Unbekannte Landschaften – Das Universum des Thomas Ruff*, documentary film, Die deutsche Welle, 2011.

Substrat 29 III probably constitutes the most explicit example of (likely extrapolated) body parts of the series. But considering its historiography – erotic imagery is hardly ever brought up by critics –, one could consider that the average viewer does not know the origin of these psychedelic tableaus. Similar to the *nudes*, Ruff addresses the meta-visual information of photographs he reflects upon. In the *nudes*, the fact that pornographic images remain sexually explicit, even in an artistic context, might explain the shift toward abstraction, in order to focus on the medium itself, photography as *substratum*. In a short text presenting the series, Valentina Sonzogni suggests a productive interpretative pattern by examining the etymology of the word "substrat." The term can refer to biochemistry; a "substrate" is a molecule transformed by a molecule. It is related to linguistics, where the "substratum" refers to an "element of language identified as being a relic of an earlier language that is now extinct." It is further used in geology, where it refers to the "layered structure" of the soil.[170] The technical layering used to produce the images and these three definitions thus point toward the idea that the *Substrates* can be seen as the outcome – but at the same time the source – of images on the web more generally, in which certain information or codes, e.g., a grammar or a shared visual culture, are contained. The interpretations of these definitions are multiple. But the idea of the perception of an image changed by other images or by the visual culture of the viewer, seems productive for understanding the image not as imprint but as vector of ever-changing meanings and interpretations, a phenomenon particularly potent in digital imaging systems where images are constantly reposted, reinterpreted and seen in other contexts.

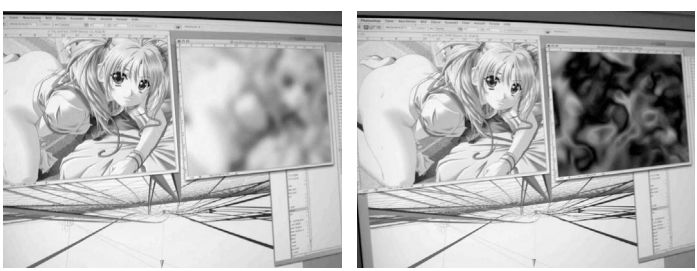

Fig. 137: Thomas Ruff, work process of *Substrat* series (pictures from Maximilian von Geymüller, *Köpfe, Kosmos, Kreise. Kontinuität im Werk von Thomas Ruf*, master thesis, University Vienna, 2009)

The project, through its blatant abstract character, deconstructs the produced meaning or any potential interpretation. In engineering, the substrate denotes "a material, which provides the surface on which something is deposited or inscribed, for example the silicon wafer used to manufacture integrated circuits." In biology, substrate refers to "the surface or material on or from which an organism lives, grows,

170 Carolyn Christov-Bakargiev (ed.), *Thomas Ruff*, op. cit., p. 98.

or obtains its nourishment."[171] Ruff addresses the surface of the image, its connotation, stripped from its content. In the recent catalogue of Ruff's retrospective show at the Haus der Kunst in Munich, the text addressing the series explains, that "Ruff noticed while searching for image material for the *nudes*, that the virtual images on the Internet essentially no longer represented reality but are merely visual stimuli conveyed by purely electronic means."[172] The coalescence of erotic imagery and "visual nothingness"[173] enhances the concept of the image as a substrate, as the latent articulation iconoclastic *versus* pornographic is neutralized: in the *Substrates*, only colors and shapes remain, leaving the image surface open to input – i.e., an identifiable reference – or output – i.e., an interpretative stance by the observer.

Thomas Ruff's first abstract work group consequently operates within a two-directional movement: technically it relies on the abstraction from a source image, combined with several layers of images and edited digitally, in order to produce psychedelic color patterns, reminiscent as much of 1970s color codes (e.g., batik fabric) as of early experiments of digital painting, in the 1980s and 1990s, whose implications were often limited to the conduct of formal experiments. On the other end, the *Substrates* address a visual architecture beneath or before the image, the layer on which it can be imprinted, as much in its technical articulation – the Internet as a substrate for a multiplicity of images – as in a more conceptual articulation – the image as a substrate to a cognitive reconstruction. If an example such as *Substrat 23 III* is juxtaposed with an erotic image – in this case, a picture from the *nudes* series (see Fig. 138) – the viewer easily reconstructs a formal correspondence. The *nude* could as much be the source image of the *Substrate* as a projection of the observer, brought about by the juxtaposition of the two examples.[174]

Through his interrogation of image distribution systems on the web and of its implications on the way images are perceived by the viewer – ultimately, highlighting their repeated transformations through their recontextualization – Ruff seemingly proves the point of post-photographic theories of the 1990s, which dreaded the potential mutability of digital photography and its consequential loss of veracity.[175] But the implied consequence of that malleable character, the manipulability of photography through its retouching, clearly did not impair its reading, or its potential truth claim. The primary outcome of the use of digital technologies in relation with photographic images, resides in their economy of distribution and their existence as multiples, and not

171 *Oxford Dictionary of English*, OSX Edition.

