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PLASTICITY: CONTAGIOUS CODES AND ALGORITHMIC VISIONS

The future is there ... looking back at us.
Trying to make sense of the fiction we will have become.¹

William Gibson's observation here could also have been made by artist Sterling Crispin of his *Data-Masks* (2013–2015; fig. 54), a series of six 3D printed face masks caught in a strange state of metamorphosis. The ghost-like and fictitious-looking visages are generated from face recognition, detection software, and genetic algorithms. They reveal how surveillance software systems perceive and construct our identity. Crispin, who initially trained as a painter at Rocky Mountain College of Art and Design, gradually extended his practice towards hybrid sculptures, investigating digital technology's form, function, and agency and its interfaces with human and non-human bodies. In his work *Data-Masks*, the artist and technologist has reverse-engineered surveillance technology to algorithmically render sculptural objects. Following complex digital translation and modelling processes, the final presentation takes the form of masks installed at eye level in front of a mirror. In Crispin's work, face detection and recognition algorithms have dissolved the solidity of human features into form-shifting, grotesque-looking data doubles. Redeeming the prognosis of Cayce Pollard, the female protagonist in Gibson's novel *Pattern Recognition*, whose story unfolds against the backdrop of a society marked by rising mass surveillance, these strange masks seem to be 'looking back at us'.² They thereby project 'the fiction we [have already] become' in the gaze of machine vision and surveillance technology.³

Sterling Crispin's *Data-Masks* are representative of a sculptural aesthetic also seen in the works of artists such as Zach Blas, Jon Rafman, Quayola and Oliver Laric. The artists digitize, archive, reference, rework, fragment, and/or reassemble emblematic art-historical references through the lens of algorithms, custom-made software, and digital prototyping technology. Their practices thus share and revise previous engagements with the Western sculptural canon in digital terms. In their artworks, the analysis and subsequent recombination of data through algorithmic commands embodied in code generate plastic form. Such plasticity doubles with a physical counterpart when their works are materialized via digital prototyping technologies.

1 William Gibson, *Pattern Recognition* (London: Penguin, 2003), 57.

2 Gibson, *Pattern Recognition*, 57.

3 Gibson, *Pattern Recognition*, 57.

The second part of this book aims to investigate the plasticity educed by contemporary sculptural practices employing digital technology. In recent artistic production, such plasticity arises in both physical and digital realms and between the material and seemingly immaterial worlds. Following its etymological roots, plasticity is negotiated as a phenomenon of the mutable, malleable, and ductile.⁴ This understanding is tied to the word's origin in the ancient Greek *plassein*, which described the moulding and forming with soft and mutable matter as well as the act of moulding a person through practice and education.⁵ Some sources further suggest a reading of *plassein* as fabricating, forging, lying, or contriving.⁶ The formal-technical terms *plastike techne* or *ars plastica*, meanwhile, designated modelling with clay, wax, and sometimes even ore.⁷ In Hellenic art literature *plastike* was established as an umbrella term for clay modelling, sculpting, casting, and carving.⁸ Hellenic culture, however, did not propose a systematic categorization or historical contextualization of the term, despite the fact that its development was from the onset determined by reflections on contemporaneous processes of production. Today, the word 'plastic' appears in various contexts, including technological, medical, and philosophical discourses. This text, however, uses 'plasticity' in its art-historical formulation. While English-speaking scholarship today still discusses plasticity mainly as a term of a formal-technical nature rooted in the word's etymology, German discourse has established plasticity as an important aesthetic term in light of German Romanticism. The text thus carefully unfolds and locates the significance of plasticity for recent object-making between different language horizons and academic worlds.

How are the digital and the physical, the virtual and the actual, the material and the immaterial bound together in Crispin's work? How do these relationships build on and transform existing notions of plasticity? How do these altered regimes reflect back at us, at the way our body enters the work and the materiality used to convey human form? Or, in Gibson's words, how to 'make sense of the fiction we will have become'? Such questions around plasticity, process, and materiality determine the problems this section attempts to answer.

To that end, I will examine the plasticity of Crispin's work within three horizons of investigation. Chapter 2.1 ('Contagious codes: Reworking the art-historical software') opens with a close reading of Crispin's *Data-Masks* followed by an inquiry into historical debates on plasticity. In light of the work's aesthetic features deriving from genetic, self-evolving algorithms, plasticity is invoked as a category closely (indeed, quintessentially) associated

4 See Christina Dongowski, 'Plastisch' [Plastic], in Karlheinz Barck et al. (eds.), *Ästhetische Grundbegriffe: Historisches Wörterbuch in sieben Bänden* [Foundational concepts in aesthetics: Historical dictionary in seven volumes] (Stuttgart: J.B. Metzler, 2010), 815; Rübel, *Plastizität* [Plasticity].

5 Dongowski, 'Plastisch' [Plastic]; 815.

6 Dongowski, 'Plastisch' [Plastic]; 815; Ulrich Pfisterer, 'Plastisch/Malerisch' [Sculptural/painterly], in Ulrich Pfisterer (ed.), *Metzler Lexikon Kunstwissenschaft: Ideen Methoden, Begriffe* [Metzler dictionary of art scholarship: Ideas, methods, terms], 2nd edn (Stuttgart: Metzler, 2011), 340.

7 See Alice A. Donohue, *Greek Sculpture and the Problem of Description* (Cambridge: Cambridge University Press, 2005), 63.

8 See Pfisterer, 'Plastisch/Malerisch' [Sculptural/Painterly], 342.



54 | Sterling Crispin, *Data-Masks*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm (each). Installation view, ZKM Karlsruhe, *GLOBALE: Infosphere*, Karlsruhe (Germany), 2015.

with material agency, the taking of, creating, and giving birth to form.⁹ This understanding follows the etymological origins of the word ‘plasticity’ but is also closely linked to a modern sculptural tradition. Here plasticity was thought to foreground the polymorphic properties of an artistic material, its intrinsic energy, and its concrete material presence.¹⁰ To this end, the first chapter compares selected works by Medardo Rosso (1858–1928, born in Turin, Italy) and Auguste Rodin – conceptualized through writings on the ‘liquid modern’ by Julius Meier-Graefe, Max Osborn, and Georg Simmel – to Crispin’s *Data-Masks* and works by his peers Jon Rafman and Zach Blas.¹¹ Highlighting aesthetic, conceptual, and discursive parallels, this section demonstrates that the perceived novelty in sculptural approaches that utilize algorithmic systems can be connected to both the modern sculptural tradition and historical techniques of fabrication. By identifying both parallels and discontinuities, this

9 See Dongowski, ‘Plastisch’ [Plastic], 815.

10 See Rübel, *Plastizität* [Plasticity], 32.

11 Dietmar Rübel proposes the terminology of the liquid modern in his book *Plastizität* [Plasticity]. It is, however, difficult to determine whether this term appears in historical writings. See Rübel, *Plastizität* [Plasticity], 39.

chapter posits a digital plasticity that connects to and simultaneously reconfigures prior art-historical dialogues.¹²

After Crispin's and his peers' work has been placed in context with the past, chapter 2.2 ('A sea of noise: Liquid phantasies and digital matters') will develop an appropriate understanding of materiality, which forms the foundation for the digital plasticity of recent sculptural production. Moving beyond debates on digital objects and their im/materiality, the chapter illustrates how code is being reconsidered in contemporary art production as both an artistic material and mutable matter. Finally, chapter 2.3 ('Algorithmic visions: Towards a digital plasticity') builds upon debates surrounding digital materiality, tracing the mutability and materiality of code from discourses on parametric architecture and early algorithmic and computer art to 1990s digital sculpture.

By mapping how digital plasticity has shifted throughout the decades, the section enables a comparison between the work of Crispin and his peers and the works of the early pioneers of digital art, particularly early digital sculpture.¹³

Crispin's interest in surveillance technology was sparked by Edward Snowden's leaks of classified NSA files in 2013. Snowden's disclosures revealed the shocking implications of several secret treaties signed by members of the UK/USA intelligence community in the efforts to implement a global surveillance network. This chapter closes by examining the digital plasticity of the works by Crispin and his peer group as symptomatic of our current moment. Crispin's work and the military-industrial complex use the same software and hardware; given this repurposing, the chapter locates digital plasticity as an integral part of our contemporary architectures of power, so familiar and yet so invisible, seemingly neutral and yet inherently political.

The act of pattern recognition, as vividly evoked in Gibson's novel, thereby not only represents the underlying mechanism of machine vision software employed in Crispin's *Data-Masks*. Rather, 'pattern recognition' also describes the working maxim for this second chapter. Motivated to recognize and understand the repeating, evolving, and dissolving patterns in recent sculptural production, the following study aims to establish connections between historical advancements in plasticity and materiality and their contemporary counterparts. The artistic patterns identified in the works of Crispin and his peer group thus become the visual indicator of the otherwise invisible plasticity of the technological system, the uncanny architecture of our moment and its evolving codes. Crispin's *Data-Masks* give a face to a future that is already here. It is a future filled with objects 'looking back at us' and uncannily scrutinizing us, trying to make sense of the fiction we shall soon have become.¹⁴

12 See in this context also Mara-Johanna Kölmel, 'Digitale Plastizität/Digital plasticity', in Elke aus dem Moore and Jandra Böttger (eds.), *Vibration der Dinge: 15. Triennale der Kleinplastik Fellbach* [Vibration of things: 15th Fellbach triennial of small-scale sculpture] (Berlin: Archive Books, 2022), 222–229.

13 For further reading on the plasticity of digital sculptures see also Ursula Ströbele, 'Memory activism: Plasticity of digital sculptures', *Philosophy Kitchen – Rivista Di Filosofia Contemporanea* 22 (2025), 165–179. <https://doi.org/10.13135/2385-1945/12034>.

14 Gibson, *Pattern Recognition*, 57.

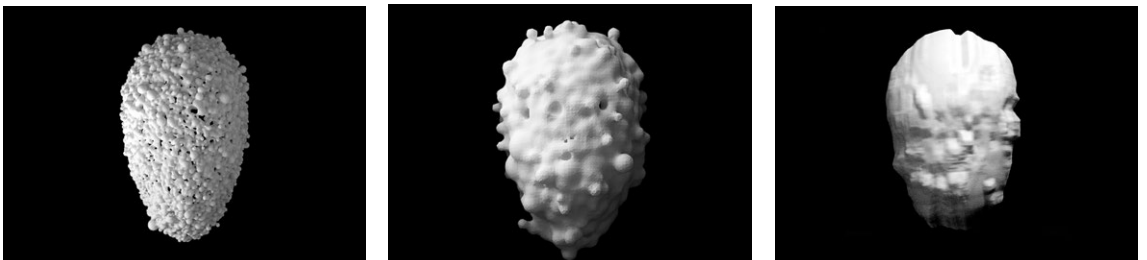
2.1 Contagious codes: Reworking the art-historical software

This chapter's point of departure is Sterling Crispin's series *Data-Masks*. Through a close reading of the visual-tactile qualities of his installation and its production processes, the chapter lays out an understanding of sculptural plasticity driven and deeply imbued by algorithmic processes. Technologically, Crispin's algorithmic systems are linked to biometric and surveillance technology and their potential to capture, classify, and render human form. Do his objects and those of his peers therefore relate differently to the concept of plasticity than did the works of his predecessors? In the artworks and writings of the 'liquid modern,' plasticity is invoked as a category closely associated with material agency, flexibility, pliability, and a given material's potential to evolve. That re-formulation of plasticity in modern sculpture foreshadows aspects of the plasticity which is at work in Crispin's pieces with genetic, agential and self-evolving algorithms. 'Contagious codes: Reworking the art-historical software' develops an art-historical foundation against which to compare the plasticity of recent objects, paving the way for a subsequent investigation into how Crispin and his peers conceive of materiality.

The text will not only use a contemporary perspective to address historical constellations unfolding around questions of material agency, plastic power, and human depictions, but also encourage alternative readings of recent artistic practices in light of their historical precursors. Positioning contemporary works within a historical perspective not only helps uncover discursive, conceptual, and aesthetic parallels to earlier understandings of plasticity but also qualifies the rhetoric of the 'new' which so often accompanies technological developments within contemporary art discourse.

Facing the mask, unmasking the face

Sterling Crispin's work *Data-Masks* (fig. 54) is composed of six amorphous and at times anthropomorphic white objects. The hollow oval shapes are mounted at eye level on six uniformly spaced wall-mounted mirrors. The serial installation, suspended between object and image, directs the gaze of the spectator. As you move along the displayed screens, the oval objects come to life in a sequence of perpetual morphosis.



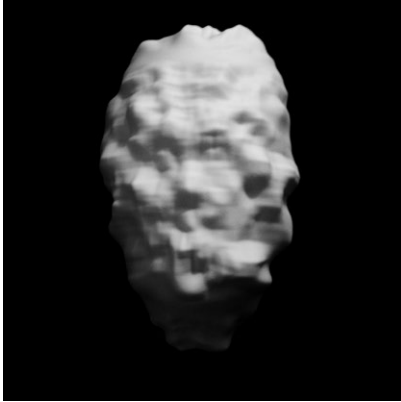
55, 56, 57 | Sterling Crispin, *Zuck Blister*, 2013–2015; *Kodama*, 2013–2015; *Void*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm.



58 | Sterling Crispin, *Chronos*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm.

Like individual film stills, the works capture particular states of an evolving form. Hovering between liquid and hardened states, tectonic or cellular structures, and geological and biological formations, each object carries its particular features and title. While *Zuck Blister* (2013–2015; fig. 55) appears like a meshwork of coral, *Kodama* (2013–2015; fig. 56) is poised between a reef-like underwater formation and a glimpse into the molecular structure of a virus. Round protrusions, reminiscent of drops or spheres, define the object's surface. It appears to be in a state of dissolution. In *Zuck Blister*, a natural appearance with references to marine biology prevails. *Kodama*, however, qualifies its natural appearance with an industrial, grid-like imprint coating the shape's surface.

Pixelated interfaces or a voxel terrain used to generate landscapes in 3D simulations come to mind. *Void* (2013–2015; fig. 57) and *Chronos* (2013–2015; fig. 58) follow the established aesthetic but also expand the visual references towards the domain of medical imaging technology. The arched and wavy surfaces of the two objects bear ghastly face-like features. In *Chronos*, an indentation on the level of the viewer's left eye appears like an eye



59 | Sterling Crispin, *Até*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm.



60 | Sterling Crispin, *Sobek*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm.

socket complemented by a nose-like elevation and a mouth-like indentation, so that the piece suggests a skull or an ultrasound image.

In *Até* (2013–2015; fig. 59) and *Sobek* (2013–2015; fig. 60), references to anthropomorphic forms have evolved towards geological and tectonic structures resembling the surface of a foreign planet, rock strata, or a topographic map of unknown territory. The objects' cool and distanced formal language is reinforced by the mirrors on which they are mounted, bestowing upon the works the impression of floating weightlessly on a liquid surface. The mirrors insert the viewer's upper body into the works. It places us in close bodily proximity to the exhibited objects, creating a moment of seduction and unease (fig. 61).

If one is positioned directly in front of the serial installation, the objects become masks covering the spectators' faces. Each mask is generated from genetic face detection and recognition algorithms, named after an animalistic deity, and then mounted on a mirror.

Chronos, the personification of time; *Até*, the goddess of mischief; and *Void*, the first primordial deity born from the cosmic void of Chaos, relate to Greek mythology. *Kodama*, a Japanese tree spirit, is also the name of the inventor of early 3D printing 'stereolithography'; and *Sobek* is the Egyptian crocodile god of strength and power. As *Zuck[erberg] Blister*, the pseudo-god of our present complements these five. By superimposing the spectator's mirror image on one of the six masks, the artist creates a tension between self and external perception. The masks invite communication but also create distance. The media theorist Erhard Schüttzel contextualizes such an experience when he remarks that masks historically either sided with a society or were seen to be opposed to society. On the one hand, masks linked to people and their societal role acted out against the inimical other, as Schüttzel examines them in relation to 'nature'.¹⁵ On the other hand, masks also took the side of a mag-

15 See Erhard Schüttzel, 'Medium Maske: Ein Kommentar zu Claude Lévi-Strauss' [The medium of the



61 | Sterling Crispin, *Chronos*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm.

ically imbued 'nature' in opposition to a 'society'.¹⁶ The mirror, meanwhile, stages and negotiates the encounter between the familiar self and the unfamiliar other. In this double-play of consolidation and contrast, Crispin also plays on the dialectic of the mask, which is often described as both 'revealing and hiding'.¹⁷ He thereby affirms the mask's most 'fundamental meaning', namely its close connection to the face.¹⁸ While Crispin's *Data-Masks* cover our faces, they also become faces. The mask can be both experienced as protection of the face from an invisible surveillance system or as its precise embodiment. It begins to function as

mask: A commentary on Claude Lévi-Strauss], in Ulrich van Loyen, Michael Neumann, Frank Böckelmann, and Walter Seitter (eds.), *Tumult 31: Gesichtermoden* [Tumult 31: Facial fashions] (Berlin: Alpheus Verlag, 2006), 54.

16 See Schüttpelz, 'Medium Maske' [The medium of the mask], 54.

17 Richard Weihe, *Die Paradoxie der Maske: Geschichte einer Form* [The paradox of the mask: History of a form] (Munich: Wilhelm Fink Verlag, 2003), 13. Translation by Mara-Johanna Kölmel.

18 Hans Belting, *Faces: Eine Geschichte des Gesichts* [Faces: A history of the face], 2nd edn (Munich: C. H. Beck, 2014), 13.

62 | Sterling Crispin,
Chronos, 2013–2015;
 3D printed nylon, mirror,
 facial recognition and
 detection algorithms,
 genetic algorithms;
 46 × 66 cm.
 Installation view, ZKM
 Karlsruhe, *GLOBALE:*
Infosphere, Karlsruhe
 (Germany), 2015.



a mediating third term, as face and mask simultaneously, making us spectators and actors alike (fig. 62).

In Crispin's *Data-Masks*, mask and face coincide. His work thus reminds us of a long historical trajectory in which the two were never purely antitheses but acted as stand-ins for one another. As Richard Weihe points out, the Greek word *prósōpon* literally means 'that which is vis-à-vis the eyes (the other)' and does not distinguish between 'natural and artificial face'.¹⁹ The equation of the mask with the face, as in the cult and theatre of Greek antiquity, created a prosopic unity of face and mask which Crispin's work plays on.²⁰

Similar historical antecedents are conveyed in the word 'person', which derives from the Latin word for mask, *persona*.²¹ In contrast to Ancient Greeks, however, Ancient Romans distinguished between *persona* (mask), *facies* (face), and *vultus* (mien).²² In the modern era, this literary equation was slowly replaced by 'mask' and 'person', leading to the *homo duplex*. This model of the human combined nature and cultural techniques in the idea of the self as a role, as Weihe has highlighted.²³ As early as the Enlightenment the common pictorial char-

19 Weihe, *Die Paradoxie der Maske* [The paradox of the mask], 35 and 27. Translation by Mara-Johanna Kölmel.

20 See Weihe, *Die Paradoxie der Maske* [The paradox of the mask], 13.

21 'Person', *Oxford English Dictionary* online, https://www.oed.com/dictionary/person_n?tab=factsheet#30948551, accessed 13 December 2024.

22 'In the fact that the term 'person' derives from the mask, from the Latin *persona* – though unlike the Greeks, the Romans did distinguish between *persona* (mask) and *facies* (face) and additionally used *vultus* (mien) – etymology and terminological history reveal a fascinating array of interrelationships and tensions. Sigrid Weigel, 'Das Gesicht als Artefakt: Zu einer Kulturgeschichte des menschlichen Bildnisses' [The face as artefact: On a cultural history of the human image], in Sigrid Weibel (ed.), *Gesichter: Kulturgeschichtliche Szenen aus der Arbeit am Bildnis des Menschen* [Faces: Cultural-historical scenes from the work on the image of the human being] (Munich: Wilhelm Fink Verlag, 2013), 9. Translation by Mara-Johanna Kölmel.

23 See Weihe, *Die Paradoxie der Maske* [The paradox of the mask], 349.

acter and history of the face and the mask were denied: The face represented an 'image of the self', whereas masks were the 'counterfeit self'.²⁴

With facial detection and recognition technology, on the other hand, living faces are captured in time, creating frozen features that once again come to stand for a permanent representation of a person, as in the prosopic unity of Ancient Greek drama. In accordance with the reading of art historian Hans Belting, face and mask can be understood as images that appear on various surfaces – on natural skin or wood or printed nylon. In the case of Crispin's work, surveillance images are thus masks used to generate further masks that are then mounted on mirrors. It is a similar observation that leads Belting to argue that the history of the face is always already a record of masks that depict faces without being faces.²⁵ Alluding to this double-play, Crispin replaces the canvas, typically the portable medium of the depicted face, with a mirror to stage the encounter between multiple perceptual regimes and spheres of agency. The mirror thereby functions as a threshold both distancing and superimposing the human spectator and the technologically generated artefact. The viewer is caught between algorithmic and human agency, human and machine vision, and human face and data-mask.

Crispin's play of reflections enables us to perceive ourselves and the observed counterpart as if from a distance and thus be implicated in a complex nexus of relations. Our sight is blocked and reciprocated by an object embodying the mechanism of facial recognition and detection technology. In the face of the technological other, we are reminded that what constitutes our identity has come under question. Echoing the myth of Narcissus, the mirror in European cultural history serves as a metaphorical tool for contemplating how it (or, in a symbolic understanding, art) reflects the world and the legitimacy of this mimetic ideal.²⁶ Throughout the centuries, the story of the beautiful boy who tragically falls in love with his self-image has become a site to negotiate questions of identity, (self-)knowledge, desire, rejection, and self-delusion.²⁷ One could identify our present-day fascination with screens as another variation of the Narcissus myth, a twist on the cultural appropriation and interpretation of Ovid's complex story. If Narcissus is intrigued by the seemingly foreign, apparently three-dimensional and yet fatal images produced by the water's mirroring surface, so are we by the promise of technology. According to media theorist Marshall McLuhan, the myth of Narcissus can be read as the primal scene of the media experience. The promise and peril of Narcissus falling in love with his own self-image and, therefore, experiencing a delusion, as argued by McLuhan, permeate our relationship with (digital) technologies. In 'The gadget

24 Belting, *Faces*, 27.

25 See Belting, *Faces*, 27.

26 See on this topic Miranda Anderson (ed.), *The Book of the Mirror: An Interdisciplinary Collection Exploring the Cultural History of the Mirror* (Cambridge: Cambridge Scholars Publishing, 2007).

27 For an overview of the various facets of the myth of Narcissus throughout its history of reception see Almut-Barbara Renger, 'Vorwort: Narcissus "Selbsterkenntnis" und "Liebe als Passion": Gedankengänge zu einem Mythos' [Preface: Narcissus's 'self-knowledge' and 'love as passion': Thoughts on a myth], in Almut-Barbara Renger (ed.), *Narcissus: Ein Mythos von der Antike bis zum Cyberspace* [Narcissus: A myth from antiquity to cyberspace] (Stuttgart: Verlag J. B. Metzler, 2002), 2–6.

lover: Narcissus as narcissis', the fourth chapter of his seminal book *Understanding Media: The Extensions of Man* (1964), McLuhan writes:

The Greek myth of Narcissus is directly concerned with a fact of human experience, as the word Narcissus indicates. It is from the Greek word narcosis or numbness. The youth Narcissus mistook his own reflection in the water for another person. This extension of himself by the mirror numbed his perceptions until he became the servomechanism of his own extended or repeated image. The nymph Echo tried to win his love with fragments of his own speech, but in vain. He was numb. He had adapted to his extension of himself and had become a closed system. Now the point of this myth is the fact that men at once become fascinated by any extension of themselves in any material other than themselves....²⁸

In his self-reflection, Narcissus imagines a three-dimensional space. Due to an intense focus on his sense of sight, as McLuhan argued, Narcissus mistakes the flat mirror image for a three-dimensional depth. Indeed, 'he loves a bodiless dream. He thinks that a body, that is only a shadow,' Ovid writes.²⁹ For the myth and media thinker McLuhan, Narcissus is therefore the prototypical recipient.³⁰ Stunned and intoxicated by the water's surface, Narcissus demonstrates above all the effectiveness of media. Crispin's use of the mirror redeems media, however, unfolding itself between seduction and perception. By superimposing the spectator's mirror image with a mask or face produced through the mechanisms of machine vision, the mirror enforces the duality of self-observation and surveillance, the tension between self and external perception.