172 *Thomas Ruff. Works 1979 – 2011*, op. cit., p. 174

173 Ibid.

174 The confrontation of these two series coincidentally occured during a Google Image search on Thomas Ruff.

175 William J. T. Mitchell for example argued that because of its mutability, digital photography was not different from painting. See *The Reconfigured Eye. Visual Truth in the Post-Photographic Era*, op. cit., p. 7. In his retrospective study Language of New Media (2001), Lev Manovich still argues that "the mutability of digital data impairs the value of cinema recordings as documents of reality." See Lev Manovich, *The Language of New Media*, Cambridge (MA)/London, The MIT Press, 2001, p. 259.

in the visual modification *within* a single image. The photograph as substrate for various meanings prevails which, paradoxically, does not prejudice its function as a document of a depicted reality. Ruff's concealed recourse to the body in the *Substrates* further allows a comparison to be drawn with both post-photographic imagery and the conception of digital tools in the 1990s. While the "manipulative" power of such tools was displayed at that time through the manipulation of the body, the invisibility of the (hidden) bodies of the *Substrate* series stresses the importance of the cultural reading of an image, which comes from the viewer, against its perception as an (indexical) depiction.

Fig. 138: Thomas Ruff, *nude ft04*, 2000 and *Substrat 23 III*, 2003

2 FROM ENHANCED TO GENERATED REALITIES: THOMAS RUFF'S "*ZYCLES*"

The movement between the figurative and the abstract, which operates at the limits of photographic representation, will be pushed even further by Ruff with his forthcoming non-figurative series *Zycles*, which crosses a conceptual and technical line in the conception of photographic representation. Using manga images – technically drawings – as the source of the *Substrates*, Ruff emphasized the fact that he focused on images, rather than on a physical reality. While he used visual sources for the series, their chirographic nature already questioned the need for indexical photographic material to produce photographic work. The *Zycles* not only generate images without a visual source or indexical information – the series materializes mathematical formulae – but concomitantly rejects the reliance on any strictly photographic technical apparatus, a symptom of the increasing convergence between photographic capture, film capture, image post-production and CGI.[176]

176 Computer-generated imagery.

Scientific models and taxonomic classification

The *Zycles* series, printed on canvas by an inkjet printer, spans from 2008 to 2009. It is considered ongoing by several publications and galleries, but no photograph has been produced since that two-year span. Its historiography commonly associates it with Ruff's account of his interest for old books on electromagnetism,[177] in particular Scottish theoretical physicist and mathematician James Clerk Maxwell's reference works *A Dynamical Theory of the Electromagnetic Field* (1865) and *A Treatise on Electricity and Magnetism* (1873).[178] Maxwell is credited with two major innovations: the visual formalization of magnetic fields and the use of color photography, the outcome of his research on color perception. While visually inspired by Maxwell's etchings of electromagnetic fields (see Fig. 139), the series is mathematically based on the cycloid – from which Ruff's series draws its title –, a specific type of curve used to describe movement of planets in an (outdated) model of spheres used to represent the solar system.[179] But it draws conceptually from Maxwell, as Ruff was interested by the resonance created by images as models, which "have no reality in the real world."[180] While these modeled etchings correspond to *a* reality, that reality – such as the trajectory of a planet – is not visible in itself. However, if those realities are *per se* distinctive in a philosophical realist perspective,[181] historians of the scientific discourse have shown that they were not necessarily considered completely dissimilar. As Lorraine Daston and Peter Galison pointed out, "it is structures like Maxwell's equation, not theoretical entities like the electromagnetic ether, that constitutes scientific reality."[182] Although the authors clearly inscribe such a structural realist position into science's claim to objectivity,[183] it nevertheless informs about discursive forms or schemata of representations of reality, historically constructed, which are clearly relevant to Ruff's approach.