According to McLuhan's well-known formula, the medium is the message insofar as it transforms the self into the 'media-like' other. At the same time, it allows the other to identify with the self. Crispin stages precisely such an encounter with his *Data-Masks*. He employs face detection and recognition algorithms to dissolve and adapt the solidity of human features to create form-shifting, grotesque-looking data doubles. At this point, however, the spectators are unaware that Crispin has generated his *Data-Masks* using data from individual faces – one of which could be their own. As such, his masks are extensions of human beings. Just like Narcissus mistakes his counterpart in the mirror for a stranger, viewers do not initially recognize themselves in Crispin's technology. Instead, the viewer glimpses a supposedly strange being. As McLuhan argues in *Understanding Media: The Extensions of Man*, what remains unrecognized is the fact that media technology determines the human as much as natural organs do. All media cognition, therefore, relies first and foremost on a misunderstanding of the media. Which medium could be more suitable to verify such observation than a mirror with its inherent ambiguity oscillating between semblance and being? Crispin's *Data-Masks* stage us as profoundly entwined within the plasticity of a technological sur-

28 Marshall McLuhan and Lewis H. Lapham, *Understanding Media: The Extensions of Man* (Cambridge, Massachusetts: MIT Press, 1994), 41.

29 Ovid, *Metamorphoses*, tr. A. S. Kline (Ann Arbor, Michigan: Borders Classics, 2004), 410.

30 See Thomas Wegmann, 'Erkennen und Verkennen. Der mythische Narziß in der medialen Endlosschleife' [Recognizing and misconstruing: The mythical Narcissus in the infinite loop of media], in Almut-Barbara Renger (ed.), *Narcissus: Ein Mythos von der Antike bis zum Cyberspace* [Narcissus: A myth from antiquity to cyberspace] (Stuttgart: J. B. Metzler, 2002), 168.

veillance infrastructure, whether we recognize it or not. The serial use of the rectangular mirrors in Crispin's installation also points to the work's conception of our experiences in front of, through and mediated by computer screens. The mirror becomes the metaphor for a screen opening up to a virtual space. Like a painting or computer screen, the data-masks are situated in actual space while encapsulating an intangible world enclosed by demarcation. These are screens in 'portrait mode'. We see nothing less than a simulation emerging from an interactive and three-dimensional environment.³¹ Crispin materializes pieces of facial data and makes them visible to us – the mirror is linked to not only the works' conceptualization but also their materialization. As 3D prints, each object has emerged layer by layer from a Selective Laser Sintering process. The mirror stages the slow emergence of the shapes from the virtual realm into actual space, from image to object, from 'within' the screen into our three-dimensional space.

A different kind of plasticity

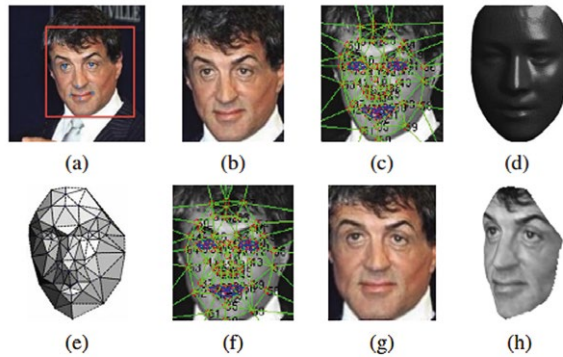
The concept of sculptural plasticity in Crispin's objects refers to more than the literal plastic compound resin used to materialize each digitally conceived object. The concept also points to the object's creation process, in which the plastic form is generated at the intersection of human and algorithmic realms of agency. The artist's production process involves the random generation of images and volumes, methods of measuring face-likeness with facial detection and recognition algorithms, and training those algorithms with the help of databases. In his material staging of those mathematically underpinned procedures, Crispin exploits the typical functioning of Facebook's *DeepFace* software.³²

Launched in 2014, *DeepFace* uses pattern recognition to detect and isolate a face in an image (fig. 63 a–b). It then measures 67 fiducial points describing the location of individual facial features before transposing a generic 3D face shape onto the image plane of the cropped face (fig. 63 c–d).³³ Mapping a simplified model of the face onto the 67 points, the

31 For a detailed account of the relationship between image and screen see Anne Friedberg, *The Virtual Window: From Alberti to Microsoft* (Cambridge, Massachusetts: MIT Press, 2009); Kate Mondloch, *Screens: Viewing Media Installation Art* (Minneapolis, Minnesota: University of Minnesota Press, 2010); Kate Ince, *The Body and the Screen: Female Subjectivities in Contemporary Women's Cinema* (New York, New York: Continuum, 2017).

32 The exploration of facial recognition methods in modern research began in the mid-1990s under the direction of the United States of America's Defense Advanced Research Projects Agency (DARPA). In the early 2000s, military authorities developed FERET, a database comprising tens of thousands of photographs, primarily featuring individuals employed at a military base in Maryland. See W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld, 'Face recognition', *ACM Computing Surveys* 35, no. 4 (December 2003), 399–458, doi: 10.1145/954339.954342; Lucas D. Intra and David Wood, 'Picturing algorithmic surveillance: The politics of facial recognition systems', *Surveillance & Society* 2, no. 2/3 (2004), 177–198; Lucas D. Intra and Helen Nissenbaum, 'Facial recognition technology: A survey of policy and implementation issues', *Social Science Research Network* website (22 July 2009), <https://papers.ssrn.com/abstract=1437730>; Caroline Wilkinson and Christopher Rynn (eds.), *Craniofacial Identification* (Cambridge: Cambridge University Press, 2012).

33 Fiducials are reference points that denote fixed points or lines within a scene. They provide a framework against which other objects can be related or measured.



63 | Alignment pipeline chart illustration. From Yaniv Taigman et al., 'DeepFace: Closing the gap to human-level performance in face verification', 2014 IEEE Conference on Computer Vision and Pattern Recognition (Columbus, OH, 2014).

Figure 1. Alignment pipeline. (a) The detected face, with 6 initial fiducial points. (b) The induced 2D-aligned crop. (c) 67 fiducial points on the 2D-aligned crop with their corresponding Delaunay triangulation, we added triangles on the contour to avoid discontinuities. (d) The reference 3D shape transformed to the 2D-aligned crop image-plane. (e) Triangle visibility w.r.t. to the fitted 3D-2D camera; darker triangles are less visible. (f) The 67 fiducial points induced by the 3D model that are used to direct the piece-wise affine warping. (g) The final frontalized crop. (h) A new view generated by the 3D model (not used in this paper).

software applies the cropped face to the 3D shape as a texture so that it can be rotated to face front or any other view (fig. 63 e–h). As the developers write, its networked architecture is 'based on the assumption that once the (previously described) alignment is completed, the location of each facial region is fixed at the pixel level. It is, therefore, possible to have the algorithms "learn" an individual's facial features from the raw pixel RGB values of their image.³⁴ The verification of a person's identity relies on the summing of pixel values in subsections of an image. The sum of these values is used as a feature set to describe human identity through data (fig. 64). The data set becomes a 'descriptor', a 'classified identity' extruded through the instruments of mathematics and computation.³⁵ The human face dissolved into feature sets becomes input data for *DeepFace*'s multi-layered neural network, which contains more than 120 million parameters for describing a human face. Its interconnected neural nets are modelled and named after the neural circuits of the human brain. Researchers at Google Labs explain the functioning system of neural networks as follows:

We train an artificial neural network by showing it millions of training examples and gradually adjusting the network parameters until it gives the classification we want. The network typically consists of 10–30 stacked layers of artificial neurons. Each image is fed into the input layer, which then talks to the next layer, until eventually the 'output' layer is reached. The network's 'answer' comes from this final output layer.³⁶

34 Yaniv Taigman, Ming Yang, Marc 'Aurelio Ranzato, and Lior Wolf, 'DeepFace: Closing the gap to human-level performance in face verification', 2014 IEEE Conference on Computer Vision and Pattern Recognition, 1701, doi: 10.1109/CVPR.2014.220.

35 Taigman et al., 'DeepFace', 1703.

36 Alexander Mordvintsev and Mika Tyka, 'Inceptionism: Going deeper into neural networks', Google

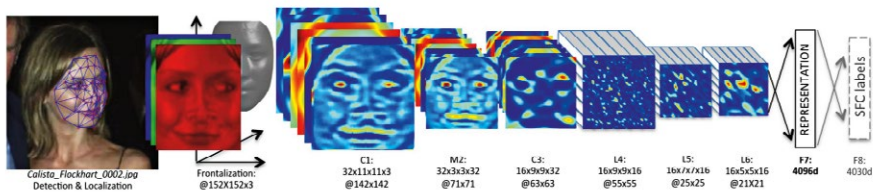


Figure 2. **Outline of the DeepFace architecture.** A front-end of a single convolution-pooling-convolution filtering on the rectified input, followed by three locally-connected layers and two fully-connected layers. Colors illustrate feature maps produced at each layer. The net includes more than 120 million parameters, where more than 95% come from the local and fully connected layers.

64 | Alignment pipeline chart illustration. From Taigman et al., ‘DeepFace: Closing the gap to human-level performance in face verification’.

Once a database of this sparse representation of individuals has been computed, new images can be compared against it, resulting in either a positive or negative verification. For instance, the deep learning architecture of Facebook’s *DeepFace* software can now leverage the labelled datasets extruded from a collection of facial images of billions of Facebook users.³⁷

For the art historian Hans Belting, ‘faces are the body’s witness to the primeval sense of the image.’³⁸ Through the face – which can make faces and thus also functions as a mask – our bodies acquire an ‘iconic quality’.³⁹ It is precisely these iconic – and for Zuckerberg just as much monetary – qualities that contemporary surveillance systems take advantage of in order to capture and classify our identity. Crispin’s *Data-Masks* are an artistic medium for staging a dominant and contemporary perception of our faces as seen by machine vision.

At the same time, data sets function like masks, too. They are never a representation of a real face but are always already symbolic.⁴⁰ They could thus be considered facial ‘exarnations’, a term which in archaeology and anthropology describes stripping a dead body of any flesh so only the bones remain. The data sets, like masks, disembody faces to embody something else, namely a mathematical equation. We are mathematically reincarnated through facial detection and recognition systems based on a constellation between iconographic sign and measured trace. Translated into the feature set, we have quite literally ‘become one with the pixel’, as Hito Steyerl has observed in a different context.⁴¹

‘As the exterior view of a being gifted with affects and emotions’, Sigrid Weigel writes, ‘the face ... has become the condensed image of the *humanum*.’⁴² With the increase of

Research blog (18 June 2015, updated 13 July 2015), <https://research.google/blog/inceptionism-got-ing-deeper-into-neural-networks/>, accessed 13 December 2024.

37 See Taigman et al., ‘DeepFace’, 1703.

38 Belting, *Faces*, 26.

39 Belting, *Faces*, 26.

40 See Belting, *Faces*, 27.

41 Hito Steyerl quoted in Claire Bishop, ‘Technical Difficulties letter in response to Lauren Cornell and Brian Droitcour’, *Artforum* 51, no. 5 (January 2013), 38.

42 ‘Als Außenansicht eines mit Affekten oder Gefühlen begabten Wesens ist das Gesicht in der europä-

contemporary surveillance technology, can the compressed datasets now convey the 'condensed' image of humanity?

Considering that facial recognition and detection algorithms are trained using vast face databases such as Facebook's over 3.07 billion monthly active users, one could answer 'yes' to such a question.⁴³ Facebook archives the changing 'image of the *humanum*' just like the portrait galleries of the past did. In capturing human identity, portrait painting could be said to prefigure Facebook's extensive data storage. Would that make Crispin's *Data-Masks* the logical continuation of the history of portrait painting using facial detection and recognition technology? In such a comparison, however, portrait painting's manual attempt at visual similarity in depicting a subject would have given way to a 'classified subject' extruded through maths and computation. Crispin's data-masks are not portraits painted with paint and brush. They are artefacts made from a surveillance technology that captures and categorizes human identity based on data.

Painted portraits and Crispin's *Data-Masks* perhaps converge in that both create distance to the represented face. They thus turn it into a mask. Where non-European cultures prominently featured masks in their cultural histories, Europeans developed portrait painting as the counterpart to objects, Belting argues.⁴⁴ Both undertakings remind us that our facial expressions end in death: Our faces become lifeless masks that we perceive as emptied. The *Data-Masks* allude to such a tradition of death masks.⁴⁵ If painted portraits and death masks nourished an absence, namely the absence of the depicted, which they equally made present, Crispin's *Data-Masks* remind us of the absent presence not so much of individual faces as of collective ones. They are the combined sum of different faces arising at the moment an individual identity is captured and its play of expressions ends.

Yet, Crispin's death masks are fictions of scary, unrecognizable visages that never existed in the first place. In the absence of an individual or recognizable human face, his work *gives face* to the technological other. It highlights the functionality of a surveillance system, turning individual traits into quantifiable sets. This insight, however, stays concealed from those unaware of the artist's production process. To them, Crispin's *Data-Masks* remain six amorphous and at times anthropomorphic white objects mounted on mirrors. As such, his work also artistically alludes to a genuine threat. It highlights the surveillance system's opac-

ischen Kulturgeschichte zum verdichteten Bild des Humanum geworden.' See Weigel, 'Das Gesicht als Artefakt' [The face as artefact], 9. Translation by Mara-Johanna Kölmel.

43 This figure is accurate as of the first quarter of 2025. See Backlink Team, 'Facebook User & Growth Statistics', *Backlinko* website (30 January 2025), <https://backlinko.com/facebook-users>, accessed 2 February 2025.

44 Belting, *Faces*, 28.

45 For a short overview of the history of death masks see Katharina Sykora, 'Totenmaske, Endstation Gesicht?' [Death mask, the final stop of the face?], in Deutsches Hygiene-Museum and Sigrid Weigel (eds.), *Das Gesicht: Bilder, Medien, Formate* [The face: Images, media, formats] (Göttingen: Wallstein, 2017), 162–163, exhibition catalogue; Georges Didi-Huberman, *La ressemblance par contact : Archéologie, anachronisme et modernité de l'empreinte* [Resemblance through contact: Archaeology, anachronism, and the modern-ness of imprinting] (Paris: Les Éditions de Minuit, 2008).

ity, wherein every selfie or other picture shared on social media could potentially be transformed into a feature set to train and enhance the surveillance apparatus.

At the same time, Crispin's work could also be construed as a data visualization project. It makes the underlying mathematical structures and imperceptible dimensions of contemporary surveillance systems perceptible and tangible. Since algorithms can quantify and qualify the visual similarities between images and what are essentially objects, it is possible to reverse-engineer the process. To this end, Crispin employs the same algorithms used in facial detection and recognition software to form and evolve the anthropomorphic structures in 2D and 3D simulations based on existing feature sets – those classified identities describing humans as seen by machine vision. Scientists at Google call a related approach to creating an image or pattern from nothing but image noise, based on the random variation of brightness and colour information, 'inceptionism' or 'deep dreaming'. Here, neural networks are used to find and enhance patterns in images. Rather than recognizing existing patterns, these algorithms create a kind of pareidolia, a dream-like hallucinogenic appearance in deliberately over-processed images. Crispin's approach shows certain parallels to deep dreaming even though he uses a generative adversarial network and not a neural network.⁴⁶ What connects deep dreaming and Crispin's use of a generative adversarial networks is their similarity to pareidolic images of art history. Such images are no new phenomenon, as artists such as Albrecht Dürer, Salvador Dali, Giuseppe Arcimboldo, Markus Raetz, and M.C. Escher have established throughout art history.⁴⁷ When algorithms create such images, however, the images reveal the networked operations of computational image creation: their presets of vision, its encoded ideologies and often biased preferences.⁴⁸

One way to visualize what goes on is to turn the network upside down and ask it to enhance an input image in such a way as to elicit a particular interpretation. Say you want to know what sort of image would result in 'Banana': Start with an image full of random noise, then gradually tweak the image towards what the neural net considers a banana.... By itself, that doesn't work very well, but it does if we impose a prior constraint that the image should have similar statistics to natural images, such as neighbouring pixels needing to be correlated.⁴⁹

This process can be considered analogous to genetic evolution based on natural selection. For his approach in 2D, Sterling Crispin has developed a set of 'genetic' algorithms

46 Generative adversarial networks correlate changes directly to parameters, unlike neural networks, which improve fitness in a non-linear way.

47 See in this context for example Jean-Hubert Martin (ed.), *Une image peut en cacher une autre: Arcimboldo, Dali, Raetz* [One image may hide another: Arcimboldo, Dali, Raetz] (Paris: Réunion des musées nationaux, 2009), exhibition catalogue; Rudolf Arnheim, *Art and Visual Perception* (London: Faber, 1972); Ernst H. Gombrich, *Art and Illusion: A Study in the Psychology of Pictorial Representation* (New York, New York: Pantheon Books, 1960).

48 See also Hito Steyerl, 'A sea of data: Apophenia and pattern (mis-)recognition', *e-flux* online journal 72 (April 2016), <https://www.e-flux.com/journal/72/60480/a-sea-of-data-apophenia-and-pattern-mis-recognition/>, accessed 13 December 2024.

49 Mordvintsev et al., 'Inceptionism'.

which continuously evolve a static image.⁵⁰ The resulting variations are then measured against a facial recognition system to determine face likeness. Generative algorithms are mathematically modelled – with arguably ‘plastic’ principles helping to generate computational solutions to optimize processes and solve problems through mutation, crossover, and selection, a vocabulary borrowed from genetic evolutionary theory.⁵¹ Software is thus considered as an ever-evolving and mutating organism.⁵² ‘Generative algorithms are said to dissolve the opposition between mathematics and biology, between abstract models and concrete bodies. Just as matter has an abstract form, so too have software programs become evolutionary bodies,’ the cultural theorist Luciana Parisi lucidly observes in the context of their implications for architecture.⁵³ In Crispin’s case, the genetic and iterative algorithms written in JavaScript make the individual images evolve by changing pixel values and applying filters, geometrical structures, and other marks over several generations. Here, ‘parent’ images interact to generate ‘new’ image ‘offspring’ (fig. 65). As in natural selection, each generated image is accorded a fitness value, namely its fitness to qualify as a human face.

To determine the face-likeness, or fitness, Crispin uses an algorithm known as *Yet Even Faster Real-Time Object Detection* implemented by libccv.org, a computer vision library including ‘a close to state-of-the-art image classifier, a state-of-the-art frontal face detector, reasonable collection of object detectors for pedestrians and cars, a useful text detection algorithm, a long-term general object tracking algorithm, and the long-standing feature point extraction algorithm.’⁵⁴ Like the algorithms used in Facebook’s *DeepFace* recognition systems, *YEFRTOD* is a pixel-pair, feature-based detection algorithm that has a machine-learned model of what a face is.⁵⁵ To train the algorithm, Crispin used *Labeled Faces in the Wild*, a

50 In computer science, colours in digital images are often represented by HEX values, which encode precise colour information for each pixel using a combination of red, green, and blue values. This structured encoding allows Crispin’s genetic algorithms to manipulate these values directly, though the algorithm doesn’t inherently rely on HEX itself – any encoded data works. However, static images, with their fixed and clearly defined colour values, make an ideal input. The algorithm can easily read, mutate, and evolve these values, enabling a wide range of visual transformations. This stable data structure maximizes the algorithm’s ability to generate complex and varied image outputs.

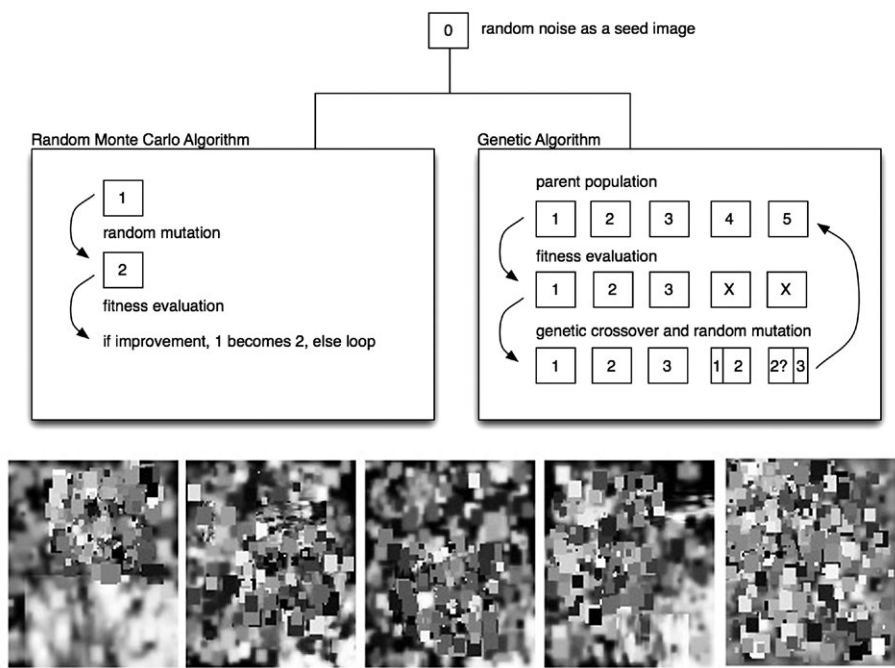
51 See Bernhard Schöneburg, Frank Heinzmann, and Sven Feddersen, *Genetische Algorithmen und Evolutionsstrategien: Scientific Computing* [Genetic algorithms and evolutionary strategies: Scientific computing] (Bonn: Addison-Wesley, 1996). The authors offer a comprehensive overview of the principles and histories of evolutionary algorithms. Throughout the discussion, the ‘plastic’ principles of algorithms are evoked.

52 See Gregory J. Chaitin, “Evolution of Mutating Software,” *Bulletin of the European Association for Theoretical Computer Science*, no. 97 (February 2009): 157–164.

53 Luciana Parisi, *Contagious Architecture: Computation, Aesthetics and Space* (Cambridge, Massachusetts: MIT Press, 2013), 2.

54 See Liuliu [pseud.], *ccv – a Modern Computer Vision Library* (date unknown), <http://libccv.org/>, accessed 12 December 2024.

55 See Sterling Crispin, ‘Data-masks: Biometric surveillance masks evolving in the gaze of the technological other’, Master thesis, University of California, Santa Barbara, California, 2014, 14, available at https://www.sterlingcrispin.com/Sterling_Crispin_Data-masks_MS_Thesis.pdf, accessed 13 December 2024.



65 | Sterling Crispin, *Data-Masks*, production image illustration. From Sterling Crispin, *Data-Masks: Biometric Surveillance Masks Evolving in the Gaze of the Technological Other*, master's thesis, University of California, Santa Barbara (CA), 2014, 16.

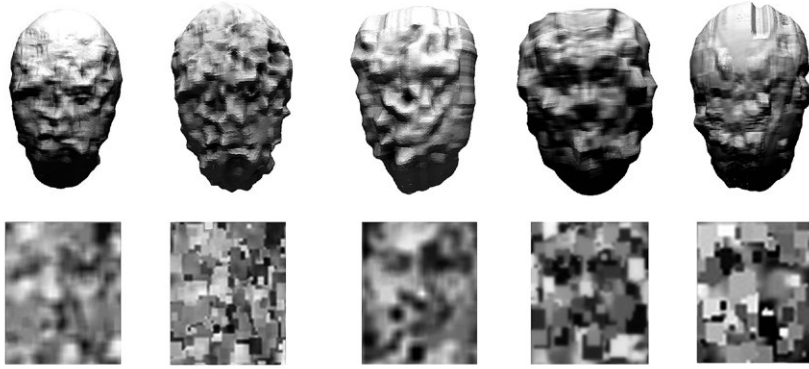
database that contains more than 13,000 images of labelled faces collected from the web.⁵⁶ Its pixel-pair features have been developed in *AdaBoost*.⁵⁷ The adaptive boosting generative algorithm helps produce a statistical model of what a face is. To achieve this, it examines thousands of images labelled as containing faces and thousands of images not containing faces to identify common features among the face-containing images.⁵⁸

In Crispin's production process, the algorithm examines the sign of the difference (i.e., positive or negative) between the individual pixel values of each generated image. The im-

56 See University of Massachusetts, 'Labeled faces in the wild database', project website (9 January 2018), <https://vis-www.cs.umass.edu/lfw/>, accessed 16 December 2024.

57 See Crispin, 'Data-masks', 15.

58 Processes in machine learning often suffer from the curse of dimensionality. This means that each sample may consist of a vast number of potential features, and evaluating every feature can reduce not only the speed of the classifier's training and execution but also its predictive power. The phenomenon is also called the Hughes Effect. The *AdaBoost* training process specifically picks features proven to enhance the model's predictive capability, thereby decreasing dimensionality. This has the potential to improve execution time, as irrelevant features do not need to be computed. See Stephen Marsland, *Machine Learning: An Algorithmic Perspective*, 2nd edn (Boca Raton, Florida: Chapman and Hall/CRC, 2014), 129 and 269–271.



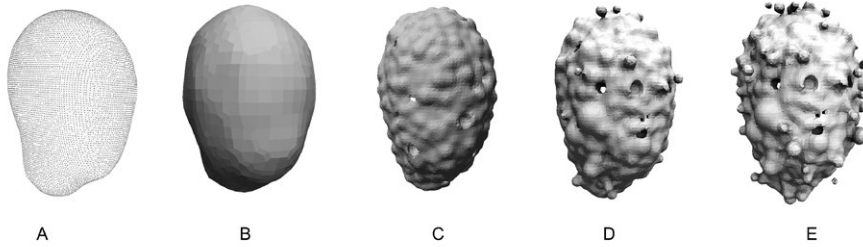
66 | Sterling Crispin, *Data-Masks*, production image illustration. From Sterling Crispin, *Data-Masks: Biometric Surveillance Masks Evolving in the Gaze of the Technological Other*, 37.

age combinations scoring highest in face-likeness, or fitness, are kept and further evolved by the algorithm while continuously being measured against the facial detection system until their face-likeness/fitness increases to around 80%. The static, algorithmically evolved image data, formed by algorithms to the point where it begins to qualify as a human face, is thus the raw and mutable matter of Crispin's artistic project. Emerging from pure image noise, the algorithmically modelled image generations, successfully recognized as faces, are then extruded from the surface. They are applied as a texture to an oval face-like shape, or a mesh made from 12,000 vertices describing its position in 3D simulated space (fig. 66).

The shape has been generated from an averaged 3D scan of the heads of ten people. The 2D images become a depth map in a 3D simulation, moving the vertices (positions in 3D space) of the averaged head mesh along their normal, directional vectors used to describe how light should interact with the surface. One can compare the process to a seal stamp embossing its features into liquefied wax. Brightness values below 127 in the image – values range from 0 to 255 – move a vertex negatively along its normal vector, pushing into the head. Values above 127 move a vertex in the positive direction of its normal vector (outward). The resultant object surfaces are reminiscent of medical images, tectonic structures, or geological formations, as seen with *Chronos*, *Sobek*, *Até*, and *Void*.

By contrast, the objects *Zuck Blister* and *Kodama* have emerged out of the sea of data like reef formations swept ashore.⁵⁹ These coarse, more protrusive faces seem blistered. Their features are dense and scattered like molecular structures. Whereas *Chronos*, *Sobek*, *Até*, and *Void* are derived from 2D images applied as a texture to a 3D head, *Zuck Blister* and *Kodama* have been conceived in a 3D simulation directly. They were created by collecting the vertices from an averaged human head, similar to the 2D approach, and then replacing each vertex

59 'Sea of data' is used here as a metaphor for the image noise on which Crispin's algorithmically modelled image generations are based. Indeed, these pixels relate to data and look like the surface of an ocean.



67 | Sterling Crispin, *Data-Masks*, production image illustration. From Sterling Crispin, *Data-Masks: Biometric Surveillance Masks Evolving in the Gaze of the Technological Other*, 36.

with a volumetric sphere (fig. 67).⁶⁰ Interestingly, the software mimics a traditional sculpting and painting environment by appropriating similar vocabulary and icons, creating confluences between what is physical and virtual, what is handmade and machine-produced, what is intuitive and what is logical-algorithmic. A ‘marching cubes’ algorithm is executed to calculate the surface of the volume, randomly displacing the spheres by changing their position and radius like the pixel values of the 2D image.⁶¹ First introduced by Lorensen and Cline in 1987 publication, the algorithm works by dividing an input volume into a discrete set of cubes.⁶² This process recalls a long art-historical trajectory of aggregating (human) forms via cubes, rings, or squares, as seen for example in Battista Bracelli’s *Bizzarie di Varie Figure* (‘Oddities of Various Figures’; 1624) or works of the Cubist movement.

In Crispin’s *Data-Masks*, the art-historical heritage of the ‘marching cubes’ has been coded into an algorithm which is further supplemented with a robust lighting method (ambient occlusion or global illumination) during the evolution of the form in the 3D simulation.⁶³ It yields a range of values sufficiently complex to reproduce a 3D structure, which can then be recognized as a face using the *YEFRTOD* as a fitness function.⁶⁴ After the successful detection of the first face, it undergoes further mutations until the frequency of successful attempts decays.

Such digital plasticity of data based on genetic algorithms performing codes coincides with a more formal plasticity when a small selection of the masks is actually materialized via selective laser sintering. Here, codes are translated into signals which guide a triangulated beam of UV light in a bed of powdered nylon to fuse precise amounts of material with high

60 Crispin, ‘Data-masks’, 35.

61 See Crispin, ‘Data-masks’, 35; for more information on the functioning mechanism of marching cube algorithms, see Giovanni Luca Masala, Bruno Golosio, and Piernicola Oliva, ‘An improved marching cube algorithm for 3D data segmentation’, *Computer Physics Communications* 184, no. 3 (2013), 777–782.

62 See William E. Lorensen and Harvey E. Cline, ‘Marching cubes: A high-resolution 3D surface construction algorithm’, in *Proceedings of the 14th Annual Conference on Computer Graphics and Interactive Techniques, SIGGRAPH ’87* (New York, New York: ACM, 1987), 163–169, doi: 10.1145/37401.37422.

63 See Crispin, ‘Data-masks’, 26.

64 See Crispin, ‘Data-masks’, 23.

accuracy. The laser scans cross-sections on the surface of the powdered bed, fusing the particles together in order to create a solid part. The powder has undergone preheating, easing the laser's ability to elevate temperatures in targeted regions of the powder bed during the model-tracing process.

After scanning each cross-section, the system lowers the powder bed by one layer of thickness and applies a new layer of material on top. The laser then scans the next cross-section of the work, repeating the process until the part is complete. After cooling, the part is removed from the printing chamber and transferred to a cleaning station, where any excess powder is removed. The final setup of the installation reflects this process, with masks seemingly emerging from the mirror, resembling how they gradually emerge from the resin powder in the printing station.

The final object versions thus contain the works' constant morphosis throughout the production process. The textual unfamiliarity of the object surfaces not only conveys the what Crispin terms the 'faint pixel-to-pixel, or voxel-to-voxel relationships machine vision expects in a human face'.⁶⁵ Their surfaces also testify to the printing process of the mask emerging layer by layer out of the powder bed. It is important to emphasize that Crispin's masks evolve as expressions of feature combinations based on 5,749 individuals.⁶⁶ They are fictionalized, artistically and algorithmically alienated versions of individuals used to train Crispin's face recognition and detection algorithms. Crispin's masks, therefore, not only represent a kind of 'machine pareidolia', as the artist points out, but demonstrate the form-generating and plastic potential of evolutionary algorithms and their perception, projection, and understanding of human form.⁶⁷

Plasticity in art history: A walk on the wild side

If plasticity, as its etymological origin in the Greek word *plassein* suggests, is understood as the capacity to give and receive form, Crispin probes this plasticity on the level of code and algorithmic control. In his *Data-Masks*, we are faced with a plasticity that is able to form-shift and metamorphose. His works educe a plasticity that arises both in virtual and actual space. Looking at these bodiless faces, Gibson's opening quotes come to mind again. 'The future is there,' Cayce hears herself say, 'looking back at us. Trying to make sense of the fiction we will have become.'⁶⁸ Indeed, how can we make sense of Crispin's objects and their particular plasticity in which concerns around agency, process, materiality, and the human body are interwoven? Throughout art history, sculptural plasticity has been deeply tied to materiality, mutability, agency, and the depiction of (human) form. The following short survey is based on comprehensive research into different yet intersecting concepts of plasticity. The inquiry into historical and recent debates on plasticity will help establish a frame of refer-

65 Crispin, 'Data-masks', 36.

66 See Crispin, 'Data-masks', 37. The number corresponds to the number of datasets of individuals available in the databases used to train Crispin's algorithms.

67 Crispin, 'Data-masks', 13.

68 Gibson, *Pattern Recognition*, 57.

ence against which the hybrid transformation of plasticity through digital technology can be traced and qualified.

Initially conceived as a formal–technical term derived from the Greek *plassein* ('to model or mould with tone or wax'), plasticity acquired significant aesthetic meaning under the German Romantics.⁶⁹ Referring to Greek sculpture, Romantic aesthetics connected sculptural plasticity with the embodiment of the ideal, reaching its zenith in the idealized forms of the human body and its archetypes. Since antiquity, the human figure has signified the very essence of plasticity. The 'plastic arts', or *les arts plastiques*, were attributed to the mind's sensuous perception and deeply tied to the forming powers of the subject. Platonic and Aristotelian philosophy considered the artistic material inferior to form, to be formless until 'animated' or ensouled by a spirit or (male) creator.⁷⁰ Vasari spoke of matter as the 'subject [*sugetta*] of form', which he equated with the respectable art form, namely drawing [*disegno*] and intellect.⁷¹ Thus it is not surprising that from the second half of the eighteenth century onward, the contemplation of art, including sculpture, was also linked to the formation of the subject. Art was seen a tool to develop self-awareness and interpret the self.⁷² Even if one could not completely overcome materiality, the goal was to reduce and subordinate it to form as much as possible.⁷³ This overcoming of the material was understood not as a quantitative reduction but as a sublimation, a transformation of the material from its natural state towards a higher and 'immaterial' dimension.⁷⁴ Such idealist aesthetics, linked as they were to Platonic and Aristotelian philosophy, significantly affected the notion of plasticity,

69 Hellenistic literature blurred the formal–technical origins of the term, since early antiquity distinguished between plastic art as the art of modelling (e.g., with clay) and sculpture as the art of cutting or carving (e.g., in stone). See Pfisterer, 'Plastisch/Malerisch' [Sculptural/painterly], 815–816.

70 See for example Aristotle's theory of hylomorphism. He articulates the concept of a soul as the vital force that animates a living being. Life, much like knowledge and health, is an intrinsic quality of living entities. Thus, a soul can be understood as a configuration – a delineating principle or causative factor – within a living organism. Moreover, Aristotle asserts that the soul is intricately linked to the body, comparable to the relationship between form and matter. Aristotle, *On the Soul*, tr. Thomas Taylor (Frome: Prometheus Trust, 2003).

71 Giorgio Vasari, *The Lives of the Artists*, tr. Julia Conaway Bondanella and Peter Bondanella, reissue (Oxford: Oxford University Press, 2008).

72 The German art historian Oskar Brätschmann contextualizes such development as a fundamental change of the way art was received. See Oskar Brätschmann, 'Pygmalion als Betrachter: Die Rezeption von Plastik und Malerei in der zweiten Hälfte des 18. Jahrhunderts' [Pygmalion as observer: The reception of sculpture and painting in the second half of the eighteenth century], in Wolfgang Kemp, Alois Riegl, and Wilhelm Pinder (eds.), *Der Betrachter ist im Bild: Kunstwissenschaft und Rezeptionsästhetik* [The observer is in the painting: Art history and the aesthetics of reception], 2nd ext. edn (Berlin: Reimer, 1992), 193.

73 'Herein, then, resides the real secret of the master in art: that he can make his form consume his material.' Friedrich Schiller, *On the Aesthetic Education of Man*, tr. Elizabeth M. Wilkinson and L. A. Willoughby (Oxford: Clarendon Press, 1967), 155–156. For the original German – 'Darin also besteht das eigentliche Kunstgeheimnis des Meisters, daß er den Stoff durch die Form vertilgt.' – see Friedrich Schiller, *Über die ästhetische Erziehung des Menschen*, ed. Benno von Wiese (Krefeld: Scherpe-Verlag, 1948), 548.

74 Günter Bandmann, 'Bemerkungen zu einer Ikonologie des Materials' [Remarks on an iconology of material], *Städte-Jahrbuch: Neue Folge*, vol. 2 (Munich: Prestel, 1969), 75.

which the German Romantics understood to as evidence of a person's reality, shaping power, and agency.⁷⁵

A significant precursor to the appearance of 'plastic/*plastisch*' in German aesthetic discourse was the revival of the antique concept of plastic power – *vis plastica* or *natura plastica* – in the work of the Cambridge Platonists and other anti-Cartesian thinkers.⁷⁶ Shaftesbury's *Soliloquy: Advice to an Author* actualized previous concepts of plastic power to describe the unlimited power of God, nature, and the human to form and conduct morphogenesis.⁷⁷ In the process, Shaftesbury introduced the concept of the human as a 'genius maker', significantly shaping the conceptual formation of 'plastic power' in German aesthetics, since the latter term was translated as *Einbildungskraft* ('imagination') or *anschauende Erkenntnis* ('intuitive knowledge', literally 'insight by looking at').⁷⁸ This still resonates in the English language today, where the adjective 'plastic' refers to the power to bestow form. 'Plastic' and its noun 'plasticity' began to thrive in German aesthetics and art theory of the eighteenth century. Here, the admiration for antique sculpture was combined with Lord Shaftesbury's aesthetics of genius.

The German philosopher Johann Gottfried Herder was among the first to separate the term 'plastic' from its original context in natural philosophy, natural sciences, and theology.⁷⁹ In his book *Plastik*, notably the first record of the word 'plastic' in German, Herder linked the antique notion of *plassein* to the concept of plastic power.⁸⁰ In Herder's view, art, particularly plastic art, resulted from a god-like creator leaving his trace in mutable matter, which could be discovered through the sense of touch.⁸¹ According to Herder, it was thus in sculpture and its plastic appearance that the creative power of the human was to be fully realized due to sculpture's unique relationship to tactility.⁸² Herder's understanding of sculpture foreshadowed the phenomenological approaches of the twentieth century.⁸³ Through the bodily experience of the sculptural body, the spectator would experience their physical presence both as subject and object; the perception of the other promotes self-awareness.⁸⁴ Herd-

75 See Dongowski, 'Plastisch' [Plastic], 815.

76 See Pfisterer, 'Plastisch/Malerisch' [Sculptural/painterly], 342.

77 See Anthony Ashley Cooper [Third Earl of Shaftesbury], *Soliloquy: or Advice to an Author* (London: John Morphew, 1710), 38–40.

78 Pfisterer, 'Plastisch/Malerisch' [Sculptural/painterly], 342; Cooper [Earl of Shaftesbury], *Soliloquy*, 19 onwards.

79 See Dongowski, 'Plastisch' [Plastic], 815; Rübel, *Plastizität: Eine Kunstgeschichte des Veränderlichen* [Plasticity: An art history of the mutable], 11.

80 See Pfisterer, 'Plastisch/Malerisch' [Sculptural/painterly], 343; Robert Thomas Clark, *Herder: His Life and Thought* (Berkeley, California: University of California Press, 1955), 57–58.

81 See Rübel, *Plastizität* [Plasticity], 11.

82 See Johann Gottfried Herder, *Sculpture: Some Observations on Shape and Form from Pygmalion's Creative Dream* (1778), tr. and ed. Jason Gaiger (Chicago, Illinois: University of Chicago Press, 2002), 40.

83 In his *Phenomenology of Perception*, Merleau-Ponty refers to Herder; see Maurice Merleau-Ponty, *Phénoménologie de la perception* [Phenomenology of perception] (Paris: Librairie Gallimard, 1945), 271, 276.

84 See Maurice Merleau-Ponty, *Phenomenology of Perception*, tr. Donald A. Landes (Abingdon: Routledge, 2012).

er's proposition to privilege the tactile over the visual sense resonated in art discourse and peaked in impressionist sculpture.⁸⁵ If, for Herder and his precursors, plasticity issued from an almost divine creator and had to be negotiated by an active viewer, another concept of plasticity became apparent in the second half of the nineteenth century.⁸⁶ With the industrial development and introduction of new materials such as latex and vinyl, these materials' ability to alter their own form enabled a conceptual shift in which the agency of a god-like creator was abandoned in favour of the domain of materials themselves. Plasticity was now thought to belong to the agential qualities of objects and their substances.⁸⁷ This new understanding ran counter to previous idealist conceptualizations of plasticity dating to the prehistory of modern aesthetics and their origins in antiquity.

Through the fundamental changes brought forth by natural sciences and industrialization in the nineteenth century, the material properties, inner energy, and economy of things began to take centre stage in discourses on sculpture. Accordingly, the notion of 'plasticity' underwent a change in meaning, as Dietmar Rübel has pointed out in his seminal book *Plastizität: Eine Geschichte des Veränderlichen* ('Plasticity: An art history of the mutable'). If the plasticity of materials was previously thought to be passive, plasticity now described the polymorphous properties of materials that can be formed and moulded, as well as their concrete, material presence and agency.⁸⁸ Günter Bandmann has conceptualized this change as an 'epistemological shift of modernity'.⁸⁹ Such development led from an idealistic system, which saw the main task of artistic labour as overcoming the material by privileging form over materiality, to a materialistic system, which tried 'to make the material speak' again.⁹⁰ According to Rübel, the change in the perception of plasticity also goes hand in hand with the introduction and production of all kinds of goods, a process which marks a significant change in the perception of the material world: Every substance becomes a raw material, a commodity for optimization, Rübel observes with reference to Karl Marx. According to the art historian, the artistic use of unstable and material substances increasingly presents an attempt to respond to the speed of modern society.⁹¹ The formation and mutability of these substances – their plastic potential – seems to indicate the transient nature of modernity driven by forces of industrialisation. As early as 1863, Charles Baudelaire conceptualized such a development within the visual arts as 'the transient, the fleeting, the contingent'.⁹²

85 See Rübel, *Plastizität* [Plasticity], 11.

86 Bandmann, 'Bemerkungen zu einer Ikonologie des Materials' [Remarks on an iconology of material], 76.

87 See Rübel, *Plastizität* [Plasticity], 11.

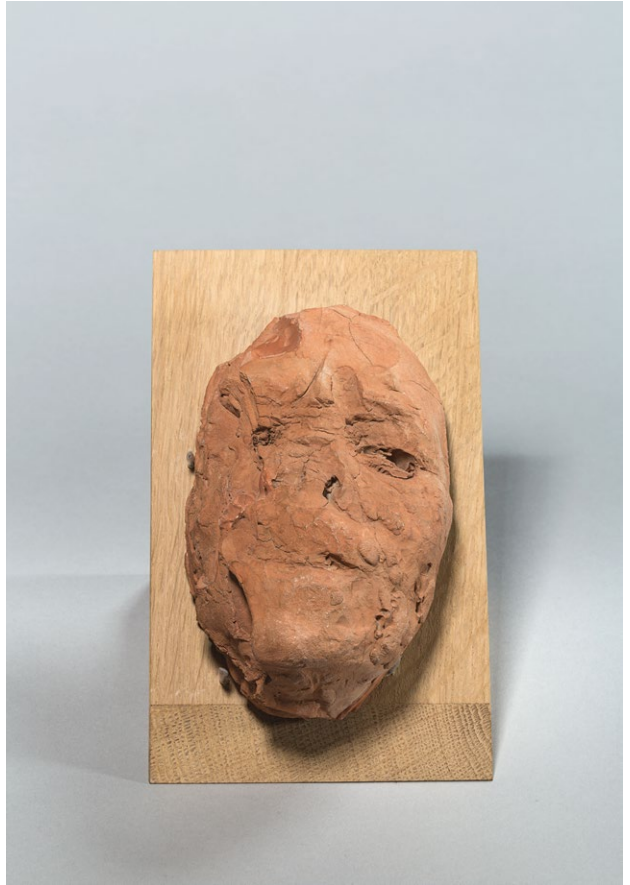
88 See Rübel, *Plastizität* [Plasticity], 32.

89 Günter Bandmann, 'Der Wandel der Materialbewertung in der Kunsttheorie des 19. Jahrhunderts' [The changing appraisal of material in nineteenth-century art theory], in Helmut Koopmann and J. Adolf Schmall gen. Eisenwerth (eds.), *Beiträge zur Theorie der Künste im 19. Jahrhundert: Studien zur Philosophie und Literatur des neunzehnten Jahrhunderts* [Contributions on the theory of the arts in the nineteenth century: Studies on the philosophy and literature of the nineteenth century], vol. 12 (Frankfurt am Main: Vittorio Klostermann, 1971), 130–131.

90 Bandmann, 'Bemerkungen zu einer Ikonologie des Materials' [Remarks on an iconology of material], 76.

91 See Rübel, *Plastizität* [Plasticity], 12–13.

92 Charles Baudelaire, *The Painter of Modern Life*, trans. P. E. Charvet (London: Penguin, 2010), 17.



68 | Auguste Rodin, *Mask of Hanako*,
Type B, ca. 1910–1911; baked clay;
15.7 × 9.5 × 6.5 cm. Musée Rodin, Paris.

The liquid modern

Despite their different research affiliations and interests, Julius Meier-Graefe, Max Osborn, and Georg Simmel have written texts that convey a significant change in the conceptualization of sculptural plasticity. Inspired by Baudelaire, the authors use metaphors such as ‘fluid’, ‘liquid’, ‘transformative’, and ‘fleeting’ to characterize modern sculpture. In doing so, they ascribe a dynamic, agential, and event-like quality to sculpture. These German thinkers thus anticipated Zygmunt Bauman’s concept of liquid modernity by nearly a century. Bauman observes the evolution from a state of ‘solid modernity’ to a more fluid social landscape in which the challenge of sustaining a stable identity that endures across time and space becomes more pronounced.⁹³ It is noteworthy how closely aligned this argument is with the observations made by Meier-Graefe, Osborn, and particularly Simmel. They discerned similar developments ninety-four years before Bauman while examining the fluid and liquified forms of sculptural production.

93 Zygmunt Bauman, *Liquid Modernity* (Cambridge: Polity Press, 2000).



69 | Auguste Rodin, *Mask of Hanako, Type C*, ca. 1910–1911; baked clay; 18.7 × 12.7 × 7.8 cm; Musée Rodin, Paris.

Max Osborn, for example, described modern sculpture in 1905 as ‘two words and two acrimonious enemies’ in which ‘the fluid, nervously moved, yearningly urging, seething, festering’ would oppose the ‘solid, ... cohesive, complete.’⁹⁴ Julius Meier-Graefe described Rodin’s technique as a ‘faster, more effective connection between matter and perception.’⁹⁵ The anticipation of the liquid modern is, however, best conveyed in Simmel’s descriptions of Rodin’s practice and the artist’s work from the early 1900s, such as the *Masque de Hanako* (ca. 1910–1911), type B (fig. 68) and type C (fig. 69).

94 ‘Moderne Plastik – das sind zwei Worte und zwei erbitterte Gegner. Dort das Fließende, nervös Bewegte, sehnsüchtig Drängende, Brodelnde, Gärende. Hier das Gefestigte, Ruhige, Sichere, in sich geschlossene, Fertige.’ Max Osborn, *Moderne Plastik* [Modern sculpture] (Berlin: Gose & Tetzlaff, 1905), 2. Translation by Mara-Johanna Kölmel.

95 ‘[Auguste Rodin] erfand eine schnellere, wirksamere Verbindung der Anschauung mit der Materie,’ Julius Meier-Graefe, *Entwicklungsgeschichte der Modernen Kunst*, ed. Benno Reifenberg and Annemarie Meier-Graefe-Broch (Munich: Piper Verlag, 1966), 475. Translation by Mara-Johanna Kölmel.