177 E.g., *Thomas Ruff. Works 1979 – 2011*, op. cit., p. 226 or Melanie Bono, "Stellar Landscapes," in *Thomas Ruff. Stellar Landscapes*, op. cit., p. 52 – 53. For the most extensive study of the *Zycles* and their relationship with nineteenth-century scientific discourse to date, see Douglas Fogle, "Dark Matter," in *Thomas Ruff. Oberflächen, Tiefen – Surfaces, Depths*, op. cit., especially p. 194 – 200.

178 James Clerk Maxwell, *A Treatise on Electricity and Magnetism*, Oxford, Clarendon Press, 1873.

179 Melanie Bono, "Stellar Landscapes," in *Thomas Ruff. Stellar Landscapes*, op. cit., p. 52.

180 Interview of Thomas Ruff by Gerald Matt, in *Thomas Ruff. Oberflächen, Tiefen – Surfaces, Depths*, op.cit., p. 241 – 242, quoted by Melanie Bono, "Stellar Landscapes," in *Thomas Ruff. Stellar Landscapes*, op. cit., p. 52.

181 Leibniz was first to postulate that science, or more specifically mathematics, could not describe reality. While science is able to produce models that correspond to reality, the multitude of alternative models – which would represent alternative realities – and the lack of defined relationality between reality and model prohibits the production of any definitive knowledge about reality. See for example Michel Serres, *Le système de Leibniz et ses modèles mathématiques,* Paris, Presses universitaires de France, 1968 (The author would like to thank Marc-André Weber, philosopher, for his insight concerning scientific epistemologies).

182 Lorraine Daston and Peter Galison, *Objectivity*, op. cit., chapter "Objectivity without Images," p. 253 – 262. Quote p. 261.

183 Ibid.

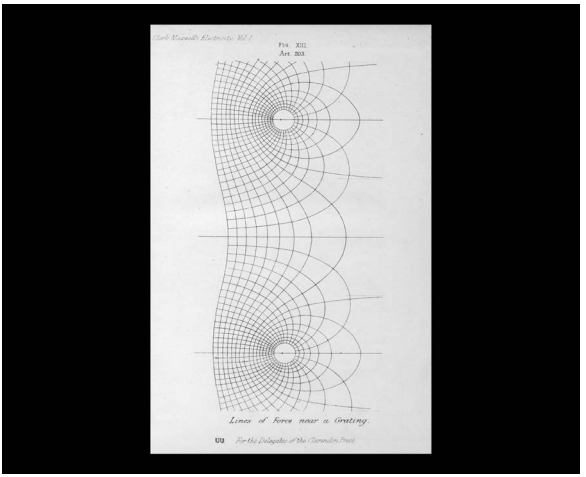

Fig. 139: James Clerk Maxwell, *A Treatise on Electricity and Magnetism,* Vol. 1, Oxford, Clarendon Press, 1873: *Lines of Force near a Grating* (fig. VIII, Art. 203)

The *Zycles*, unlike previous series by Ruff, solely rely on digital technologies, as no trace – even residual – of captured images constitutes the final photograph. Technically, Ruff has extruded 3D models from these two-dimensional images with a very common 3D modeling program, Maxxon's Cinema 4D.[184] With the software, primarily used for product design, architectural renderings or animation, Ruff produces a three-dimensional mesh of spline curves, which suggest volume and perspective. Such vector drawing integrates mathematical data, which allows generating and modifying a curve according to pre-set values, a result that couldn't be drawn manually. The result could be compared to ballistic curbs, modulated according to certain values, in that case gravity. If Ruff's models do not correspond to any physical reality such as an electromagnetic field, they nevertheless are submitted – to a certain extent – to mathematical laws, whose execution is automated by the software. 3D modeling software integrates numerous mathematical and physical parameters, which simulate the behavior of an object in real life, such as gravity. More elaborate software such as Autodesk's 3DS Max even calculates the "real" lighting conditions according to geographical data, daytime and time of the year.[185]

Formally, there are four sub-series in the *Zycles*, according to used colors, formats and types of curves. An important amount of the 2008 images combine black, green, yellow and red curves on a white background, using rectangular image formats. A few square formats, mostly realized in 2009, are bi-chromatic. They use only one plain color (yellow, violet, black) on black or white background (e.g., *Zycles 6024*). These sub-series can further be classified according to the two types of drawn lines: while examples such as *Zycles 6024* or

184 See interview of Thomas Ruff by Gabriele Naia, "Thomas beyond the Surface," op. cit.
185 Luminosity, light intensity, angle of sun rays, etc.