Rodin's art ... stands under the sign of modern Heracliteanism. For the worldview that can be described in this way, all substantiality and solidity of the empirical perspective have turned into movement. In restless transformation, a quantum of energy flows through the material world, or rather, is the material world. No formation is accorded even the slightest degree of permanence, and all the seeming unity of its contour is nothing other than vibration and surging movement of the exchange of forces.... Here form is therefore dissolved just as it is in Rembrandt. The world of Rodin's figures, however, is (according to their idea, which visual intuition only points out from the distance) precisely such an absolute flow: the abandonment of all solidity in which a before and an after – that is, time – could mark itself. Here, the fleeting moment of life is banished but in such a way that one really feels its passing, while the before, just like the after, remains sunk in impenetrable darkness. ... The human being in Rodin is dissolved in all the trembling and contradictions of becoming. He only exists, as it were, in the Heraclitan moment of becoming, but we do not feel the coming into being of this moment. He is also torn from his own past, which is to say that he is not an individual.⁹⁶

Before Simmel's publication, Henri Bergson's concept of *élan vital* (1907) had addressed a similar phenomenon in the self-organization and self-creative, spontaneous adaptation and morphogenesis of matter.⁹⁷ Jules Romains' poems *La Vie Unanime* (1904), too, had focused on questions of self-organization in the context of the rapidly changing socioeconomic and cultural texture of society.⁹⁸ His book evoked a simultaneous, self-creative, collective consciousness that emerged wherever groups formed, transcending the consciousness of the individual. Following such texts, it seems plausible that Simmel would have turned to sculpture as a seismographic radar for such developments. Like Bergson and Romains, Simmel was very much aware of modernity's technological dimension when he formulated his ideas on its liquids features in 1916. Simmel wrote that the transitory quality manifesting itself in the fluid forms of modern sculpture was to be understood as a reflection of the dynamics of mechanization and industrialization.⁹⁹ These developments led not only to a change in the perception of time, as Bergson had observed with *La Durée*, but also to the homogenization and depersonalization of the individual.¹⁰⁰

This historical constellation becoming evident in Simmel's writing seems to reappear in a changed figuration and under completely changed conditions when applying Simmel's descriptions of Rodin's practice to Crispin's work. Despite the historical distance between

96 Georg Simmel, *Rembrandt: An Essay in the Philosophy of Art*, tr. and ed. Alan Scott and Helmut Staubmann (London: Routledge, 2005), 105–106.

97 See Henri Bergson, *Creative Evolution*, tr. Arthur Mitchell (Mineola, New York: Dover Publications, 2003). First published 1907.

98 See Jules Romains, *La Vie Unanime: Poème* [Unanimist life: Poemes] (London: Forgotten Books, 2017). First published 1904.

99 See Georg Simmel, 'Die Kunst Rodins' [Rodin's art], in Rüdiger Kramme, Angela Rammstedt and Otthein Rammstedt (eds.), *Aufsätze und Abhandlungen, 1909–1918, Band I: Georg Simmel Gesamtausgabe Band 12* [Essays and treatises, 1909–1918, vol. I: Collected works of Georg Simmel, vol. 12] (Frankfurt: Suhrkamp, 1959), 34–35; Georg Simmel, *Die Großstädte und das Geistesleben* [Large cities and the life of the mind] (Frankfurt am Main: Suhrkamp Verlag, 2006), 8–10, first published 1903; George Simmel, 'Auguste Rodin: Part I-III', in Austin Harrington (ed.), *Georg Simmel: Essays on Art and Aesthetics* (Chicago, Illinois: University of Chicago Press, 2020), 304–306, 314, 317.

100 See Simmel, *Die Großstädte und das Geistesleben* [Large cities and the life of the mind], 10–12.

these two artists, Simmel's writing seems as though it describes not only the iconographic features of the *Data-Masks* – capturing restless, algorithmic transformations – but also the way the contemporary artist profiles and conceptualizes his work when he writes:

[*The Data-Masks*] are expressions of feature combinations between those individuals [used to train the biometric system], but are more like children of the total crowd itself than any individual. They are the biometric rejects, they are identities without bodies, they are people without a past or a future.¹⁰¹

Acknowledging, as Perry Anderson has shown, that 'eras are discontinuous with each other, and heterogenous within themselves,' the following comparisons aim to focus on aesthetic and thus qualitative similarities as well as differences rather than on understanding these works as chronologically related.¹⁰² The challenge is to hold together repetition and difference – that which is carried over from one epoch into another and that which complicates such an approach.

Like Crispin's *Data-Masks*, the amorphous masks of the artist Zach Blas (figs. 70–71) share in an amorphous 'Heraclitean' aesthetic. If, in accordance with Simmel, Rodin indeed captured in his mutable matter the change of subjectivity under the pressure of industrialization, a similar motivation can be seen in Blas's work. The artist uses the image of a liquified face to speak to a changing subjectivity under the pressures of our post-industrial surveillance state. His work is thus situated in a different temporal configuration and more complex context than Rodin's or Simmel's contributions. The masks of his series *Facial Weaponization Suite* (2012–2014), reminiscent of modern aesthetics, are modelled after distorted 3D biometric scans of human faces. While one of the masks, *Mask - May 31, 2013, San Diego, CA* (2013; fig. 70), explores the tripartite conceptions of blackness inscribed in the algorithmic commands of biometrics, *Fag Face Mask - October 20, 2012, Los Angeles, CA* (2012; fig. 71) is generated from the biometric facial data of queer men. It reflects on scientific studies that determine sexual orientation through rapid facial recognition techniques.¹⁰³ This line of research can be traced back to the invention of photography and its immediate use in criminology. The French criminologist Alphonse Bertillon devised the first modern mug shots as part of a classification system, which he based on the assumption that a person's physical measurements were as distinct as their fingerprints.¹⁰⁴ Like the English statistician and pioneer of eugenics Francis Galton, Bertillon discovered in photography an instrument

101 Crispin, 'Data-masks', 37.

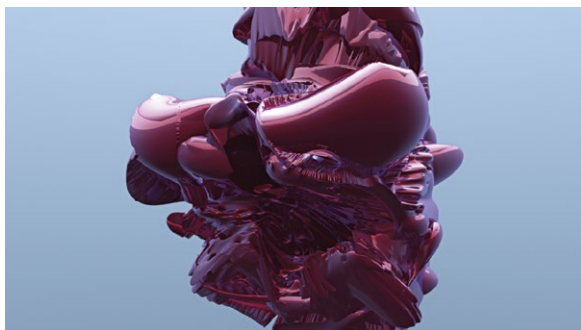
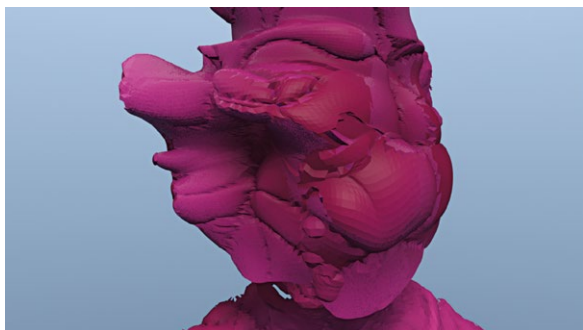
102 Perry Anderson, 'Modernity and revolution', *New Left Review* I, no. 144 (1984), 101.

103 See, for example, the study by Stanford University's Yilun Wang and Michal Kosinski, 'Deep neural networks are more accurate than humans at detecting sexual orientation from facial images', *OSF online repository* (15 February 2017, last updated 17 February 2023), doi: 10.17605/OSF.IO/ZN79K.

104 See Shawn Michelle Smith, 'The mug shot: A brief history', *Aperture* 230 (spring 2018), 31–32. For a more elaborate account on the history of mug shots see Nicolas Quinche (ed.), *Crime, science et identité: anthologie des textes fondateurs de la criminalistique européenne, 1860–1930* [Crime, science, and identity: An anthology of foundational texts of European forensic science, 1860–1930] (Geneva: Slatkine, 2006).



70 | Zach Blas, *Mask* – May 31, 2013, San Diego, CA, from *Facial Weaponization Suite*, 2013; painted, vacuum-formed recycled polyethylene terephthalate; 21.5 × 19 × 10.4 cm.



71 | Zach Blas, *Fag Face Mask* – October 20, 2012, Los Angeles, CA, 2012; painted, vacuum-formed recycled polyethylene terephthalate; 21.5 x 19 x 10.4 cm; *Facial Weaponization Communiqué: Fag Face*, 2012; HD video still.

of social control based on dubious pseudo-scientific principles.¹⁰⁵ Even though his system reflected racist applications of eugenics and phrenology, Bertillon laid the groundwork for similar problematic profiling techniques currently being explored and applied through facial recognition technology.¹⁰⁶ In Blas's work, the fluid forms of the masks produced by the algorithmic architecture of biometric technology become not only an emblem of the discriminatory nature of biometric technology but also an 'opaque tool of collective transformation' that undermines normative forms of political representation.¹⁰⁷

Like Crispin, Blas reflects on the human form as seen by the panopticon of the machine, which is deeply tied to our algorithmic and plastic contemporary. His arbitrarily distorted masks, often in bold colours, are, however, not generated by reverse engineering computer vision technology. Blas averages 3D scans of human faces and compiles them to artistically alienated masks. While Crispin's technologically advanced masks materially and visually resist detection, computer vision can still detect Blas's masks. Nevertheless, both artists play on the dialectic of mask and face. The mask is experienced as a tool to hide our faces from an invisible surveillance system or as a means to expose it. While Crispin's and Blas's works are the products of a time radically different from Rodin's, all three artists employ plasticity to explore depersonalized subjectivity. Their portrait subjects are caught literally in dissolution, metamorphosis, or – in the words of Simmel – 'torn from [their] own past, which is to say that he [or she] is not an individual!'.¹⁰⁸

Such observations also apply to the work of the Italian symbolist sculptor Medardo Rosso. The juxtaposition of his work with Crispin's alienated and anonymized faces yields a strange resemblance (figs. 72–73). Medardo Rosso's striking *fin de siècle* sculptures, formed from clay and then usually cast in wax or plaster and sometimes bronze, not only strongly resonate with the Simmel's, Osborn's and Meier-Graefe's characterizations of contemporaneous sculpture but also bear similarities to Crispin's aesthetic language.¹⁰⁹ The two artists use different methods to evoke a form that emerges out of the momentary state of the employed material substance. Although Rosso modelled his sculptures by hand, the sculptural plasticity of his work exhibits the properties of the materials used for it quite radically. Like Crispin's *Data-Masks* or the masks of Blas's *Facial Weaponization Suite*, Rosso's finely worked sculptures appear to be caught in a moment of transformation. Their plasticity resides in the

105 See Allan Sekula, 'The body and the archive', *October* 39 (1986): 3–64, doi: 10.2307/778312.

106 See for example Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York, New York: NYU Press, 2018); Kate Crawford, 'Artificial Intelligence's white guy problem', *The New York Times* online (25 June 2016), <https://www.nytimes.com/2016/06/26/opinion/sunday/artificial-intelligence-white-guy-problem.html>, accessed 11 December 2024.

107 Zach Blas, 'Facial weaponization suite', artist's website (date unknown), <http://www.zachblas.info/works/facial-weaponization-suite/>, accessed 11 December 2024.

108 Simmel, *Rembrandt*, 106.

109 The myth persists that Medardo Rosso modelled his sculptures in wax over plaster, but in fact, written records confirm that he modelled in clay. See Sharon Hecker, 'Reflections on repetition in Rosso's art', in Harry Cooper and Sharon Hecker (eds), *Medardo Rosso: Second Impressions* (New Haven, Connecticut: Yale University Press, 2003), 31.



72 | Medardo Rosso, *Madame X*, 1896; modern contact print from original glass negative (c.1900); 18 × 13 cm. Private collection.



73 | Sterling Crispin, *Chronos*, 2013–2015; 3D printed nylon, mirror, facial recognition and detection algorithms, genetic algorithms; 46 × 66 cm.

mutability of the employed material. The plastic quality in Rosso's work becomes detached from a human maker and assumes a life of its own, a characteristic particularly evident in his works from 1882/83 onwards.¹¹⁰ Those works demonstrate a sacrifice of detail 'in favour of sketchy modelling, flattened planes, and gently modulated surfaces', which can be 'linked to his discoveries of French Impressionism' but also 'of alternative materials'.¹¹¹ 1883 marks the year when Rosso first started to make sculptures in wax.¹¹² Trying to capture a fleeting moment or rather 'an impression', as Rosso himself emphasized using a pictorial term, his

110 See Rübel, *Plastizität* [Plasticity], 45.

111 Hecker, 'Reflections on repetition in Rosso's art', 33.

112 It is interesting that since the eighteenth century, wax had lost its status in high art and had drifted towards the sphere of mass culture. Julius Schlosser calls this phenomenon the proletarianization of



74 | Medardo Rosso, *Bambino alle cucine economiche*, 1892–1893; wax with plaster interior; 46 × 49 × 37 cm.

forms seem in a state of coming into being or melting away (figs. 74–75).¹¹³ In such a context, a contemporary of Rosso, Ludwig Hevesi, described the plasticity of his works as implying a sense of a continuous flow, of an undefined state.¹¹⁴ Later, the art historian Georges Didi-Huberman characterized wax, referencing a passage from Sartre's *Being and Nothingness* (1943), as an agential 'substance in between two states' which would lead to the breaking down of stable subject–object relations.¹¹⁵ Elsewhere, he describes wax as

a material that is insensitive to the contradictions of its material qualities. Wax is solid, but it may easily be liquefied. It is impermeable, but it may easily be dissolved in water.... It may be worked either by hand or by means of all kinds of tools. It may be painted or tinted as a block, and given

wax sculpture; see Thomas Medicus and Julius von Schlosser, *Tote Blicke: Geschichte der Porträtbildnerei in Wachs* [Dead gazes: History of wax portraiture] (Berlin: De Gruyter, 1995), 104.

113 As Paola Mola Kirchmayr points out, Rosso's first recorded use of the word *impressione* occurred in 1887. He used the term in a letter to the author of a review of his work; see Paola Mola Kirchmayr, 'Gli anni della formazione di Medardo Rosso alla luce di un epistolario inedito' [Medardo Rosso's formative years in the light of an unpublished letter], quoted in *Medardo Rosso: Catalogo della mostra* [Medardo Rosso: Exhibition catalogue], ed. Luciano Caramel (Milano: Mondadori Electa, 1990), 45.

114 See a text by Ludwig Hevesi from 1905 reprinted in Dieter Schwarz, Christoph Brockhaus, and Birgit Brunk (eds.), *Medardo Rosso* (Winterthur: Richter Verlag, 2004), 136, exhibition catalogue.

115 Georges Didi-Huberman, 'The order of material: Plasticities, malaises, survival', tr. Jann Matlock and Brandon Taylor, in Brandon Taylor (ed.), *Sculpture and Psychoanalysis* (Aldershot: Ashgate Publishing, 2006), 199.

75 | Medardo Rosso, *Carne altrui* (*Flesh of Others*), 1883–1884; wax with plaster interior; 33 × 37 × 30 cm. Private collection.



either a matte or polished finish. It can be opaque or transparent, either smooth or sticky. Its consistency may be transformed indefinitely.... It is a fragile and temporary material, but most often used, because of the very richness of its textures, for the fabrication of objects intended to last.¹¹⁶

Wax would invert the idea of sculpture as a passive object animated by an active viewer, since wax has an agency, a power on its own.¹¹⁷ Huberman's conclusion is thus evocative of the observations of his predecessors who characterized the material properties of the liquid modern in similar terms.

Rosso's works *Bambino alle cucine economiche* ('Child to the cheap kitchens') (1893; fig. 74), *Carne altrui* ('Flesh of others') (1883–1884; fig. 75), *Se la fusse grappa!* ('If only it were grappa!') (1883), *Yvette Guilbert* (1895), and *Madame X* (1896; fig. 76) reflect such a dynamic understanding of plasticity. Here, vaguely recognizable characteristics of anonymous faces appear to be emerging from or melting into fluid mounds of matter. In *Madame X*, described by the art historian Paola Mola Kirchmayr as the remain of 'a future civilization'¹¹⁸ (a notion which could equally be applied to Blas's or Crispin's works), the wax is restored with a soft application near the upper right side of the forehead, extending close to the eye. Like some descendant of a 'perfectly symmetrical Cycladic idol', the work is without a base, fixed on an amalgam of plaster almost entirely hidden by jute.¹¹⁹ The outline of the patch is visible

116 Didi-Huberman, 'The order of material', 195.

117 Didi-Huberman writes: 'What does this preliminary look at the material wax teach us? First, its plasticity cannot be reduced to the canonical passivity of Madame Matter enduring the thrusting – and the pounding of seals – that Mister Form would forever subject her to. The reality of the material proves more disturbing: it possesses viscosity, a kind of activity or an intrinsic power, which is a power of metaporphosis [sic], of polymorphosis, of insensibility to contradiction (particularly to the abstract contradiction between form and formlessness)'. Didi-Huberman, 'The order of material', 202.

118 Paola Mola Kirchmayr, *Rosso: The Transient Form* (Milano: Skira Editore, 2008), 96, exhibition catalogue.

119 Mola Kirchmayr, *Rosso: The Transient Form*, 96.

against the dark and already cracked oval. Rosso does not mend the cheek. He leaves a gap so that the plaster may be seen, almost giving the work the appearance of a doubled-faced creature.

Comparing the work to Crispin's data-mask *Chronos* (fig. 73), one immediately notices the frontal view of both presentations. The almond-shaped forms hover between the human face and its obliteration, preventing any exchange of gazes. Their uneven object surfaces become a threshold in which the face or mask assumes the quality of a fluid, malleable, and barely modulated moving surface of matter. Crispin's *Chronos* could also be the abstracted face of a 'Monsieur X', while *Madame X*'s face appears like a mask (fig. 76). Scholarship on Rosso confirms such a reading. As Hecker writes, Rosso's works reveal his 'revolutionary idea of veiling as an erasure of transparency', which he infused into his sculptures as 'a metaphor for artistic opacity ... a threshold not only between seeing and invisibility, artist or viewer and the subject'.¹²⁰ While the veil is an old and established metaphor for opacity, it here becomes an essential figure of modernity.¹²¹ The veil is the emblem of an anonymous crowd.¹²² 'For the flaneur, the "crowd" is a veil hiding the "masses,"' Benjamin asserts in his reflections on Baudelaire.¹²³ By protecting the gaze of the beholder from detection by the figure and allowing the figure to accost the beholder visually, both Rosso and Crispin use a veiling effect to play on and address different regimes of vision, leading to a confusion of viewer and viewed, subject and object.

By contrast with Crispin's *Data-Masks*, *Madame X* still seems to display a scintilla of individuality. The finely crafted nose of Rosso's work, the subtlest hint of eyes and a mouth, and the amber-coloured wax whose discolorations appear like veins, give it a sense of humanity, even femininity. While the face of *Madame X* is faint, it 'still expresses a desire to connect with the other, without fearing exposure or forgetting difference' as Sharon Hecker lucidly observes.¹²⁴ If, in accordance with the American critic Max Kozloff, *Madame X* 'whittled down to even less than its existential minimum, [still] exists in a state of open possibility', then *Chronos* and the other *Data-Masks* instead convey a feeling of inhuman, powerless inanimateness. Their visual characteristics thus point to a different process of production. *Madame X*'s traits mirror Rosso's form-giving process, in which the material becomes receptive to the artist's humane touch. In contrast, the aesthetic features of Crispin's *Data-Masks* bear witness to the impersonal and distanced processes of digitized production. Here, the object's surface can be read no longer as an index of the artist's touch but as the optimized product of a multi-layered technological infrastructure.

120 Sharon Hecker, *A Moment's Monument: Medardo Rosso and the International Origins of Modern Sculpture* (Oakland, California: University of California Press, 2017), 141.

121 For the veil as a metaphor of opacity see Klaus Krüger, *Das Bild als Schleier des Unsichtbaren: Ästhetische Illusion in der Kunst der frühen Neuzeit in Italien* [The image as veil of the invisible: Aesthetic illusions in the art of early modern Italy] (Munich: Wilhelm Fink Verlag, 2001).

122 See Hecker, *A Moment's Monument*, 142.

123 Walter Benjamin, *The Arcades Project*, tr. Howard Eiland and Kevin McLaughlin (Cambridge, Massachusetts: Belknap Press, 1999), 334.

124 Hecker, *A Moment's Monument*, 142.



76 | Medardo Rosso, *Madame X*, 1896;
wax on plaster base; 30 × 19 × 24 cm.

This is also the case in Barry X Ball's interpretation of Rosso's work in his *Medardo Rosso Project*. Ball started using 3D scanning and printing technology to produce sculptural work in the 1990s.¹²⁵ At this point, the technology was not easily accessible and available to only the military or film industry. Ball started doing body scans in a film studio in Burbank, Los Angeles County. He subsequently became one of the first artists using 'CNC milling machines, scanners, and a robot wire' to treat stone at the Johnson Atelier in New Jersey, one of the largest art fabrication sites in the US at the time.¹²⁶ By contrast with Crispin's approach, Ball's fascination with 3D technology stems merely from its potential as a tool for the perfection of his sculp-

125 See Laster, 'Remastering masterworks'.

126 Ball quoted in Laster, 'Remastering masterworks'.



77 | Barry X Ball, *Madame X*, 2013–2019; translucent golden honeycomb calcite on white Vietnamese marble, stainless steel, wood, acrylic lacquer, steel, nylon, plastic; 29.2 × 18.8 × 22.8 cm (sculpture), 135.4 × 26 × 26 cm (pedestal).

tural productions. These, in turn, take as their departure point the Western male sculptural canon, including the works of Medardo Rosso. It is the declared goal of Ball to not only create a perfect copy but to use the technology to 'exceed what my forebears were able to achieve'.¹²⁷ He thus not only inserts himself in a Western sculptural lineage, one that appears to be defined by male white sculptors only, but intends to outdo his predecessors. However, with his technologically laborious and techno-enamoured replicas of Rosso's *Madame X* (2013–2019, fig. 77) and *Yvette Guilbert* (2013–2019, fig. 78), Ball misses the point of Rosso's approach. Unlike Rosso's carefully modelled and mended work, Ball's pieces have been milled on the basis of 3D scans of Rosso's sculptures and then further detailed, polished, and carved by the hands of Ball's many studio assistants – a process that can take up to 10.000 hours on each sculpture. The result resembles a 'Disneyfication' of Rosso's additive approach to sculpture – one that was interested in the forms that emerged out of momentary states of the material substance used for each work. While Crispin's and Rosso's works speak of the plasticity in the mutability of the employed material, Ball's sculptures emerge from a subtractive approach. They have sacrificed their aliveness in favour of machine perfection. Rather than appearing caught in

127 Ball quoted in Laster, 'Remastering Masterworks'.



78 | Barry X Ball, *Yvette Guilbert*, 2013–2019; ultra-translucent white Mexican onyx on white Vietnamese marble, stainless steel, wood, acrylic lacquer, steel, nylon, plastic; 40.5 × 34.3 × 24.6 cm (sculpture), 135.4 × 32 × 32 cm (pedestal). Private collection, New York.

a moment of material metamorphosis, they are static and sterile, and thus entirely different from Rosso's gently modulated and sketchy surfaces.

Interestingly, recent sculptural production revives the modernist aesthetic vocabulary by using not wax but digital data and plastic. Canadian artist Jon Rafman uses imagery from renowned modernist paintings sourced online as textures on 3D models obtained from Google 3D Warehouse.¹²⁸ These models, in turn, take on the appearance of modernist sculp-

128 At the time of completing this publication, Jon Rafman has faced accusations of sexual misconduct and emotional abuse by multiple women. I strongly condemn any form of abusive behaviour, assault, sexual harassment, and misconduct. For an overview of the accusations, see Valentina di Liscia, 'Three museums suspend Jon Rafman exhibitions following allegations of "predatory behavior"', *Hyperallergic* blog (29 July 2020), <https://hyperallergic.com/579110/jon-rafman-exhibitions-suspended/>, accessed 2 January 2025; Sarah Cascone, 'Three museums have cancelled planned Jon Rafman exhibitions following allegations of sexual misconduct', *Artnet News* blog (28 July 2020), <https://news.artnet.com/art-world/john-rafman-shows-cancelled-1897589>, accessed 11 December 2024; Sarah Bahr, 'Hirshhorn suspends Jon Rafman show after allegations of sexual misconduct', *The New York Times* online (28 July 2020), <https://www.nytimes.com/2020/07/28/arts/design/hirshhorn-museum-jon-rafman.html>, accessed 10 December 2024; Monopol, 'Museum und Galerie beenden nach Vorwürfen Zusammenarbeit mit Künstler Jon Rafman'



79 | Jon Rafman, *New Age Demanded (Swerveman Silicon)*, 2014; 3D photopolymer resin and silicone; 39.4 × 47.2 × 25.7 cm.

tures. Rafman thus transmutes the two-dimensional canvas into a three-dimensional object and back. While most of the works exist as online images or prints, some busts become three-dimensional via 3D printing, such as the eerie, mysterious, faceless figure busts *New*

[Museum and gallery, after allegations, end collaboration with artist Jon Rafman],” (23 July 2020), <https://www.monopol-magazin.de/museum-und-galerie-beenden-nach-vorwuerfen-zusammenarbeit-mit-kuenstler-jon-rafman>, accessed 13 December 2024. Rafman has since sued the *Montreal Gazette* for defamation over its coverage of the allegations, with the *Gazette* issuing a letter of apology as part of the settlement; see Tessa Solomon, ‘Kanye West teases new album with film by artist Jon Rafman’, *ARTnews* blog (25 January 2024), <https://www.artnews.com/art-news/news/kanye-west-vultures-jon-rafman-film-1234694207/>, accessed 2 January 2025.



80 | Jon Rafman, *Wavy Brut*, 2014; pigment print on aluminium (back-ground); and Jon Rafman, *New Age Demanded (Swerveman Silicone)*, 2014; 3D photopolymer resin and silicon. Installation view, Zabludowicz Collection, *One & Other*, London, 2017.



81 | Medardo Rosso, *Ecce Puer*, 1906; painted plaster; 50 × 32.5 × 38.5 cm.

Age Demanded (Swerveman Silicone) (2014; fig. 79) and *Wavy Brut* (2014; fig. 80), the latter still dripping after having emerged from the 'liquid' software world. These works are caught in the iridescent transformation between their modernist past, digital present, and sci-fi future. Like their predecessors, Crispin and Rafman evoke forms rising out of the momentary state of the employed polymorphic materials, though the artists use different methodological approaches.

Like the 'Heraclitean' forms of Rodin or Rosso's sculptures marked by 'restless transformation' and 'absolute flow', Crispin's *Data-Masks* (figs. 54–60), Blas's *Facial Weaponization Suite* (figs. 70–71) and Jon Rafman's *New Age Demanded* series (figs. 79–80) take on the aesthetic quality and plasticity of shape-shifting, fluid organisms open to material manipulation and metamorphosis.¹²⁹ These works' visually 'melting' elements enhance the sense of evanescence, providing an image of matter on the verge of engulfing the modelled form. Despite

129 Simmel, *Rembrandt*, 106.

their different approaches to production, the artists therefore use the agency inherent in their chosen materials to impart plasticity to their works.

A similar sense of plasticity through material agency can be felt in Rosso's work *Ecce Puer* (1906; fig. 81), which appears ghost-like and alien with an unnaturally curved forehead, a pointed chin, a neck draped with etchings, and an oblique eye like that of a faun. Rosso gave his *Ecce Puer* a reverberating presence by flattening the clay and covering it with repetitive, deeply scored vertical grooves. Like Crispin's pieces *Chronos*, *Até*, and *Sobek*, the face seems to penetrate through a surface of water or a veil. '*Ecce Puer* begins and ends on this surface. Nothing is implied beyond it,' the art historian Rosalind Krauss writes, trying to characterize the play of obscuring and shrouding mediated by a veil-like surface structure.¹³⁰

This observation also applies to the frontality of Rosso's works, intended by the artist to fix the spectator's viewing plane.¹³¹ The serial use of the mirror in Crispin's *Data-Masks* has similar effects. On the one hand, the mirrors relate the works to a pictorial and thus a surface-focused plane of viewing. On the other hand, they emphasize the object quality of the works, which are silhouetted against the mirror and thus assume a plastic nature. For Rosso, different possible views of his sculpture were unimportant. What counted was the 'impression' made in the first moment of viewing his work. In the scholarly literature, Rosso's conscious use of a pictorial term to describe his sculptures has been linked to a 'frustrated pictorial enterprise.'¹³² According to several experts, the artist substituted his interest in the image with a crucial extension of his practice through the 'new media of his time,' namely photography.¹³³ Rosso presented his photographs alongside his sculptures and perceived them as an important ensemble. Rosso's passion for photography has also been linked to his quest for dematerialization and a desire to find different ways to destabilize the object. Through the image, he could make the viewer forget the material of sculpture, as Sharon Hecker concludes.¹³⁴ It appears as if he made a sculpture almost for the purpose of capturing it on film under different conditions and interacting with the photographic image as with an object.¹³⁵ Inscribed into Rosso's sculptural plasticity is an interest not only in materiality

130 Rosalind E. Krauss, *Passages in Modern Sculpture*, 2nd edn (Cambridge, Massachusetts: MIT Press, 1981), 33.

131 See Cooper and Hecker, *Medardo Rosso*, 9.

132 Hecker, 'Reflections on repetition in Rosso's art', 31.

133 For more comprehensive accounts of the importance of photography in Rosso's work, see for example Nina Gülicher, *Inszenierte Skulptur: Auguste Rodin, Medardo Rosso und Constantin Brancusi* [Staged sculpture: August Rodin, Medardo Rosso, and Constantin Brancusi] (Munich: Silke Schreiber, 2011); Jane R. Becker, 'Medardo Rosso: Photographing sculpture and sculpting photography', in Dorothy M. Kosinski and Dallas Museum of Art (eds.), *The Artist and the Camera: Degas to Picasso*, (Dallas, Texas: Dallas Museum of Art, 1999), 159–175, exhibition catalogue; Gabriele Stix-Marget, *Maler ohne Pinsel: Der Bildhauer und Fotograf seiner Werke Medardo Rosso, 1858–1928* [Painter without a brush: The sculptor and photographer of his works Medardo Rosso, 1858–1928] (Munich: Utz, 1998); Dietmar Rübel, 'Die Fotogenese der Skulptur (molekulare Gemeinschaften)' [The photogenesis of sculpture (molecular communities)], in Ecker, Kummer, Lammert, et al. (eds.), *Lens-Based Sculpture*, 116.

134 See Hecker, 'Reflections on repetition in Rosso's art', 31.

135 See Jeffrey Weiss, 'Close up: The absent object', *Artforum International* 52, no. 2 (October 2013), 256.



82 | Sterling Crispin, *Data-Masks*; production video.

but also in its various forms of dematerialization. Crispin's *Data-Masks*, the work analysed at the start of this chapter, relates directly to a pictorial enterprise, much like Rafman's *New Age Demanded* series or the masks from Blas's *Facial Weaponization Suite*. In fact, all these works could more appropriately be termed 'image-objects', as they arise from the image plane before reaching objecthood. This is true on the very level of production: Layer by layer, each object is printed from more than a thousand different two-dimensional image layers. While Rosso explored questions of dematerialization by translating his objects into images, Crispin, Blas, and Rafman translate images into objects to explore the various forms of materialization underpinning digital technology. One approach pictorializes the sculptural object; the other objectifies the image. The importance of the relationship between image and object is evident in the final presentation of Crispin's *Data-Masks*. Here the objects seem to emerge not only from a mirror but from a screen. The artist further indicates such intimate links between image, object, and screen in a video showing the production process of his works (fig. 82). In a series of constantly changing pop-ups and windows on a computer screen, he enacts the production of the multi-layered algorithmic system underpinning the modelling of his work as superimpositions of images. Computer commands, codes, surface structures, and databases are juxtaposed here with snapshots of a constantly evolving data-mask.

Soft codes

The video demonstrates how the artist sculpts with the programmes of his time, which, like wax, are a type of software. The idea of staging the modelling act is reminiscent of Rosso's approach, which likewise emphasizes the process of his works. 'Rosso is going to cast tonight and he invited me,' begins a written record of one of Rosso's studio visits by Jehan

Rictus. His account highlights the performative and at the same time bodily dimension of Rosso's casting process:

There is Rosso who has again climbed up onto the edge of the well of the growling fire. More stabs with the poker. Then with a pair of tongs he pulls out a rather large crucible full of molten metal...and live red...There at the edge they tilt the crucible like a bowl...and the molten metal flows with blue flames...I am impressed by this work while sensing its theatrical and pretentious aspects.... He is in sweat; He drinks milk, Vichy [his assistant gives him] water. Then he offers us champagne.¹³⁶

Unlike his contemporary Rodin, Rosso cast and modelled most of his sculpture by himself and even staged his production process with an audience present.¹³⁷ The process of making sculpture was thus as important to the artist as the final product. Rosso's object surfaces were permitted to preserve and reveal the residual material of their creation in the form of a flash of clot.

While Rosso emphasizes the body of the sculptor performing the act of modelling and his 'plastic power', Crispin's *Data-Masks*, Blas's *Facial Weaponization Suite*, and Rafman's *New Age Demanded* series distance themselves from the subjectivity of a human maker. Their formal language is rather cool and sterile at times. The accidental and unorthodox treatment of matter as registered in Rosso's unconventional marks of process, such as 'knife slashes from cutting away moulds, air-bubble holes, raised lines from mismatched moulds, holes from core pins, casts of rods and sprues and trickles and globs of solidified liquid matter' has given way to calculated, lean, and clean processes.¹³⁸ One could argue that manipulating the mesh of polygons or applying various surface textures (named according to concrete materials such as marble, bronze, or wax) to the digital object is somewhat akin to physically modelling with materials like clay or wax. At the same time, the familiar sculptural vocabulary used in modelling programmes like Z-Brush hides how these acts are mere stand-ins for algorithmic processes.¹³⁹ The fluid, morphing, and distanced features that mark the aesthetics of the more recent objects hint at the agency and plasticity of the technological (surveillance) system. Crispin's, Blas's and Rafman's works thus attest to the destabilizing nature of data. They are based on algorithms performing codes that have also come to shape our digitally supersaturated surroundings.

There has not yet been a thorough scholarly assessment of how these recent developments affect the image of the individual. However, the Chinese government's 'Sharp Eyes Project' may already allow observers to draw some tentative assumptions. The programme employs facial recognition and artificial intelligence to analyse and make sense of captured

136 Jehan Rictus quoted in Hecker, 'Reflections on repetition in Rosso's art', 23.

137 See Hecker, 'Reflections on repetition in Rosso's art', 23.

138 Hecker, 'Reflections on repetition in Rosso's art', 24.

139 The software mimics a traditional sculpting and painting environment by appropriating similar vocabulary and icons, creating confluences between what is physical and virtual, what is hand-treated and digitally generated, what is intuitive and what is algorithmic.

video evidence, using it to 'track suspects, spot suspicious behaviours and even predict crime; to coordinate the work of emergency services; and to monitor the comings and goings of the country's 1.4 billion people, [as] official documents and security industry reports show'.¹⁴⁰ The declared goal is not only to combine these sources into a vast database encompassing every citizen and their criminal and medical records, online purchases, and social media comments – but also to link them to identity cards and essentially their faces, aiming to orchestrate a "single social credit score" based on whether the government and their fellow citizens consider them trustworthy.¹⁴¹ This omnipresent surveillance network reduces the facets and complexity of human identity to general recognition features. This, in turn, raises significant questions about our human existence, the image of the individual, as well as the interfaces between individuality and general perceptibility, akin to the questions prompted by Crispin's and Blas's masks.

By rendering visible the multi-layered algorithmic system underpinning the modelling of his work, Crispin's video not only underlines the strong relationship of his work to the screen and image plane. It also demonstrates that his employed 'material' does not initially create visible, three-dimensional space. The digital plasticity of his work primarily resides within the flatness of a vertical plane, abstract and rich with information. It is inherently transformed into geometries and images for human vision. This serves as a reminder that the data space of the computer world, where 'numbers themselves turn into space,' as Matteo Pasquarelli writes, evokes a distinct kind of topology.¹⁴² Crispin's work centres on making precisely such a space and its different characteristics sensible and visible. The *Data-Masks* are not so much about using an image or object to replace something lost but rather about highlighting the physical presence of something that is invisible yet constantly present.

Despite such drastic differences in the conceptualizations of plasticity, it should nevertheless be noted that Rosso, like other artists and theorists around his time, discovered the performative and agential properties of his artistic materials. Issuing from industrialization and new modes of merchandized production, the idea of a liquid modern thus conveyed a deep interest in plasticity, derived from various material flows and agencies. By highlighting the form-shifting and form-giving qualities of the sculptural material, these artistic and theoretical contributions pointed to an understanding of plasticity that would slowly decouple the notion of form from the authority of a human maker. The artists' interest in the plasticity of their employed materials thus also indicated a shift away from the notion of sculpture as a passive object animated by an active viewer.

140 Simon Denyer, 'China's watchful eye: Beijing bets on facial recognition in a big drive for total surveillance', *Washington Post* online (7 January 2018) https://www.washingtonpost.com/news/world/wp/2018/01/07/feature/in-china-facial-recognition-is-sharp-end-of-a-drive-for-total-surveillance/?utm_term=.c1c83adf0dbb, accessed 11 December 2024.

141 Denyer, 'China's watchful eye'.

142 Matteo Pasquinelli, 'The spike: On the growth and form of pattern police', in Grégoire Chamayou, Anselm Franke, Stephanie Hankey, and Marek Tuszynski (eds.), *Nervous Systems: Quantified Life and the Social Question* (Leipzig: Spector Books, 2016), 250.

In recent sculptural discourse, this understanding resurfaces through conceptual, discursive, and aesthetic parallels but presents itself in a different, digitally mediated reconfiguration. I refer to this hybrid transformation of plasticity through the digital as 'digital plasticity'. In their attempt to visualize the invisible plasticity of a digitally driven system, Crispin's *Data-Masks* participate in a particularly Western strain of art history, namely the 'representation of the invisible and its most supreme sense'.¹⁴³ Within art history's continuing project of visualizing the invisible, or materializing the immaterial, the icon of Christ plays a key role. It is stylized to embody the 'paradoxical search' of Christian iconography for the representation of a body that had disappeared from Earth only to return in a different form.¹⁴⁴ As Hans Belting has shown, the icon of Christ, therefore, never filled the gap left by the loss of a body; rather, it served as symbol of life by recording that past life.¹⁴⁵ It vouched for a lost body and represented the very proof of the existence of Christ's earthly body despite the empty grave.¹⁴⁶ The sacred Shroud of Turin, the alleged relic of Christ's impressed face, exhibits surprising parallels to Crispin's more recent visualization project. Both assume the reality of a body based on the mechanical trace that this body, particularly its face, has left.¹⁴⁷ The bodies' trace is not so much a portrait but evidence of a bodily and material existence.¹⁴⁸ Compared to the supposed trace left by Christ's body, Crispin's *Data-Masks* are not only indexes of bodies but traces of the technological infrastructure and its material presence. Both shroud and Data-Mask are defined by an 'indexical truth' which goes beyond a pure effigy.

The artist Trevor Paglen observes that visual culture 'has become detached from human eyes and has largely become invisible. ... The overwhelming majority of images are now made by machines for other machines, with humans rarely in the loop.'¹⁴⁹ Despite this invisible visual culture, we are not confronted with an entirely new historical constellation. Visual culture has always maintained a productive relationship with the invisible and its various visualization processes.¹⁵⁰ In today's world, seeing alone isn't enough.

143 Patrik Reuterswärd, *The Visible and Invisible in Art: Essays in the History of Art* (Vienna: IRSA, 1991), 7.

144 See Hans Belting, 'Face oder Trace: Zur Anthropologie der frühen Christus-Porträts' [Face or trace: On the anthropology of early portraits of Christ], in Sigrid Weigel (ed.), *Gesichter: Kulturgeschichtliche Szenen aus der Arbeit am Bildnis des Menschen* [Faces: Cultural-historical scenes from work on the human image] (Munich: Wilhelm Fink Verlag, 2013), 91.

145 See Hans Belting, 'Face or trace? Open questions around the prehistory of Christ's icon', ed. Alexander B. Strakhov, *Palaeoslavica. International Journal for the Study of Slavic Medieval Literature, History, Language and Ethnology* 10, no. 1 (2002), 2.

146 See Belting, 'Face oder Trace: Zur Anthropologie der Frühen Christus-Porträts' [Face or trace: On the anthropology of early portraits of Christ], 93.

147 In Crispin's work, 'the body' encapsulates both the captured human bodies and the technological body of the surveillance system.

148 See Belting, 'Face oder Trace: Zur Anthropologie der frühen Christus-Porträts' [Face or trace: On the anthropology of early portraits of Christ], 93.

149 Trevor Paglen, 'Invisible images (your pictures are looking at you)', *The New Inquiry* website (8 December 2016), <https://thenewinquiry.com/invisible-images-your-pictures-are-looking-at-you/>, accessed 13 December 2024.

150 For further reading on this topic, see Anja Rathmann-Lutz, *Visibilität des Unsichtbaren: Sehen und Ver-*

Strictly speaking, in Paglen's example we are dealing not with images but rather with data sets. Perhaps Paglen deliberately deploys the notion of the image to orchestrate a more fundamental observation. Besides visual culture's advances in the spheres of invisibility, his text speaks of a shift of agency that also permeates the works of Crispin, Blas, and Rafman. If 'Turing's revolution displaced the human from the hegemony of cognition' through an 'accumulation of information that exceeds the scale of human memory and as a growth in computing power that exceeds the scale of human thought,' the artists demonstrate that it has also replaced us from the hegemony of vision, of agency and of 'plastic' power.¹⁵¹ The biometric technology underpinning the production of Crispin's work contributes to this argument in that it brutally divorces the image of a person from its traditional spatial coordinates and turns it into a data set. This process remains a mere process until someone makes sense of the flow of data or information they have arrested, sculpted, and stabilized by rendering it into geometry. Their sense-making work becomes the visible indicator of an otherwise invisible formation and, thus, a plastic process. Functioning similarly to the Shroud of Turin, these works bring the materiality of a body, the body of the technological system, into the space of the sensible. The works thereby become indices and evidence of a new kind of plasticity. Developing the Christian concept of the *cheiro-poieton* (an image made by divine hands), these works witness the presence of a different type of plastic power. They speak of a digital plasticity that emerges from the flatness of our computer screens into the world, like Christ from a piece of cloth.

Crispin, Rafman, and Blas intuitively connect historical concepts of plasticity, materiality, and corporeality to recent sculptural concerns by referencing and revising such aesthetic vocabulary in their recent sculptural productions. As this chapter has shown, their works cannot be simply subsumed under the rhetoric of the 'new' and digital, nor can they be placed within a chronological reading of historical progress. Their artistic and theoretical contributions to the discourse of modern sculpture point to an understanding of plasticity that would start to decouple the notion of form from the authority of a human maker, indicating a shift away from sculpture being considered a passive object. While Rosso and Rodin still strongly emphasized the sculptor's body and his 'plastic power' when modelling the material, Crispin, Blas, and Rafman distance themselves from the subjectivity of a human maker. Not only is their works' formal language somewhat cool and sterile, but the 'sculptural' vocabulary of the modelling programmes they employ also serves as mere stand-in for unseen algorithmic processes. This hybrid transformation of plasticity through the digital is truly a 'digital plasticity'.

The transitory and mutable, exemplified in the fluid forms of modern sculpture, was once understood as a reflection of the dynamics of mechanization and industrialization. However, the amorphous masks created by Crispin, Blas and Rafman now speak not only to a changing subjectivity but also to a digital plasticity transforming under the pressures

stehen in Mittelalter und Früher Neuzeit [Visibility of the invisible: Seeing and understanding in the Middle Ages and early modernity] (Zurich: Chronos, 2011).

151 Pasquinelli, 'The spike', 250.

of our post-industrial surveillance state.¹⁵² Nevertheless, the artists' use of rapid facial recognition techniques can be traced back to the invention of modern photography and its immediate use in the realm of criminology and eugenics. While Rosso and Rodin dove into questions of dematerialization by translating their objects into images, Crispin and his peers take a different approach. They translate images into objects to explore the various forms of materialization that underpin digital technology.

In other words, modern sculpture pictorialized the sculptural object; contemporary sculpture objectifies the image. The works of this group of artists could then more appropriately be termed 'image-objects' as they arise from the image plane before reaching objecthood through 3D printing or CNC milling.¹⁵³ The plasticity of their works activates the compressed mathematical and invisible space underpinning contemporary surveillance systems and renders it visible. Crispin's *Data-Masks* are thus less concerned with the dematerialization of image or object than with making the material presence of something invisible yet pervasive perceptible. Their digital plasticity unfolds predominantly within a flat, vertical surface. The material used does not initially generate a visible, three-dimensional form; rather, it has already been transformed into geometries and images to be accessible for human vision.

The following section proceeds with an examination of the digital plasticity evident in Crispin's objects and those of his peers against the backdrop of debates on (im)materiality. It thereby connects the aesthetics of their sculptures and their links to the discourse of modern sculpture to the (re-)emergence of the metaphors of the fluid and liquid in debates around digital objects. Following an examination of the discourses on the liquid modern, it is thus at the intersecting points of art-historical and technological discourses that the concept of digital plasticity in recent sculptural production can be further elucidated. If plasticity, as has been shown here, is historically linked to the potential of matter to evolve, how can we develop a rigorous reading of the materiality defining the works of Crispin and his peers.

2.2 A sea of noise: Liquid fantasies and digital matters

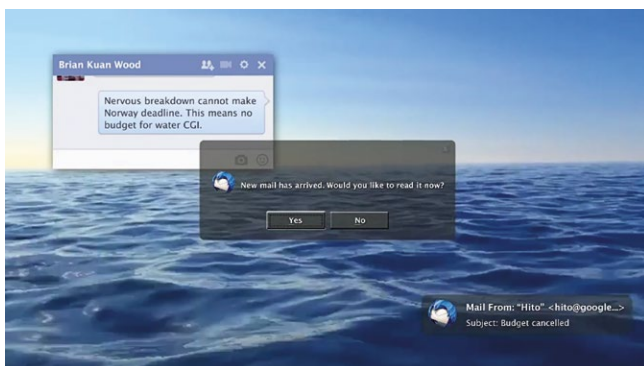
Empty your mind. Be formless, shapeless, like water. Now you put water into a cup, it becomes the cup; you put water into a bottle, it becomes the bottle; you put it into a teapot, it becomes the teapot. Now water can flow or it can crash. Be water, my friend.¹⁵⁴

Martial arts legend Bruce Lee's thoughts on the properties of water are a suitable metaphor to describe digital objects and their basic substance information. Building on the manifold that circumscribes the art-historical and technological space between the past and the pres-

152 See Simmel, *Die Großstädte und das Geistesleben* [Large cities and the life of the mind].

153 For the concept of the image-object see Vierkant, 'The image object post-internet'.

154 See Bruce Lee, 'Be as water my friend' [video], *YouTube* (15 August 2013), <https://www.youtube.com/watch?v=cJMwBwFj5nQ>, accessed 12 December 2024. Lee elaborates on his observations in Bruce Lee, *Tao of Jeet Kune Do* (Milwaukee, Wisconsin: Ohara, 1975).



83 | Hito Steyerl, *Liquid-ity Inc.*, 2014; stills from single-channel HD video; 00:30:00 min.

ent, this chapter situates Crispin's and his peers' practices in the context of debates on digital objects, their agency, materiality, and mutability. By considering how Crispin and his peers negotiate the plasticity of their objects on the level of code before these objects reach a physical manifestation, the chapter develops a complex notion of materiality. This forms the base of an examination of recent concerns related to sculptural plasticity. A central point will be that code needs to be rethought in contemporary art production as both artistic material *and* mutable matter.

As early as 1942, Norbert Wiener observed that cybernetics, 'the science of communication and control', depended upon the flow of information, which 'in scientific or aesthetic inquiry can be modelled via conceptual communication and conscious cognitive control of information'.¹⁵⁵ It comes as no surprise, then, that the word 'cybernetics' derives from the Greek word *kybernetes*, which literally means 'steersman', and has thus inscribed into its etymology an association with water.¹⁵⁶ Wiener not only invoked the qualities of water to describe the

155 Norbert Wiener quoted in Heinz von Foerster (ed.), *Cybernetics of Cybernetics: The Control of Control and the Communication of Communication*, 2nd edn (Minneapolis, Minnesota: Future Systems, 1995), 7.