Zycles 7044 predominantly use single lines,[186] the other set combines single lines with aggregates of ten to twenty parallel lines (e.g., *Zycles 3061*), whose shapes are more overtly reminiscent of Maxwell's etchings (see Fig. 139) – and thus reflect more explicitly scientific imagery. Even though the series is based on the concept of cycloid, a specific type of curves, Ruff has also experimented with straight lines articulated by angles, which thus calls to mind fractal structures rather than curves. If the two-year span is too short to allow a systematic analysis, it can still be advocated that 2008 images are rather polychromatic, rectangular, with single and multiple curves, while 2009 photographs rather use square image formats, bi-chromatic patterns and single lines only, three characteristics which appeared in 2009. Initial inspiration of the Maxwell models seems to be somehow fading in 2009, the visual concept autonomizing itself gradually.

	30xx (70xx)	40xx	60xx	80xx
2008	●			
2009	●	●	●	●
Rectangle	●		●	●
Square		●	●	
Monochromatic Lines	●	●	●	
Polychromatic Lines	●			●
Single Lines	●		●	
Multiple Lines	●	●		
Angular Lines				●
Black Background		●		
White Background	●		●	●

Fig. 140: Typology of titles in *Zycles* series

These various formal features are interestingly reflected in the four-digit title typology, as shown in the figure above: the work groups are defined by a certain number of variables – date (2008 or 2009), image format (rectangle or square), color of lines (only single color or multiple colors), types of lines (single, multiple or angular) and background (black or white) – whose expression is reflected in the titles. The first two digits of the 30xx, 40xx, 60xx and 80xx sub-series, inform about the formal construction. The second two-digit part of the title uses numbers ranging from one to ninety-nine, identifying each photograph. The same digit is never used twice (i.e., *Zycles 3099* and *Zycles 4099*). It evolves chronologically in the four sub-series, which gives a maximum of one hundred possible photographs; twenty-five could be identified (see Fig. 141).

186 *Zycles 7044*, 2008 is displayed on the website of one of Ruff's three galleries (Mai 36, Zurich) and in the catalogue of the 2013 Haus der Kunst, Munich exhibition. It corresponds in all points to the 30xx series, but is the only example of title not fitting into the overall typology. *Thomas Ruff. Works 1979 – 2011*, op. cit., p. 226–237.

	2008	2009
3000 series (7000)	3041, 3042, 3045, 3048, 3050, 3052, 3054, 3060, 3061, 3065, 7044	3075, 3078, 3080, 3085, 3090
4000 series		4020, 4070, 4078, 4072, 4080
6000 series		6021, 6024, 6033
8000 series		8022

Fig. 141: List of works of *Zycles* series by date

Ruff's title methodology as such doesn't inform much about the series, but it exposes a very systematic methodology, which can be associated to scientific taxonomies. Its four-digit title system calls to mind Jörg Sasse's *Speicher I* (also 2008) although he generates them digitally with algorithms, while Ruff coins them according to certain pre-set criteria. The various categories of color schemes and curve types produce Ruff's most "mathematical" series, although the concept of a sub-categorization based on formal criteria can be found in earlier works: the *Sterne* series (1989 – 1992) uses a complex taxonomy – reproduced by Matthias Winzen in Ruff's 2001 monograph[187] – dividing the series into six categories, according to the type of celestial bodies visible in the photograph:

1 Record of foreground stars with normal stellar density in the background
2 Record of foreground stars with higher stellar density in the background
3 Record of foreground stars with other galaxies
4 Record of very remote stars
5 Record of stars with interstellar objects and nebulae
6 Record of the Milky Way with high stellar density

The photographs of the same category are not as easily recognizable as the *Zycles*. However, Ruff clearly applies similar taxonomic strategies; the titles of the *Sterne* use stellar coordinates,[188] which further reflects Ruff's systematic classification endeavor. Although his work is rather uncommonly associated with the Bechers' typological experiments – Ruff does not compare physical objects in the real world – it clearly contains an underlying pattern categorizing visual aspects in the image, which becomes even more clear with the *Zycles*. The *Sterne* categorization corresponds to a certain extent to a physical reality, or the description of what is shown on the photograph. The *Zycles* on the other hand, in which the categories are not explicit, classifies formal features, analyzing the image itself. The classification grid becomes a central feature of the series, an aspect which plays a central role in the

187 Matthias Winzen (ed.), *Thomas Ruff, Fotografien 1979–heute*, op. cit., p. 191.
188 The "stellar equivalent" to longitude and latitude. See skyview.gsfc.nasa.gov, accessed on June 26, 2018.

jpegs as well. In this case, the image typology itself becomes the object of the series, while in the *jpegs* a referent remains.