156 For the etymology of cybernetics, see Norbert Wiener quoted in von Foerster (ed.), *Cybernetics of Cybernetics*, 7. The steersman/helmsman also becomes a metaphor for the two signal elements of cybernetics: feedback and control. The steersman needs to control any adverse consequences of his previous



84 | Petra Cortright, *The Infinite Sculpture Garden without the Boundaries Torn and Ripped into the Vacuum of Emptiness*, 2010; series of digital images.

properties of information but also associated information with mutability that can be modelled like a material. Such parallels between water and the mutable information 'as a kind of ... fluid that circulates effortlessly around the globe while still retaining the solidity of a reified concept', as N. Katherine Hayles has observed, surface not only in the iconographic features of Crispin's *Data-Masks* but also in the way the artist profiles them.¹⁵⁷ According to the artist, the 'amorphous fluid-like faces' have emerged from a 'sea of noise' and look like they are penetrating the surface of 'a pool of water'.¹⁵⁸

The imagery of liquid as both an aesthetic feature and a metaphor for infinite malleability, variability, and remixability is also found in the practice of other contemporary artists



85 | Oliver Laric, *Versions*, 2010; stills from single-channel HD video; 00:09:06 min.

actions and predict the future implications of his current decisions.

157 Hayles, *How We Became Posthuman*, 246.

158 Crispin, 'Data-masks', 1, 36, 42.

such as Petra Cortright (born 1986 in Santa Barbara, California, USA), Hito Steyerl, and Oliver Laric. According to Domenico Quaranta, Petra Cortright explores 'the liquid nature of digital images [by] literally liquefying found photographs of models, still-lives or landscapes'.¹⁵⁹ This approach is evident in her work *The Infinite Sculpture Garden without the Boundaries Torn and Ripped into the Vacuum of Emptiness* (2010; fig. 84). The same observation also applies to Hito Steyerl's video essay *Liquidity Inc.* (2014; fig. 83) and Laric's *Versions* videos (2009, 2010, 2012; fig. 85). While Laric parallels the introductory Bruce Lee quote on the properties of water with poetic-visual characterizations of data, information, and communication, Steyerl's *Liquidity Inc.* juxtaposes the exact same quote with the fluid forms that populate her cinematic essay, including a flood of memes, images of transpacific migrations, liquidity of finance systems, the dissolution of communications, and the flowing but violent gestures of martial arts. Similarly, Laric's *Versions* videos, each a transubstantiation of its predecessor, splice together recurrent image sequences working as vignettes in combination with quotes by Bruce Lee, Henry James, Gertrude Stein, Jorge Luis Borges, James Brown, Lyn Collins, and Rob Base & DJ E-Z Rock. The series examines the performativity and mutability at play in image reproduction and proliferation. Here, subjects, signs, and soundtracks are sporadically fragmented and dissolve into one another as if mixed in a watery solution.

Liquid objects

Lev Manovich confirms this image when he writes that characterizations such as 'mutable', 'liquid', and 'variable' are 'often used in relation to new media'.¹⁶⁰ In his pioneering book, *The Language of New Media*, Manovich outlines what he maintains are the fundamental principles that distinguish new media from analogue objects. Published in 2001, the text remains relevant for its basic outline of what media objects are. Firstly, media objects are represented numerically. They are 'described using a mathematical function', and thus, they can be manipulated algorithmically and 'become programmable'.¹⁶¹ Secondly, as Manovich points out, they are modular. Media objects do not appear as self-contained entities; rather, a new media object is 'represented as collections of discrete samples' and can be 'assembled into larger-scale objects' while each element retains its own identity.¹⁶² The textures of Crispin's, Rafman's, or Blas's objects, for example, can be modified independently of their form and then sampled as a whole. Thirdly, 'numerical coding' and 'modular structure' allow for the 'creation, manipulation, and access' of new media objects without direct human interaction.¹⁶³ Human agency is thus subjected to algorithmic processes, as evident in Crispin's work based on genetic algorithms. Manovich calls this principle 'automation'.¹⁶⁴ A further principle, 'transcoding', relates to the ability of a digital object to negotiate multiple

159 Domenico Quaranta, *In Your Computer* (Brescia: LINK editions, 2011), 163–164.

160 Lev Manovich, *The Language of New Media*, rev. edn (Cambridge, Massachusetts: MIT Press, 2002), 36.

161 Manovich, *The Language of New Media*, 27.

162 Manovich, *The Language of New Media*, 30.

163 Manovich, *The Language of New Media*, 32.

164 Manovich, *The Language of New Media*, 32.

layers in a computer's internal architecture, but also facilitates the relationships between the systems of organization of culture and the means by which we affect those systems in computing.¹⁶⁵

Perhaps closest to the origins of plasticity within art-historical discourse, however, is Manovich's fourth principle, 'variability'. For Manovich, variability is understood as the mutability of a material and its agency. The modularity and numerical representation of digital objects produces variability in the context of Manovich's theory.¹⁶⁶

Old media involved a human creator who manually assembled textual, visual, and/or audio elements into a particular composition or a sequence ... [whereas New Media objects,] stored in some material and able to produce identical copies,... give rise to many different versions... often in part automatically assembled by a computer.¹⁶⁷

Media objects are not fixed entities with a determined form. Like Crispin's *Data-Masks*, they can 'exist in different, potentially infinite versions', which are automatically composed and can be customized by a computer.¹⁶⁸ Thus the principle of variability is, for Manovich, closely linked to that of automation. If, however, the algorithmic processes that govern the conception of digital objects, along with the communication of machines and networks, are designed to be mutable and malleable, could digital plasticity be added to his conceptual vocabulary?¹⁶⁹ Plasticity is, as the previous chapter shows, historically linked to the potential of matter to evolve. How, then, can we conceptualize the materiality at play in the works of Crispin and his peers?

Matter of concern

According to Hayles, the metaphor of the 'liquid' vaporized the material of information – leading to its perception as being 'immaterial'.¹⁷⁰ In this context, it is interesting to highlight the understanding of information as plastic, mutable, and part of an open, dynamic, and evolutionary system, a view seen above in relation to second-order cybernetics. This perspective has led cultural theorists to emphasize that digital information, far from being immaterial, 'is always already another form of matter'.¹⁷¹ One cannot help thinking of the art-historical discourse, which since antiquity has considered a material's materiality as the very evidence of its plasticity and vice versa. Since the 1980s, such observations have been the subject of academic research on digital materiality, increasingly gaining attention since the 2000s.¹⁷²

165 Manovich, *The Language of New Media*, 46.

166 Manovich, *The Language of New Media*, 36.

167 Manovich, *The Language of New Media*, 36.

168 Manovich, *The Language of New Media*, 36.

169 As Johnny Ryan observes, Web 2.0 takes such ideas to their logical conclusion, see Johnny Ryan, *A History of the Internet and the Digital Future* (London: Reaktion, 2010), 139.

170 See Hayles, *How We Became Posthuman*, 246.

171 Parisi, *Contagious Architecture*, 2.

172 See Nathalie Casemajor, 'Digital materialisms: Frameworks for digital media studies', *Westminster Papers in Communication and Culture* 10, no. 1 (15 September 2015).

Scholars from this tradition link digital information and communication to material presence and physical implications. The following short detour on the debates over digital materiality will help to describe the complex notion of materiality at play in recent sculptural productions by Crispin, Rafman, Laric, and Blas. It will also shed light on the relationship between digital materiality and immateriality, a characteristic often ascribed to digital objects.

Intellectually heterogeneous research communities have formed under the heading of 'digital materialism'. In Germany, the Berlin School of Media was led by Friedrich Kittler.¹⁷³ In America, scholars in the fields of software studies and science, technology, and communication studies have actively discussed the materiality of the digital.¹⁷⁴ The literary critique of electronic texts proposed by Kathrine N. Hayles; the forensic approach encouraged by Matthew G. Kirschenbaum, Jean-François Blanchette, and Johanna Drucker; as well as the new materialist media ecology represented by Diana Coole, Samantha Frost, and Lisa Gitelman, are all distinct and partly contrasting frameworks for thinking about the materiality of digital media.¹⁷⁵ Related reflections are also found in the field of Marxist critical studies.¹⁷⁶ These various formations of thought reject the idea of 'pure' and disembodied information by emphasizing the very material side of the digital. This emphasis has in turn inspired an interest in the 'materiality

173 See Friedrich A. Kittler, *Literature, Media, Information Systems*, ed. John Johnston (London: Routledge, 1997); Friedrich A. Kittler, *Gramophone, Film, Typewriter*, tr. Geoffrey Winthrop-Young and Michael Wutz (Stanford, California: Stanford University Press, 1999); Geoffrey Winthrop-Young, *Kittler and the Media* (Cambridge: Polity, 2010).

174 See for example Matthew Fuller, *Behind the Blip: Essays on the Culture of Software* (New York: New York: Autonomedia, 2003); Matthew Fuller, *Media Ecologies: Materialist Energies in Art and Technoculture*, rev. edn (Cambridge, Massachusetts: MIT Press, 2007); Matthew Fuller and Andrew Goffey, *Evil Media* (Cambridge, Massachusetts: MIT Press, 2012); Manovich, *The Language of New Media*; Noah Wardrip-Fruin, *Expressive Processing: Digital Fictions, Computer Games, and Software Studies* (Cambridge, Massachusetts: MIT Press, 2012); Noah Wardrip-Fruin and Nick Montfort (eds.), *The New Media Reader* (Cambridge, Massachusetts: MIT Press, 2003); Nick Montfort et al., *10 PRINT CHR\$(205.5+RND(1)): GOTO 10* (Bellingham, Massachusetts: MIT Press, 2012).

175 See Hayles, *How We Became Posthuman*; N. Katherine Hayles and Anne Burdick, *Writing Machines* (Cambridge, Massachusetts: MIT Press, 2002); Matthew G. Kirschenbaum, *Mechanisms: New Media and the Forensic Imagination* (Cambridge, Massachusetts: MIT Press, 2008); Matthew G. Kirschenbaum, Richard Ovenden, and Gabriela Redwine, *Digital Forensics and Born-Digital Content in Cultural Heritage Collections*, research assistance from Rachel Donahue (Washington, DC: Council on Library and Information Resources, 2010); Jean-François Blanchette, 'A material history of bits', *J. Am. Soc. Inf. Sci. Technol.* 62, no. 6 (June 2011), 1042–1057, doi: 10.1002/asi.21542; Johanna Drucker, 'Performative materiality and theoretical approaches to interface', *DHQ: Digital Humanities Quarterly* 7, no. 1 (2013), <http://www.digitalhumanities.org/dhq/vol/7/1/000143/000143.html>, accessed 11 December 2024; Anne Burdick, Johanna Drucker, Peter Lunenfeld, Todd Presner, and Jeffrey Schnapp, *Digital Humanities* (Cambridge, Massachusetts: MIT Press, 2016); Diana Coole and Samantha Frost (eds.), *New Materialisms: Ontology, Agency, and Politics* (Durham, North Carolina: Duke University Press, 2010); Lisa Gitelman, *Always Already New: Media, History, and the Data of Culture* (Cambridge, Massachusetts: MIT Press, 2008).

176 See Hans Ulrich Gumbrecht and K. Ludwig Pfeiffer, *Materialities of Communication* (Stanford, California: Stanford University Press, 1994); Timothy Lenoir, *Inscribing Science: Scientific Texts and the Materiality of Communication* (Stanford, California: Stanford University Press, 1998); Phillip Thurtle and Robert Mitchell (eds.), *Data Made Flesh: Embodying Information* (New York, New York: Routledge, 2003).

of the medium, of information, and of communication' ranging 'from the material stratum of media to the human body's interaction with technology to the socioeconomic systems which support such interaction,' as Bill Brown observes.¹⁷⁷

Im-materiality in materiality

Challenging the trope of immateriality, these various intellectual positions reject the notion that digital materiality consists of abstract entities, instead emphasizing the material bits, as exemplified by Jean-François Blanchette in his seminal text, 'A material history of bits'.¹⁷⁸ As these scholars point out, the trope of immateriality has been ascribed to electric technologies since the telegraph and further nourished by an understanding of information as liquid, 'transferring from vessel to vessel'.¹⁷⁹ 'By annihilating space and time,' such myths of immateriality allowed 'humankind to escape physical limitations'.¹⁸⁰ This logic also pervades Marshall McLuhan's understanding of electricity as the ultimate medium, 'since with electricity we extend our central nervous system globally, instantly interrelating every human experience'.¹⁸¹ At the same time, McLuhan's media theory turned to the medium's materiality by highlighting how physical processes shape information. In a manner slightly reminiscent of Herder's argument cited earlier, McLuhan ennobles tactility as the 'integral sense'.¹⁸² 'Touch is the sense of multimedia, the immersive simulations of cyberspace, and the connections, switches, and links of all nets. Communication cannot be caught by the gaze, but it always a matter of getting in touch,' Sadie Plant writes so eloquently.¹⁸³ Cybernetic theory, too, was very much aware of the physical constraints of electronic systems issued forth by material phenomena and thus emphasized the physicality of (digital) media. Such reflections might have also motivated Jean-François Lyotard's exhibition *Les Immatériaux*, curated with Thierry Chaput at the Centre George Pompidou in 1985.¹⁸⁴

'Why Immaterials'? Research and development in the technoscience, art and technology, yes even in politics, give the impression that reality, whatever it may be, becomes increasingly intangible.... The good old matter itself comes to us in the end as something which has been dissolved and reconstructed in complex formulas.¹⁸⁵

177 Bill Brown, 'Materiality', in W. J. T. Mitchell and Mark B. N. Hansen (eds.), *Critical Terms for Media Studies* (Chicago, Illinois: University of Chicago Press, 2010), 50.

178 Blanchette, 'A material history of bits'.

179 Brown, 'Materiality', 50.

180 Shawn Rosenheim, *The Cryptographic Imagination: Secret Writing from Edgar Poe to the Internet* (Baltimore, Maryland: Johns Hopkins University Press, 1997), 93.

181 Marshall McLuhan, *Understanding Media: The Extensions of Man* (New York, New York: Sphere Books, 1967), 395.

182 McLuhan, *Understanding Media*, 77.

183 Sadie Plant, 'On the matrix: Cyberfeminist simulations', in Robert M. Shields (ed.), *Cultures of Internet: Virtual Spaces, Real Histories, Living Bodies* (London: SAGE Publishing, 1996), 179.

184 The exhibition took place in the main gallery on the fifth floor from 28 March to 15 July 1985. It was developed by the Centre de Création Industrielle (CCI) for the Centre National d'Art et de Culture Georges Pompidou, with Jean-François Lyotard serving as the lead organizer.

185 Jean-François Lyotard, Jacques Derrida, and F. Burkhardt, *Immaterialität und Postmoderne* [Immateriality and postmodernity], tr. Marianne Karbe (Berlin: Merve Verlag, 1985), 10.

With the concept of 'immaterials', Lyotard argues that the relationship between human and material, and significantly human self-conception, would alter to the extent that technology would be able to reassume the abilities of the *logos* by storing and processing dematerialized data.¹⁸⁶ In light of this increasing penetration of mind and matter, Lyotard's neologism, *Les Immatériaux*, expressed that the material could no longer be viewed as an inert object opposing an intelligent subject, but instead now as 'cousins in the family of "Immaterials"'.¹⁸⁷ This dawning postmodern condition was translated into a labyrinthine exhibition environment, an uncanny data space, comprising a large number of computers, projectors, and other pieces of high-tech equipment, besides sculptures, paintings, conceptual art, video projections, documentaries, scientific experiments, holograms, contemporary music scores, architectural drawings, refrigerators, and robots.¹⁸⁸ Encouraging a state of unease and disarray, *Les Immatériaux* was meant to sensitize the visitor to the developments arising from the dissolution of the concept of matter as a solid building material of reality.¹⁸⁹ Lyotard posits that digitalization marks the ultimate level of abstraction in this process, as it enforces a finite encoding scheme that substitutes tangible matter with the language of an abstract universal code – the digital code, devoid of any direct analogy to its origin.¹⁹⁰ Such consecration of digital codes as 'existing independently of the usual material constraints and determinants, such as material bodies, politics, and the economy' enabled art historian Monika Wagner to argue that the exhibition was 'less received as a critical examination of an assailed notion of materiality but rather as a confirmation of the overcoming of the old physical world through information technology'.¹⁹¹ Reminding us of the idealist tradition of aesthetic theory that referenced Aristotle and Plato, Lyotard too subjects materiality to sublimation, a transformation of the material from its natural state towards a higher dimension.¹⁹²

'While Lyotard and his peers – very much in tune with the predominant fantasies of their period – mused about a future without material objects, the very title of the project pointed towards the incorporation of the virtual into the material world,' Marianne van den Boomen highlights.¹⁹³ Experts on the exhibition, including Antonia Wunderlich, Andreas Broeckmann, and Yuk Hui, have all implied that Lyotard understood the digital not as immaterial

186 Jean-François Lyotard, 'Les Immatériaux' [The immaterials], in Reesa Greenberg, Bruce W. Ferguson, and Sandy Nairne (eds.), *Thinking about Exhibitions* (London: Routledge, 1996), 162.

187 Lyotard, 'Les Immatériaux' [The immaterials], 159.

188 See Lyotard, 'Les Immatériaux' [The immaterials], 165.

189 See Lyotard, 'Les Immatériaux' [The immaterials], 170.

190 'The model of language replaces the model of matter'; see Lyotard, 'Les Immatériaux' [The immaterials], 164.

191 Monika Wagner, 'Material', in Karlheinz Barck, Martin Fontius, Dieter Schlenstedt, Burkhart Steinwachs, and Friedrich Wolfzettel (eds.), *Ästhetische Grundbegriffe: Historisches Wörterbuch in sieben Bänden* [Foundational concepts in aesthetics: Historical dictionary in seven volumes], 867.

192 For the conception of materiality in idealist aesthetics, see Bandmann, 'Bemerkungen zu einer Ikonologie des Materials' [Remarks on an iconology of material], 75.

193 Marianne van den Boomen, *Digital Material: Tracing New Media in Everyday Life and Technology*, 2nd edn (Amsterdam: Amsterdam University Press, 2014), 9.

but as deeply material.¹⁹⁴ Yuk Hui states, 'The term *les Immatériaux* was strategically chosen in order to disrupt the modern concept of matter ... the immaterial designates a new material, which could not and should not be the continuation of the traditional conception of matter.'¹⁹⁵ The immaterial, undergoing a transformative shift into materiality while retaining its original essence, gave rise to a novel framework where the conventional separation of mind and matter became untenable. Language was fundamental to Lyotard's formulation of the new material, in which 'the model of language replaces the model of matter'.¹⁹⁶ This is also evident in his conceptualization of the new materiality according to five categories: *Matériau* ('support'): the medium by which the message speaks; *Matériel* ('receiver'): the destination which the message addresses; *Maternité* ('sender'): the origin in the name of which the message speaks; *Matière* ('referent'): the contents of which the message speaks; and *Matrice* ('code'): the manner in which the message speaks.

The cyberculture which was emerging in the 1980s did not adopt Lyotard's thinking. Instead, it revived the notion of the immaterial digital. This notion is exemplified by John Barlow's 'Declaration of the Independence of Cyberspace', which states in part that 'there is no matter' in cyberspace.¹⁹⁷ William Gibson, too, fuelled such visions in his book *Neuromancer* (1984), which depicts a global computer network called the 'Matrix' wiring together brains and machines into a 'consensual illusion' located in 'the nonspace of the mind [made of] clusters and constellation of data'.¹⁹⁸ According to the founder of the MIT Media Lab, Nicholas Negroponte, the conceptual shift from 'atoms to bits' leads to the gradual dematerialization of advanced society.¹⁹⁹ Left behind, the body remains inert, while 'a disembodied subjectivity inhabits a virtual realm'.²⁰⁰ For Hayles, this image becomes the ultimate metaphor to describe the unjust distinction between materiality and information that has succeeded the Cartesian mind/body split.²⁰¹ By getting 'rid of the decay and inertia of material reality', as Slavoj Žižek writes, the image achieves what Dan Thu Nguyen and John Alexander call

194 See Yuk Hui and Andreas Broeckmann (eds.), *30 Years after 'Les Immatériaux': Art, Science, and Theory* (Lüneburg: meson press, 2015); Antonia Wunderlich, *Der Philosoph im Museum: Die Ausstellung 'Les Immatériaux' von Jean François Lyotard* [The philosopher in the museum: The exhibition 'Les Immatériaux' by Jean-François Lyotard] (Bielefeld: transcript Verlag, 2008).

195 Yuk Hui, 'Towards a relational materialism', *Digital Culture & Society* 1, no. 1 (2015), 131–132, doi: 10.14361/dcs-2015-0109.

196 Lyotard, 'Les Immatériaux' [The immaterials], 164.

197 John Perry Barlow, 'A declaration of the independence of cyberspace', *Electronic Frontier Foundation* website (date unknown, written 8 February 1996), <https://www EFF.org/cyberspace-independence>, accessed 10 December 2024.

198 William Gibson, *Neuromancer* (New York, New York: Berkley Publishing Group, 1989), 128.

199 Nicholas Negroponte, *Being Digital*, new edn (Rydalmere: Coronet Books, 1996).

200 Hayles, *How We Became Posthuman*, 379.

201 See in this context also the opening chapter of Hayles's book, where she writes 'Second, the post-human view considers consciousness, regarded as the seat of human identity in the Western tradition long before Descartes thought he was a mind thinking, as an epiphenomenon, as an evolutionary upstart trying to claim that it is the whole show when in actuality it is only a minor sideshow'. Hayles, *How We Became Posthuman*, 3.

'the human dream of transcending materiality at unforeseen cost.'²⁰² Similarly limited understandings of immateriality have also populated other areas of research. Colin Renfrew, one of the founding figures of cognitive archaeology, speaks of a 'dematerialization of material culture.'²⁰³ Here the 'physical, palpable material reality is disappearing,' marking an increased separation of 'substance' and 'communication.'²⁰⁴

A summary of these diverse positions is given by the literature critic Bill Brown. He speaks of the 'dematerialization hypothesis' comprising three main concepts.²⁰⁵ First, for Brown, such mythologies understand the digital as divorced from material constraints, thereby neglecting the materiality of communication (Barlow, Gibson, Negroponte). Secondly, they dismiss that reality is always mediated via media, thereby artificially demarcating mediality from reality (Žižek, Renfrew). Most prominently, Baudrillard claimed that the image has 'no relation to any reality whatsoever, it is its own pure simulacrum.'²⁰⁶ Thirdly, ideas of dematerialization tend to be built on a techno-deterministic hypostatization of the immaterial – they frame discourses of hypertext, virtual reality, and cyberspace outside a known materiality and as operating autonomously of material determinacies. Such prognoses often go hand-in-hand with arguments that the loss of reality is indicated by a loss of tactility in favour of the visual (Baudrillard). In the era of the 'hyperreal', materiality is merely a remnant of the past.²⁰⁷

Given these discourses on the dematerializing and immaterial aspects of the digital, Lyotard's ambitious *Les Immatériaux* can today be seen as the ancestor to more recent discussions around 'digital materialism'. The diverse debates have continued to evolve towards 'mapping out how new media can be traced as digital material ... by showing how technology is interwoven with material bodies, politics, and the economy.'²⁰⁸ These newer positions can be summarized as propelling a 'material turn' within various disciplines ranging from art history, anthropology, history, and media studies to the history of science and literary and cultural studies. While the various approaches within the field of materialist media studies may collectively explore the material substrates of digital culture, they significantly differ in their objects of study, methodologies, and theoretical approaches.

In trying to come to terms with the complex notions of materiality and plasticity at play in the works by Sterling Crispin and his peer group, it is fruitful to turn to two conceptualizations of digital materiality by Matthew Kirschenbaum and Bernard Stiegler. In his book *Mechanisms: New Media and the Forensic Imagination*, Kirschenbaum focuses on storage and the

202 Dan Thu Nguyen and Jon Alexander, 'The coming of cyberspacetime and the end of polity', in Robert M. Shields (ed.), *Cultures of Internet: Virtual Spaces, Real Histories, Living Bodies*, (London: SAGE Publishing, 1996), 99; Slavoj Žižek, *On Belief* (London: Routledge, 2001), 33.

203 Colin Renfrew, *Figuring It Out: What Are We? Where Do We Come From?*, new edn (London: Thames and Hudson Ltd, 2006), 185–186.

204 Renfrew, *Figuring It Out*, 185–186.

205 Bill Brown, 'Materiality', 49.

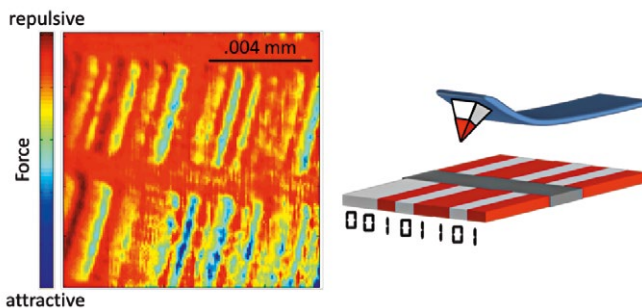
206 Jean Baudrillard, *Simulacra and Simulation*, tr. Sheila Glaser (Ann Arbor, Michigan: University of Michigan Press, 1994), 6.

207 Baudrillard, *Simulacra and Simulation*, 6.

208 Van den Boomen, *Digital Material*, 8.

inscription of digital information on hard drives. Prompted by Kittler's unsatisfying narrative of 'the universal ones and zeros of digital computation', he aims to uncover 'the heterogeneity of digital data and its embodied inscriptions' read through the framework of the hard drive.²⁰⁹ His theory on the status of digital inscription is based on a vocabulary borrowed from forensic expertise. The physical and chemical analyses used in criminology for reconstructing digital evidence allow Kirschenbaum to shift attention to the physical properties of digital inscription, a dimension also relevant for archival preservation. 'Every contact leaves a trace,' he states.²¹⁰ Once again, the Shroud of Turin comes to mind, as the supposed evidence of the materiality of an invisible being through the concept of trace. Kirschenbaum states, 'a forensic perspective furnishes us with two key concepts for an alternative approach to electronic textual studies: trace evidence and individualization.'²¹¹ The model he proposes distinguishes between *forensic* materiality and *formal* materiality. Forensic materiality rests upon the idea that bits are inscribed in the form of individualized physical traces and that 'no two things in the world [even the micron-sized residue of digital inscription] are ever exactly alike.'²¹²

Take, for example, the digital files of Crispin, Blas, or Rafman: These are typically stored on a hard drive where individual bit representations deposit discrete legible trails that can be observed with the aid of a technique known as microscopy.²¹³ Figure 86 is an example of a microscopic image that shows two rows of bits that encode a tiny fraction of a digital object, like those by Crispin and his peer group. The digital ones and zeros are depicted as alternating red and blue stripes. These colours symbolize the forces acting on the microscope lever: blue for zeros, which attract the lever, and dark red for ones, which repel it. In the illustration,



86 | Close-up image of bits seen through microscopy. From Andy Berger, 'Here's what the data on your hard drive looks like', *D-Brief* blog (31 July 2015).

209 Kirschenbaum, *Mechanisms*, 6.

210 Kirschenbaum, *Mechanisms*, 25 onwards.

211 See Kirschenbaum, *Mechanisms*, 19.

212 Such forensic materiality reveals itself in the 'surfaces, substrates, sealants and other material that have been used over the years as computational storage media, and in the engineering, ergonomic, and labour practices that attend computation'. See Kirschenbaum, *Mechanisms*, 10.

213 Kirschenbaum, *Mechanisms*, 10.

the lever is shown suspended above a hard drive sample, being deflected by the magnetic bits.²¹⁴ Kirschenbaum sees these physical remnants of the digital inscription as the indicators of *forensic materiality* that leaves physical traces in the matter.

Formal materiality, on the other hand, characterizes the state of bits as symbols, series of ones and zeros, manipulated by the computer. It describes the ‘imposition of multiple relational computational states on a data set or digital object’ and is therefore not an ‘absolute term’.²¹⁵ These two categories do not precisely reproduce the distinction between hardware and software ‘because the lines between hardware and software are themselves increasingly blurred, as is manifest in so-called firmware, or programmable hardware’.²¹⁶ The source code of the printable STL-files of Crispin’s *Data-Masks*, for example, features a list of symbols and letters describing a series of points in space that are connected via triangulation (fig. 87). They represent the surface geometry of a three-dimensional object, reminding us that ‘instead of manipulating matter, the computer allows us to manipulate symbols’.²¹⁷ Such files are typically regarded as carriers of information about the object itself, presenting a condensed and sign-based representation of the object’s digital plasticity. At the moment of printing, this representation transforms into an actual, physical *gestalt*. The file can, however, also carry metadata (embedded as plain text in the file’s header, for example), which is only revealed in a suitable software environment.

[illegible]

87 | Example of a 3D printable .STL file in binary format.

214 See Andy Berger, 'Here's what the data on your hard drive looks like', *D-Brief* blog (31 July 2015), <https://www.discovermagazine.com/technology/heres-what-the-data-on-your-hard-drive-looks-like>, accessed 6 January 2025.

215 Kirschenbaum, *Mechanisms*, 13.

216 Kirschenbaum, *Mechanisms*, 12.

217 Woodrow Barfield and Thomas A. Furness (eds.), *Virtual Environments and Advanced Interface Design*
(New York, New York: Oxford University Press, 1997). i.

Suddenly, the file reveals more (hidden) data than initially expected. Kirschenbaum's notion of *formal* materiality thus 'tries to capture something of the procedural friction or perceived difference – the torque – as a user shifts from one set of software logic to another.'²¹⁸ Kirschenbaum designates such materiality 'a relative or just-in-time dimension of materiality, one where any material particulars are arbitrary and independent of the underlying computational environment and are instead solely the function of the imposition of a specific formal regimen on a given set of data and the resulting contrasts to any other available alternative regimens.'²¹⁹

With Kirschenbaum, it can be observed that the algorithmic systems underpinning the digital plasticity of Crispin's, Blas's, or Rafman's works, systems that 'we call virtual[,] are in fact *physical* phenomena lacking the appropriate mediation to supplement wave-lengths optics; that is, the naked eye.'²²⁰ Their digital plasticity (in Kirschenbaum's terminology, their formal materiality) lacks the dimension of touch until it is matched or instanced in a physical and tactile counterpart. Inasmuch as objects, images, and texts take on the same material but invisible nature, the materiality of these works of art needs to be considered anew. Stiegler, expanding on Lyotard's notion of *Les Immatériaux*, comes to a similar observation, introducing his notion of the *hypermateral*. His emphasis is not so much on dematerialization in light of digital technologies, as Lyotard might suggest. He instead argues for an increasing superposition of the realms of information and materiality:

I call hypermatter a complex of energy and information where it is no longer possible to distinguish its matter from its form – what first appears with quantum mechanics, necessitating the abandonment of what Simondon called the hylomorphic scheme. This is the manner of thinking according to a pairing of concepts, form (*morphè*) and matter (*hylè*), which are thought as opposed to each other. I call hypermaterial a process where information – which is presented as a form – is, in reality, a sequence of states of matter produced by materials and apparatuses, by technological diapositives in which the separation of form and matter is also totally devoid of meaning. In terms of everyday life, we are not a part of a dematerialization at all but rather, quite to the contrary, a hypermaterialization: everything is transformed into information, which is to say into states of matter[,] by the intermediaries of materials and apparatuses, and it is this which makes everything controllable at the level of the nanometres and the nanosecond. This process leads to a considerable expansion of increasingly accessible states of matter which carry form, which is henceforth able to work in the infinitely small and the infinitely brief. As a result, matter is becoming invisible.²²¹

Stiegler's introductory words to his concept of the hypermaterial here recall Didi-Huberman's meditations on the plasticity of wax, one of Medardo Rosso's favourite preferred mu-

218 Kirschenbaum, *Mechanisms*, 13.

219 Kirschenbaum, *Mechanisms*, 13.

220 Kirschenbaum, *Mechanisms*, 19.

221 Bernard Stiegler, *Economie de l'hypermateriel et psychopouvoir: Entretiens avec Philippe Petit et Vincent Bontems* [Economy of the hypermaterial and psychopower: Interviews with Philippe Petit and Vincent Bontems] (Paris: Mille et une nuits, 2008), 110–112. The translation is from Sam Kinsley, 'Stiegler on "immateriality" and "virtual spaces"', Sam Kinsley personal website (12 August 2013), <http://www.samkinsley.com/2013/08/12/stiegler-on-immateriality-and-virtual-spaces/>, accessed 6 January 2025.

table matters. Didi-Huberman opens 'The Order of Material', initially published in 1999, with a similar observation. Wax, Didi-Huberman argues, overcomes the traditional hylomorphic structure 'deduced from the polarity of Matter/Form ... and Matter/Spirit', that had been invented in 'a Platonic context, popularized by Vasari at the moment of birth of the academic discourse called art history finally transported into the twentieth century by Panofskyian neo-Kantianism'.²²² Wax, in its 'paradox of consistency', its 'malleability', and its power of 'resemblance' presents itself instead as a 'substance between two material states'.²²³ It thereby moves 'between resemblance and formlessness'.²²⁴ As such, wax is characterized in a manner astonishingly similar to how the materiality of the digital has been described by, among others, Stiegler (whose 'hypermateral' is also conceived as a sequence of states of matter), Lyotard (whose 'immaterial' is 'a matter which has been dissolved and reconstructed in complex formulas'), and Kirschenbaum (for whom forensic materiality is not an absolute concept but rather seeks to encapsulate aspects of procedural resistance or perceived distinctions). Code, like wax, threatens the idealist concepts of form and matter, and matter and spirit, dichotomies which also nourished and sustained the all too physical and material productions of the immaterial. If one were to replace the word 'wax' with the word 'code' in the following quote taken from Huberman's text, it would serve as an ideal introduction of an anthology to digital materiality:

When one reads the technical writings of people who work with wax [code], one comes away with the strange impression that wax [code] is characterized only by being uncharacterizable: each time we recognize a material quality in wax [code], we immediately see another quality that is exactly opposite. Wax [code], emerges therefore as a material that is insensitive to the contradictions of its material qualities. It may be sculpted, modelled, or cast and is thus insensitive to the contradictions as well as the traditional hierarchies of plastic arts.²²⁵

Had he lived a century later, would Rosso have modelled with data and essentially in code? Reading the works of Crispin, Laric, or Rafman through the lens of recent debates on digital materiality, we are not only faced with states of matter beyond visibility but with a form of matter that shifts between material states. Following leading thinkers in the debates on digital materiality, it can therefore be argued that the algorithmic systems underpinning the digital plasticity of works by Crispin, Blas, or Rafman are physical but remain beyond the scope of human vision.²²⁶ These works are not so much symptoms of a dematerialization in light of digital technologies; rather, they are exemplars of the increasing superposition of the realms of information and materiality. Digital code – not unlike the mutable matters of wax and gesso used by modern sculptors – threatens the idealist concepts of form and matter and of matter and spirit – a dichotomy which also nourished and sustained the all too

222 Didi-Huberman, 'The order of material', 195, 203.

223 Didi-Huberman, 'The order of material', 202.

224 Didi-Huberman, 'The order of material', 200.

225 Didi-Huberman, 'The order of material', 200.

226 See Kirschenbaum, *Mechanisms*, 19.

physical and material productions of the immaterial. In recent sculptural production, code has, therefore, become not only an artistic material but also a mutable matter. Such observations complicate the notion of materiality at play in the sculptural production of Crispin and his peer group, significantly impacting any understanding of plasticity.

If code has become an artistic material, how can we conceive of code's mutability? The following section traces the morphological understanding of digital materials from a historical perspective, beginning with cellular automata, moving on to early digital art in the 1960s, and culminating in the 3D printed 'digital sculptures' of the 1990s. This exploration highlights the need to reconsider the notion of plasticity in contemporary sculptural production in '(post-) digital' terms.

2.3 Algorithmic visions: Towards a digital plasticity

The imperative of information processing has turned culture into a lab of generative forms that are driven by open-ended rules. Whether we are speaking about DNA, bacteria, or stem cell cultures, cultures of sounds and images, time-based cultures, or cultures of spatial modelling, algorithms now explain evolution, growth, adaptation, and structural change. Algorithms, therefore, have become equated with the generative capacities of matter to evolve.²²⁷

This lucid reflection on the ontological and epistemological transformations of architecture through (digital) technology comes from the cultural theorist Luciana Parisi, in the introduction to her book *Contagious Architecture: Computation, Aesthetics and Space*. Her thoughts can be read in conjunction with a larger paradigm shift in architecture as summarized by architect Paul Wintour:

Architecture has recently undergone a paradigm shift from being based on purely visual concerns towards an architecture justified by its performance. This shift privileges material performance over appearance and process over representation (Leach, 2009, p. 34). The resulting design process can be described as an interest in morphogenesis.²²⁸

Processuality, mutability, and generative malleability – characteristics that strongly resonate with the history of plasticity at the turn of the twentieth century – return in more recent debates across fields ranging from architecture and design to art. The following section traces the mutability and materiality of code from second-order cybernetics to software studies, and from discussions on algorithmic art to parametric architecture. The goal is to develop a nuanced understanding of digital plasticity and its relationship to various reproductive technologies from a historical perspective. Questions surrounding authorship permeate the

227 Parisi, *Contagious Architecture*, 1.

228 Greg Lynn bases his observations on a text by Neil Leach, 'Digital morphogenesis', *Architectural Design* 79, no. 1, Special Issue: Theoretical Meltdown (January/February 2009), 32–37, doi: 10.1002/ad.806. See Paul Wintour, 'The Big Bang of architectural evolution', *Parametric Monkey* website (2 January 2015), <https://parametricmonkey.com/research/the-big-bang/>, accessed 12 December 2024.

88 | Quayola, *Laocoön Fragments*, 2016; iron-filled resin, mirror-polished steel slates. Installation view, Bitforms Gallery, New York, 2016.



discussion of digital plasticity and its relationship to technology, demonstrating that a generalized consideration of the subject matter is not sufficient. It also highlights the significant role of women in the development of computing, emphasizing their crucial contribution to any conceptualization of digital plasticity.

Furthermore, an understanding of historical contingencies will help to further refine the understanding and conceptualization of plasticity in recent artistic productions. How does the digital plasticity of Crispin and his peers build on and distinguish itself from previous digital plastic concerns?

Unsurprisingly, Parisi's and Lynn's characterizations apply intuitively to Crispin's *Data-Masks*. Crispin employs generative algorithms to evolve image data until such data begins to qualify as a human face (see fig. 66). Algorithmic 'deep dreaming' based on performativity and processuality is part of the work, determining its final appearance: face-like masks caught in metamorphosis. Another artist for whom Parisi and Lynn provide critical understanding is the Italian sculptor Quayola. Influenced by architectural concerns, particularly parametric architecture, Quayola uses genetic software to create and manipulate his digital forms. In *Laocoön Fragments* (2016), his appropriation of the Hellenistic sculpture *Laocoön and his Sons* (second century BCE), Quayola interweaves sculptural approaches and digital technology to produce a simulated archaeology.²²⁹

Presented as if unearthed from a fictional future, six sculptural fragments are arranged across a mirror-polished table (fig. 88). Each object captures one version of Laocoön's head caught in a strange metamorphosis, oscillating between abstraction and figuration, destruction and construction, stereometric fragmentation and organic representation (fig. 89).

229 See Quayola's statements quoted in Wall Street International, 'Quayola: Fragments', *Wall Street International – Art blog* (23 February 2017), <https://wsimag.com/art/23816-quayola-fragments>, accessed 16 December 2024.



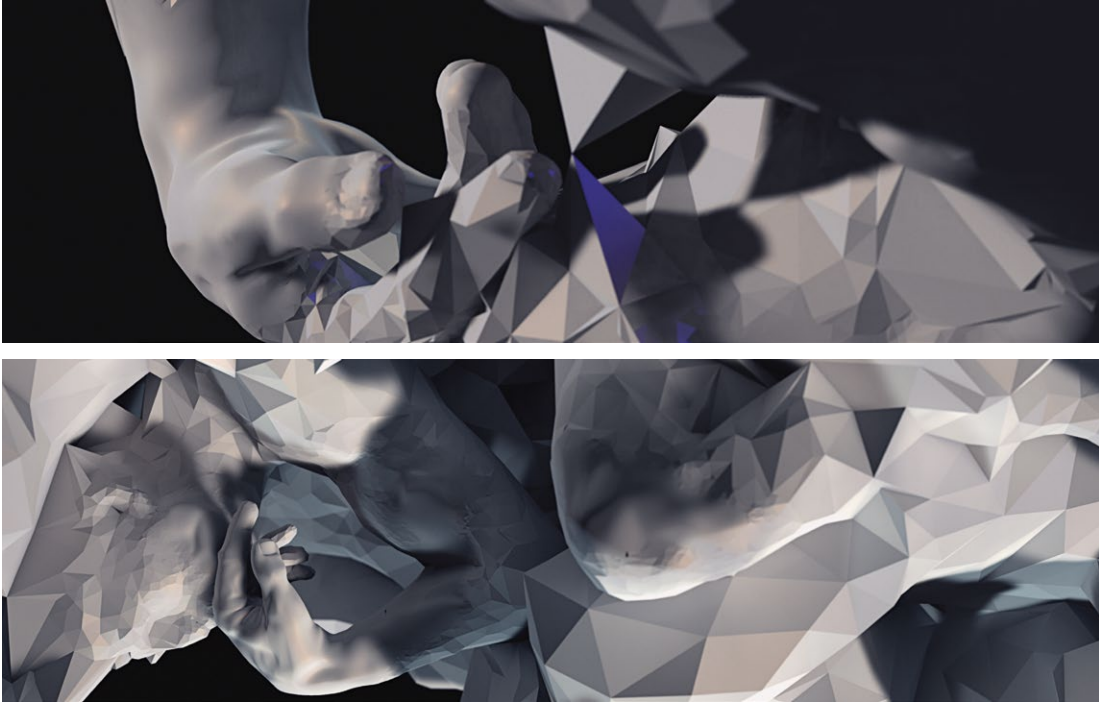
89 | Quayola, Laocoön Fragment # B_004.002, 2016; iron-filled resin; 51 × 47 × 43 cm.

Unlike the careful studies of the *Laocoön* group through drawings or cast making – typical in the approaches by artists such as Michelangelo, El Greco, or Rubens – Quayola's working process begins with quantitative data capture. He uses photogrammetry and online imagery of the sculpture at the Vatican Museum to generate a 3D reconstruction.²³⁰ The careful scanning of the object quite literally translates the plasticity of the object into digital space. The antique work, itself a copy and fragment, begins to exist both in the digital and physical realms, as real and virtual versions, without having Quayola assign more importance to whichever version he decides to materialize. Quayola translates formal and actual plasticity into digital plasticity, negotiated on the level of the objects' source codes. The resulting data set of spatial coordinates, a list of numbers in ASCII text comprising millions of points with XYZ coordinates on the surface, is then rendered as a point cloud.²³¹ Once the object becomes removed from its original materiality, it can be displayed in various formats (such as text or simulation). 'Sign' and 'signified' are now inseparably linked, challenging our understanding of text and material.

After isolating Laocoön's upper body, Quayola transfers the file into the 3D animation software Houdini. In collaboration with a programmer, Quayola has customized parts of the

230 Bernard Andreae, *Laokoon und die Gründung Roms* [Laocoön and the founding of Rome] (Mainz: Verlag Phillip von Zabern, 1988), 13.

231 Due to limited access to the original sculpture, the data is insufficient to generate an accurate sculpture model via the photogrammetric process. The generated model, therefore, needs to be supplemented and further cleaned up in ZBrush. For instance, if image data is missing, then geometry overlaps, surfaces need to be softened and smoothed, or the number of polygons that define the texture of the object surface must be adjusted. Divorced from its original materiality, the object becomes infinitely malleable and composed in digital code.



90 | Screenshots of Quayola's short film *Matter*, 2013; 00:03:07 min.

software. By adding scripted code, he has created an algorithmic system allowing for the manipulation of the *Laocoön Fragments*. It is interesting to note that already at the simulation level, the artist adds new details like hair or muscles which do not exist on the original sculpture's monumental features. As such, the artist creates not a realistic cast of the statue but rather an artistic fiction. Through different filters, splits, and points of impact, the algorithms stereometrically fracture and transform the object's surface, vantage points, and scale. Quayola has captured this morphological approach to his digital material in a short film called *Matter* (2013, fig. 90).²³²

The object surfaces intuitively resemble the parametric designs of architects such as Frank Gehry, Coop Himmelb(l)au, Herzog and de Meuron, and Zaha Hadid. Their buildings are the visible indicators of an otherwise invisible formation and thus the plastic process. Like Quayola or Crispin, these architects use the generative power of algorithms as exploratory tools and thus shift parts of their artistic autonomy to the technological system.²³³ Much like

232 See Quayola, 'Matter (excerpt)' [video], *Vimeo* (16 March 2012), <https://vimeo.com/38651080>, accessed 6 January 2025.

233 See Ingeborg M. Rocker, 'When code matters', *Architectural Design* 76, no. 4 (1 July 2006), 23, doi: 10.1002/ad.289.



91 | Documentation of *Laocoön Fragments* production process: Application of patina on iron-filled resin casts, 'Laocoön Fragments: Quayola 2016–2017', Factum Arte blog.

the plasticity of parametrically designed buildings, the plasticity of Quayola's *Laocoön Fragments* is mediated by algorithmic processes. They outline interactions and movements between elements within parameters. The artist or creator thus retains significant aesthetic and conceptual input. They not only encode their creative intentions and design parameters into algorithms and design workflows but also make aesthetic choices which reveal their artistic attitudes, personal styles, and processes of reflection. One could think of the computational infrastructure as a 'synthesizer', an instrument that allows 'co-creation between artist and algorithmic system', as Quayola explained to me. The process remains random until the artist makes sense of the various versions through deliberate selection. From the vast number of *Laocoön* versions generated from the applications of fractures and filters, Quayola realizes only a small number in actual physical material – either in the form of 2D or 3D prints.

In the case of *Laocoön Fragments*, the artist materializes the digitally computed versions with a Selective Laser Sintering process, the same method used by Crispin for his *Data-Masks*. As part of the process, the fragment is further fragmented to enhance the accuracy of printing. Once printed in three dimensions, the surfaces of the prints are smoothed and then used to create silicone moulds in preparation for casting in an epoxy resin filled with iron. After casting the objects in iron-filled resin, their parts are reassembled and then finished with a patina (fig. 91). Like Crispin's objects and selected sculptures by Laric or Rafman, their digital plasticity is doubled up and made durable with a formal plasticity realized in actual materiality. Their works, computed on almost all production levels, now exist somewhere between physicality and virtuality. At the heart of his making process resides not a physical object but its virtual iteration.²³⁴

Early digital plasticity: Cellular automata

Significant precursors to the morphogenic approaches in recent cultural production are the process-oriented, generative, and self-replicating cellular automata and the perceptron.²³⁵ As an essential subject of research in the early 1950s, these technologies were used to determine possible models for biological systems, thus foreshadowing Crispin's genetic algorithms.²³⁶ At its core, a cellular automaton can be defined as a set of coloured cells arranged on a designated grid shape, undergoing discrete time steps and evolving based on a predefined set of rules influenced by the states of neighbouring cells. Here, the patterns become,

234 See Victor Buchli, *An Archaeology of the Immaterial* (Milton Park: Routledge, 2015), 144.

235 Stephen Wolfram, *A New Kind of Science* (Champaign, Illinois: Wolfram Media, 2002), 48.

236 This historical development marks the initial point for the genetic algorithms employed today. For further reading see Lawrence Jerome Fogel, Alvin J. Owens, and Michael John Walsh, *Artificial Intelligence Through Simulated Evolution* (New York, New York: Wiley & Sons, 1966); Ingo Rechenberg, *Cybernetic Solution Path of an Experimental Problem* (Hampshire: Ministry of Aviation, 1965); Hans-Paul Schwefel, *Numerical Optimization of Computer Models* (Chichester: Wiley & Sons, 1981); David E. Goldberg, *Genetic Algorithms in Search, Optimization, and Machine Learning*, 13th edn (Reading, Massachusetts: Addison Wesley, 1989); John H. Holland, *Adaptation in Natural and Artificial Systems: An Introductory Analysis with Applications to Biology, Control, and Artificial Intelligence*, new edn (Cambridge, Massachusetts: MIT Press, 1992).

as in Crispin's work, the 'visible indicator for an otherwise invisible algorithmic operation'.²³⁷ The rules are then applied iteratively for as many time steps as desired. The system's defining characteristic is the self-replication of its own process, made possible by the mutating and malleable nature of its code. The theoretical groundwork for cellular automata was established by the mathematician Alan Turing, and their practical implementation was anticipated by Norbert Wiener's cybernetic research on feedback systems. It is worth noting that both Turing's and Wiener's investigations originated within the military-industrial complex. The historical context holds importance, emphasizing that the aims of digital adaptability were predominantly moulded by the military and aviation industries until artists became interested, introducing novel applications for pre-existing technologies.