Fig. 142: Cory Arcangel, *Photoshop CS: 84 by 66 inches, 300 DPI, RGB, square pixels, default gradient, «Blue, Red, Yellow» (turn reverse off), mousedown x=4000 y=5350, mouse up x=20000 y=1200*, 2011 (212.7 × 141 cm)

Objectivity and abstraction

Besides its aesthetic features, the *Zycles* chiefly addresses two specific epistemological questions, merging in their formal expression: the series reflects upon Ruff's interest for the history of images in scientific thought and examines contemporary concerns addressing the limits of photographic representation. To which extent can generated 2D and 3D models still be considered photographic, and which parameters ought to be considered to sketch out an answer to such question? In order to highlight the importance of a contextual reading of such projects, a comparative example using similar technologies might be revealing. Cory Arcangel's image (see Fig. 142), the outcome of a single mouse stroke in Photoshop – the values defining the image are pre-determined (and reflected in the title of the work) –, is not considered a photograph. But it is less for technical reasons than for its contextual and institutional inscription: even though the status of the *Zycles* is interrogated by Ruff's historiography, because of the series' technical origin and its materiality (pigment print on canvas), he is commonly considered a photographer. Arcangel's background is based on mainstream Internet and digital culture – he appropriates game consoles or YouTube videos –, so his digital image is not perceived as a photograph. Yet Ruff's use of canvas instead of the common Diasec c-prints indicates that he clearly aims at re- or de-contextualizing his images from a specific photographic context. There is no technical reason to produce an inkjet print on canvas rather than on a c-print. But at this point, an assessment of the "photographic" nature of these images remains outstanding. The three-dimensional construction also plays a central role in the series. The

digitally generated images, which are most likely accepted – or mistaken – for photography, are hyperrealist architectural renderings, because they reconstruct the concept of the camera obscura. The image is "taken" from a set point of view, which simulates photography's transparency, which its claim for veracity or objectivity has been derived from. If on a conceptual level the *Substrates* and Ruff's oeuvre address two-dimensional images and their architecture, the *Zycles* paradoxically reconstruct a 3D space in order to re-evaluate photography through its original defining feature: the equivalence between the three-dimensionality of the physical space and the modeling in a 2D image of that 3D space. With that radical rapprochement, Ruff emphasizes the fact that photographic capture – despite the idea of imprint or the supposed acheiropoietic nature of the medium – might be a sheer modelization.

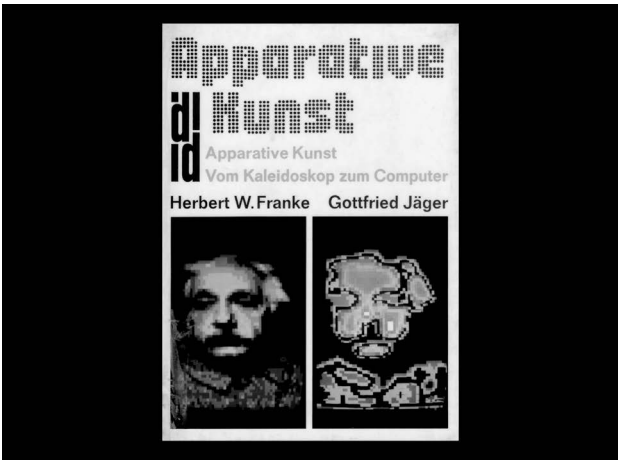

Fig. 143: Cover of Herbert W. Franke and Gottfried Jäger, *Apparative Kunst*, 1973

This particular stance appears in Ruff's *Photograms* (2012 – 2014) series,[189] inspired by two Art Siegel photograms of his private collection. The computer-generated images reinterpret the famous art historical model, using 3D software to recreate a virtual studio setup with paper, objects and camera.[190] Such experimental proceedings echo as much epistemological concerns addressing the histories of (mechanical) representation as philosophical interrogations discussing the possible relationships between reality and its visual formalization, providing numerous leads for the interpretation of Ruff's oeuvre in doubtlessly forthcoming historical studies.

189 See Michael Famighetti, "Thomas Ruff. Photograms for the New Age," *Aperture*, Summer 2013, p. 84.
190 Ibid.

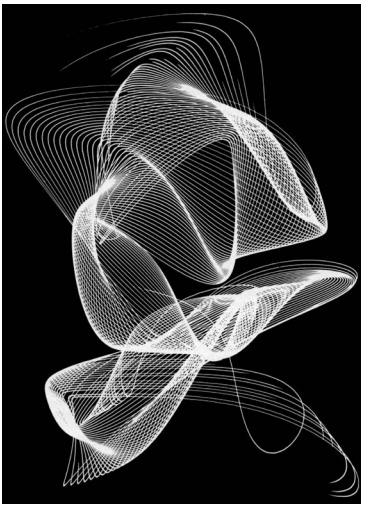

Fig. 144: Illustration of *Apparative Kunst* (Peter Keetman, *Schwingungsfigur* 995, 1949), p. 38

An alternative genealogy

The *Zycles* series, based on curves generated by a computer program, is commonly interpreted in relationship with Maxwell's visual models of electromagnetic fields. The connection with the history of scientific imagery seems legitimate, but the confrontation with another model proves productive, particularly if considering its circulation. Generated visualizations based on mathematical models show evident formal and conceptual meetings point with Ruff's series. Peter Keetman's *Schwingungsfigur*, for example, created in 1949, constitutes the photographic predecessor of Thomas Ruff's *Zycles* (Fig. 136) and suggests yet another photohistorical relationship with photographic representation. Keetman's illustrations are images of revolving light sources, embodying the movement of Lissajou's curves, described for the first time by French physicist Jules Lissajous (1822 – 1880). To create his images, he attaches light sources to an oscillating metal rod strapped to a moving gramophone and captures the resulting curves with a conventional camera.[191] Ruff's and Keetman's "generated" images are formally and conceptually similar: both address the visualization of mathematical formulas in order to create abstract, visually interesting images. But more than the connection between both photographers or sets of images, it is a specific context in which Keetman's work was displayed that is interesting in regard to the genealogy of digital generative processes. His project is featured in one of the earliest publications on digital art in Germany, *Apparative Kunst*, published in 1973 by Gottfried Jäger and Herbert W. Franke (Fig. 143).

191 See Herbert W. Franke and Gottfried Jäger, *Apparative Kunst: Vom Kaleidoskop zum Computer*, op. cit.

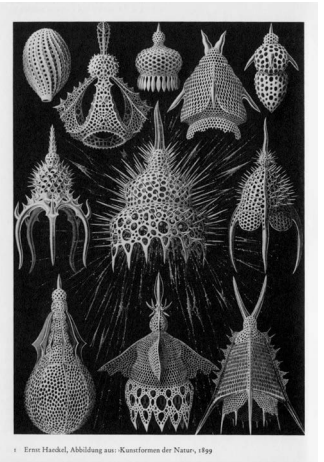

Fig. 145: Illustration of *Apparative Kunst* (Ernst Haeckel, *Kunstformen der Natur*, 1899), p. 18

Jäger, key artist-theorist of the "*generative Fotografie*," a movement of abstract photography focusing primarily on mechanical or chemical generation processes,[192] co-signed the book with Franke, a physicist, science-fiction writer and early digital artist. The book surveys various historical models of science, photography and the intersection of both (e.g., Muybridge, Marey, etc.), in order to establish the process computer-generated art might be based upon. Its search for formal models in nature for example, exemplified through Ernst Haeckel's *Kunstformen der Natur* (1899, e.g., Fig. 145), is reminiscent of Karl Blossfeldt's Urformen der Kunst (1929). What could be called the *Urformen der Computer Kunst* in the context of a publication of the sources of generative processes ironically connects the history of computing with the history of Düsseldorf. But above strictly contextual connections or common references, more concrete examples show a proximity between Düsseldorf and computer art in the German context, on a formal and aesthetic level.

192 The main protagonists of the "*generative Fotografie*" besides Jäger are Hein Gravenhorst, Kilian Breier and the Belgian artist Pierre Cordier, who exhibited together at the Kunsthaus Bielefeld in 1968. See especially Anaïs Feyeux, "La *Generative Fotografie*. Entre démon de l'exactitude et rage de l'histoire," *op. cit.* and *Generative Fotografie*, exhibition catalogue, Bielefeld, Städtisches Kunsthaus, 1968.