Turing, who was prosecuted for 'homosexual acts' by the British government and forced to undergo chemical castration treatment, died two years after his punishment from cyanide poisoning. He never conceptualized his Turing machine as an operating, practical computer technology.²³⁸ Turing envisioned it as a 'thought experiment' that offered a 'precise definition of a mechanical procedure – an algorithm'.²³⁹ In his paper *Cybernetics: Or Control and Communication in the Animal and the Machine*, initially published in 1948, Wiener contended that feedback could be incorporated into the control system of Turing's machine.²⁴⁰ Consequently, the machine could adjust its behaviour in response to changes in the environment, just like a human or animal, and thereby function autonomously and successfully on its own. John von Neumann, who developed the first two-dimensional self-replicating automaton, the *Universal Copier and Constructor*, referenced and extended Turing's and Wiener's models.²⁴¹ He introduced a system that would constantly modify each code and operation, resulting in a successive iteration that visually manifested itself in evolving and changing patterns.²⁴² Wiener and von Neumann had met at the Los Alamos National Laboratory when consulting for the Manhattan Project. At this secret facility in New Mexico, launched to design and build an atomic bomb, von Neumann had been involved with developing the mathematical model that underpinned the development of the critical lenses focusing the explosion of the Fat Man bomb dropped on Nagasaki. Prior to creating one of the earliest cellular automata in the 1950s, von Neumann played a key role in the creation of the Electronic Numerical Integrator and Computer (ENIAC) during the 1940s. ENIAC, an

237 Rocker, 'When code matters', 21.

238 See Alan M. Turing, 'On computable numbers, with an application to the "Entscheidungsproblem"', *Proceedings of the London Mathematical Society* s2-42, no. 1 (12 November 1937), 230–265, doi: 10.1112/plms/s2-42.1.230. Nevertheless, Turing considered his machine universal, as it had the ability to simulate all other calculable machines; he thus saw the ground-breaking potential of his invention.

239 Rocker, 'When code matters', 20.

240 Norbert Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine*, 2nd edn (Cambridge, Massachusetts: MIT Press, 1961).

241 See John von Neumann, *Theory of Self Reproducing Automata* (Champaign, Illinois: University of Illinois Press, 1966).

242 See Moshe Sipper, 'Fifty years of research on self-replication: An overview', *Artificial Life* 4, no. 3 (1 June 1998), 240, doi: 10.1162/106454698568576.

early forerunner of contemporary computers, was initially conceived to calculate firing tables for artillery by the United States Army's Ballistic Research Laboratory.²⁴³ Von Neumann's work on the cellular automaton was also profoundly inspired by the mathematical works of Warren S. McCulloch and Walter Pitts, who in 1943 had published on neural networks that can be seen as the precursors of the neural networks used for facial recognition technology like Facebook's *Deep Face* technology.²⁴⁴ In particular, Frank Rosenblatt's perceptron, the first operating artificial neural network, is one of the most influential precursors of machine learning. The machine, inspired by the brain's functioning, was designed for image recognition using learning algorithms.²⁴⁵ It could be trained to recognize shapes and determine whether a pattern fell within a specific class. For example, it could ascertain whether an image depicted a circle or not. The perceptron functioned as a 'binary classifier', meaning that if the input image was recognized as belonging to a certain class, it produced the result '1'.²⁴⁶ If not, it returned '0'. However, this was a linear classification achieved with a binary single-layer neuron model, which stands in stark contrast to the multilayer neural networks used in machine learning today.

Yet Rosenblatt engineered his device not only to memorize specific patterns but also with the aim of enabling it to learn and recognize any potential pattern. To this end, the device progressively adjusted the values of its nodes to resolve a large numerical input (a spatial matrix of four hundred numbers) into a simple binary output ('0' or '1').²⁴⁷ As Matteo Pasquinelli observes, 'the Perceptron marked not a biomorphic turn in computation but a topological one; it signified the rise of the paradigm of "computational space" or "self-computing space." This turn introduced a second spatial dimension into a paradigm of computation that until then had only a linear dimension (see the Turing machine that reads and writes 0 and 1 along a linear memory tape).'²⁴⁸ This topological turn indicates the beginning

243 James Bridle describes the environment at the Ballistic Research Laboratory as follows: 'In 1948 the ENIAC was moved from the University of Pennsylvania in Philadelphia to the Ballistic Research Laboratory in Maryland. The monstrous machine consisted of 18,000 vacuum tubes, 700,000 resistors, 10,000 capacitors and 6,000 switches. It was about two feet across and three feet deep and ten feet high. It consumed 140 kilowatts of power. To reprogram, it, it was necessary to turn hundreds of ten-pole rotary switches by hand, the operators moving between the stacks of equipment, connecting cables and checking hundreds of thousands of hand-soldered joints.' James Bridle, *New Dark Age: Technology and the End of the Future* (London: Verso Books, 2018).

244 See Herbert D. Landahl, Warren S. McCulloch, and Walter Pitts, 'A statistical consequence of the logical calculus of nervous nets', *The Bulletin of Mathematical Biophysics* 5, no. 4 (1 December 1943), 135–137, doi: 10.1007/BF02478260; Warren S. McCulloch and Walter Pitts, 'A logical calculus of the ideas immanent in nervous activity', *The Bulletin of Mathematical Biophysics* 5, no. 4 (1 December 1943), 115–133, doi: 10.1007/BF02478259.

245 See Frank Rosenblatt, 'The perceptron: A probabilistic model for information storage and organization in the brain', *Psychological Review* 65, no. 6 (1958), 386–408, doi: 10.1037/H0042519.

246 Matteo Pasquinelli, 'Three thousand years of algorithmic rituals: The emergence of AI from the computation of space', *e-flux* online journal 101 (June 2019), <https://www.e-flux.com/journal/101/273221/three-thousand-years-of-algorithmic-rituals-the-emergence-of-ai-from-the-computation-of-space/>, accessed 13 December 2024.

247 Pasquinelli, 'Three thousand years of algorithmic rituals'.

248 See Pasquinelli, 'Three thousand years of algorithmic rituals'.

of a significant shift, namely from modelling with 'passive information' to modelling with 'active information'.²⁴⁹ The perceptron ushered in an era in which a visual matrix is no longer only computed by a 'top-down algorithm' comparable to editing images in a graphic image programme such as Adobe Photoshop. Rather, the perceptron organized the pixels of the visual matrix according to their spatial disposition. The algorithm's operation is shaped by the spatial relations inherent in the visual data it processes.

This modelling with active, vivid information informs the digital plasticity emerging in recent artistic productions. Cellular automata based on Neumann's research were tested in the natural sciences from the 1960s through the 1970s and used to simulate the evolution of natural processes. Alongside the research on neuron networks by Rosenblatt, Warren S. McCulloch, and Walter Pitts, these devices anticipated the genetic and object-oriented algorithms used in contemporary times.²⁵⁰ These automata and devices showcased the potential of evolving code and active information, which could be visualized on the screen and materialized through the digital medium.

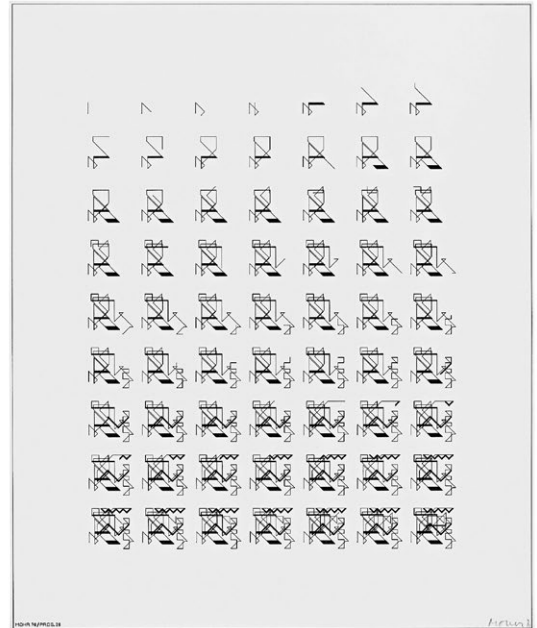
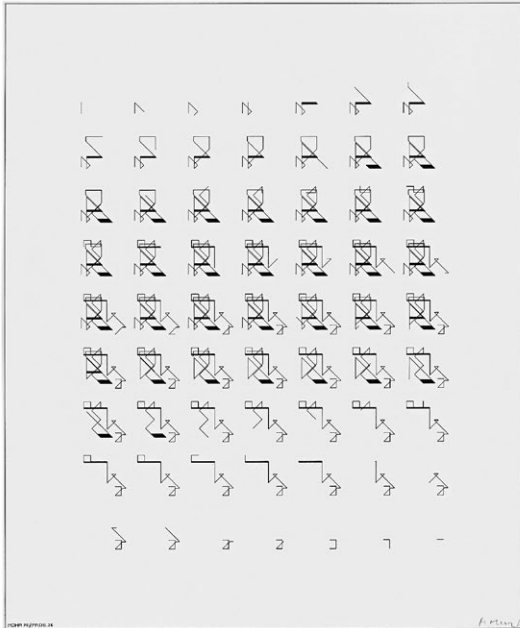
Plasticity in early computer art

Such processuality and mutability of digital code, which mark central concerns in recent sculptural productions of Crispin and his peers, also featured strongly in the early days of computer art in the 1960s. Influenced by the conceptual practices of artists such as Sol LeWitt, Victor Vasarely, Jean Tinguely or Jean-Pierre Hébert, the early digital artists – including Manfred Mohr, Vera Molnár, Frieder Nake, Georg Nees, A. Michael Noll, Lillian Schwartz, Agnes Denes, and Sonia Landy Sheridan – showed a deep interest in how codes and algorithmically-driven processes could determine the outcome of artworks. This post-cybernetic notion of information that had led to the rapid rise of conceptual art and the reveries of a dematerialized world imbued with information could now finally be probed in the digital medium. The early pioneers of digital art shared an exploration of generative approaches to building serialized models – however, not through analogue means like Sol LeWitt, but through digital ones. Anticipating the practices of contemporary artists, the efforts of early digital practitioners rehearsed the malleability of code that arises from reducing one's referent to binary data. By allowing software algorithms to design primitive generic forms, these artists fundamentally questioned the modalities of the conception and reproduction of an artwork. In what he called 'programmed expressionism', the German artist Manfred Mohr explored a novel form of art-making, employing self-written software to generate works.²⁵¹

249 Pasquinelli, 'Three thousand years of algorithmic rituals'.

250 Fuelled by a rapid proliferation of publications on the biological growth and form in physico-mathematical terms, such as D'Arcy Thompson's *On Growth and Form*, first published in 1917, scientists like John Conway (inventor of *Game of Life*) used computational L-systems for modelling the growth of plants. L-systems consist of four elements: a starting point, rules or syntax, constants, and variables. They grow by writing and rewriting the code, and the expression of the code depends on the graphical command selected.

251 Manfred Mohr quoted in William Fowler, 'Manfred Mohr: The groovy German who taught computers to make art', *The Guardian* online (12 February 2016), <http://www.theguardian.com/artanddesign/2016/feb/12/manfred-mohr-the-man-who-taught-computers-to-make-art>, accessed 11 December 2024.



92 | Manfred Mohr, *P-026-028*, 1970; computer-generated plotter drawing, ink on paper; 56 × 46 cm each.

Through iteration of code based on rules he defined, Mohr generated an algorithmic 'alphabet of arbitrarily generated elements' which he called 'aesthetic filters' (fig. 92).²⁵² All works were generated by the computer in accordance with the final programme and accepted unconditionally as legitimate results. He referred to his two-dimensional works as '*êtres graphiques*', which, according to Thomas Kurtz, 'attributing to them a development and a history of their own resulting from the "program[me] dialogue", and thus a real life of their own, regarding them as bearers of individual esthetic information'.²⁵³

This generative programming approach also allowed Mohr to create a series of images that were all instances of one original idea altered by random selection principles built into his algorithms – 'versions', as artist Oliver Laric would say. 'The algorithmic principle had entered the world,' the artist Frieder Nake observes in retrospect, calling it a 'revolutionary act' which was disguised by the superficial label 'computer art' assigned to his work and that of his peers in the mid-sixties.²⁵⁴ Algorithms now generated signs mediated by process signals,

252 Marion Keiner, Thomas Kurtz, and Mihai Nadin (eds.), *Manfred Mohr* (Weiningen-Zürich: Waser Verlag 1994), 45.

253 Thomas Kurtz, 'Mut zur Konsequenz / The courage of one's convictions' in Keiner et al. (eds.), *Manfred Mohr*, 22.

254 Frieder Nake, 'Paragraphs on computer art, past and present', in Nick Lambert, Jeremy Gardiner, and Francesca M. Franco (eds.), *CAT 2010: Ideas Before Their Time: Connecting the Past and Present in Computer Art: Index* (London: Computer Art and Technocultures AHRC Project, 2010), 55, doi: 10.14236/ewic/CAT2010.0.

and thus shifted the artist's creation process towards the writing of programmes. The materialization of the work was a central concern, too. Mohr, Molnár, Nake, Nees, and Sheridan implemented their work with early plotter technology, a mechanical device connected to a computer that controls the movements of a pen or brush.

Counter to the dematerializing phantasies of their time, these artists not only explored code's specific materiality that was imprinting itself on the face of the artwork but also its plastic potential. This approach becomes most evident in the personal diaries of artist Vera Molnár, published and researched by the art historian Pierre Braun. Molnár diligently records the stages of conceptualization of her work, which is often drawn from geometrical forms, altered and manipulated according to Molnár's rules, and processed by a computer.²⁵⁵ According to Braun, these sources cast light on Molnár's 'plastic', 'generative', and 'tangible' approach to coding.²⁵⁶ A page of Molnár's *Diary No. 2* (1984–1987) juxtaposes two types of drawings (fig. 93), one made by the artist's hand, the other produced by a plotter. Both drawings show a serial and seemingly evolving structure of similarly sized rectangles. The artist's sketch serves as the starting point for an algorithmic process, through which Molnár translated her drawing into instructions for a plotter. It is interesting to note that while Vera Molnár adjusted the code, she didn't actually write the programs herself. Instead, she preferred to ask friends or students of her husband, François Molnár, to do the coding.²⁵⁷ Figure 94 illustrates the code for her plotter drawing, written in the 'computer language BASIC and implemented under MS-DOS'.²⁵⁸ It conveys a series of commands in which each rectangle is transcoded as a slight configuration and modulation of the previous one. It is based on the mathematical function of the type $y = \sin(x)$ – the height of the curve at every point is the line value of the sine – and translates the code into the tracing steps of the plotter.²⁵⁹

In this transcoding from one representation to another, certain graphic elements are preserved while others seem to disappear in the translation process. The creative dialogue between artist and machine results in 'an organizational logic that gradually develops micro-narratives based on structural arrangements of elementary geometrical shapes'.²⁶⁰ The difference between handmade and plotted drawings could thus be understood as demonstrating the artistic autonomy of the machine. At the same time, the signs used to instruct

255 See Pierre Braun, 'Véra Molnar: atlas génératif et stitch up graphique' [Vera Molnár: Generative atlas and graphical stitch-up], *Computer Drawing* blog (19 December 2011), <https://computerdrawing.hypotheses.org/197>, accessed 11 December 2024.

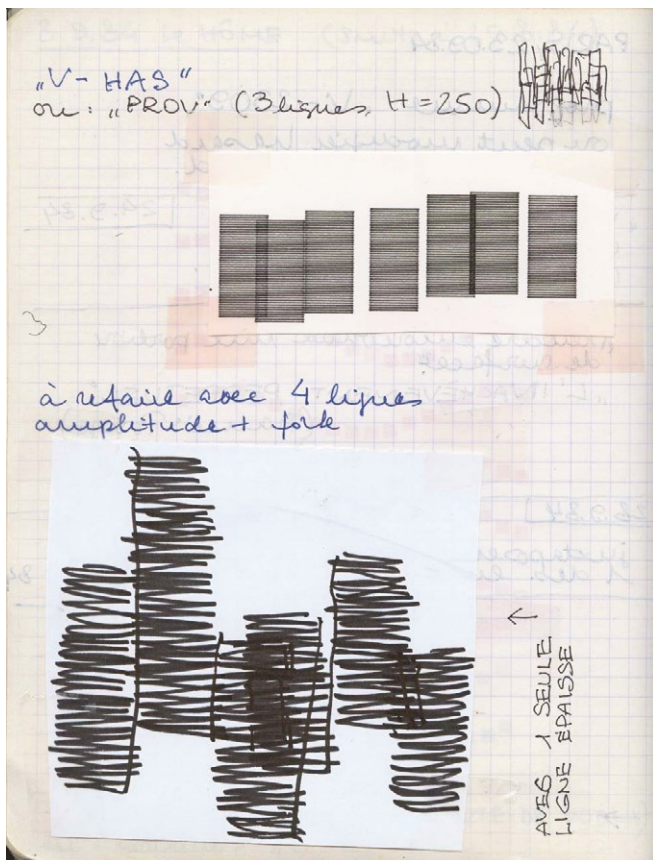
256 Pierre Braun, 'Véra Molnar: Enquête sur le code et l'archive' [Vera Molnár: Overview of code and archive] in Vincent Baby, Pierre Braun, Amely Deiss, et al. (eds.), *Véra Molnar: une rétrospective, 1942–2012* [Vera Molnár: A retrospective, 1942–2012] (Paris: Chauveau, 2012), 50–51.

257 My thanks to Pierre Braun, who pointed this out to me in an email.

258 Braun, 'Véra Molnar: Enquête sur le code' [Vera Molnár: Overview of code], 51. Translation by Mara-Johanna Kölmel.

259 See Braun, 'Véra Molnar: Atlas génératif' [Vera Molnár: Generative atlas]. Translation by Mara-Johanna Kölmel.

260 Braun, 'Véra Molnar: Atlas génératif' [Vera Molnár: Generative atlas]. Translation by Mara-Johanna Kölmel.



93 | Vera Molnár, page of diary
no. 2, entry from 02.10.1984.

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26 ISCREEN=0: IWINDOW=5: IVIEW=10: INAP=15: ICOLOR=20: ICIRCLE=25: ILINE=30: IPAIN=35
27 IPOINT=40: IPSET=45: IPRESET=50: IGET=55: IPUT=60: ICLS=65: IGEND=65
28 DEF SEG=ISEG
29 INODE=3: CALL ICLS(INODE)
30 IX1=0: IV2=0: IX2=959: IV2=653: CALL IWINDOW(IX1, IV1, IX2, IV2)
31 A=3: RANDOMIZE A
32 CB=2.5
33 AC=INT(RND*30): AC=RND: IF AC<.5 THEN AC=-AC
34 KR=10: CR=LR=.5: Z=RND: IF Z<.5 THEN LR=-LR
35 HA=190: LA=35: PAS=70: PAR=1.2
36 PI=3.141592: FR=KR+100
37 RV0=50: RV0=30: RV=RV0: AV0=AV0
38 FOR I=0 TO ((2*PI)*1000)/40 STEP PI/110
39 K=7
40 LQ=INT(RND*10): LJ=INT(RND*22
41 LZ=RND: IF LZ<.5 THEN LQ=LQ: IF LZ<.5 THEN LJ=LJ
42 SZER=2
43 IX1=RV+PAS/2: IV1=RV+LJ: IX2=IX1+LA: IV2=IV1+HA: ITVP=0: ICOL=K: IT=1: IP=0: IPTN=0
44 GOSUB 500
45 RV=RV+LA+PAS/2: AV=RV+K: SINK(RND+LR)*SZER
46 K=RND*10: GOTO 78
47 L=RND: IF L<.5 THEN GOTO 77
48 L=RND: IF L<.5 OR L<.5 THEN GOTO 76
49 IF L<.7 OR L<.7 THEN GOTO 75
50 K=K+GOTO 78
51 K=K+GOTO 78
52 K=K+GOTO 78
53 NEXT I: RV=RV+LQ-19*(LA+PAS/2): AV=RV0*(U+Z): RV=RV+PAS*(U+Z)-PAS/2
54 U=D*33
55 M=M+1: IF M<4 THEN GOTO 41: ELSE GOTO 2205
56 X=200: V=200+LQ
57 A=9
58 RANDOMIZE A
59 W=1+I+V+IV1+4: HA=HA+4: LA=LA+4
60 CALL ILINE(ITVP, IX1, IV1, IX2, IV2, ICOL, IT, IP, IPTN)
61 RETURN

```

94 | Vera Molnár, Instruc-
tions for plotter drawing
on CD-Rom, diaries 1976–
2003.

the plotter assume a 'tangible' quality.²⁶¹ Braun concludes that it is these material 'assemblages of plastic and mental operations' that make up Molnár's and much of the early computer-generated work.²⁶² Her creations embrace both the limitations and the possibilities of code, with or without the direct use of a computer. In this way, her work stands as an early testament to digital acculturation, exploring the intersection between painting and art in the digital age (Fig. 95).

Women played significant roles in the development of computing and, thus, the conceptualization of a digital plasticity – take Ada Lovelace's development of the first software for the programmable computer or Adele Goldstein's contribution as software developer for the early ENIAC. Concomitantly, women also participated in the computer art and technology movement from the first decade and contributed to this emerging digital plasticity. For example, Lillian Schwartz's early kinetic sculptures fused mechanics with computational mathematics. Schwartz worked at Bell Labs in 1968 alongside several digital pioneers experimenting with creative processes and the computer.²⁶³ Schwartz collaborated with distinguished scientists, mathematicians and artists – among them Ken Knowlton, the author of BEFLIX, one of the original animation programming languages. In 1972, Schwartz started working on a five-storey computer-controlled kinetic sculpture commissioned by AT&T in honour of physicists Clinton Davisson and Lester Germer, who discovered the wave–particle duality of matter fundamental to the development of the electron microscope (fig. 96).²⁶⁴ Her proposed work consisted of sixteen rectangular, highly polished aluminium panels hung from a frame within which each panel was to be controlled by a motor. In the spirit of Davisson and Germer's research, Schwartz designed her sculpture to mirror light waves off its reflective surfaces, resulting in an intricate interplay of reflections and evolving patterns across the walls of the exhibition space. The sculpture's unique feature, however, was its computer-controlled movement that used algorithmic instructions to create an infinite series of patterns. Schwartz worked with scientists Bill Blumberg and Dave Zuckerman, who 'interfaced each motor with its own microprocessor and wrote a program[me] so that the degree, duration, and direction of a rotation could be controlled on the basis of a single panel's motion and its motion in relation to the other panels. A personal computer ran the operation but was later replaced by a control box with toggle [sic] switches.'²⁶⁵ The company divested before completing this version of the sculpture. In 1987, the piece, now named *Waves*, underwent a revision with the assistance of Dan Nachbar, who was then a computer

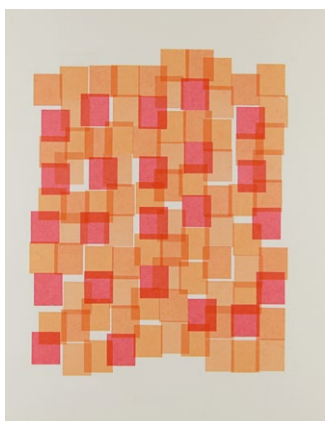
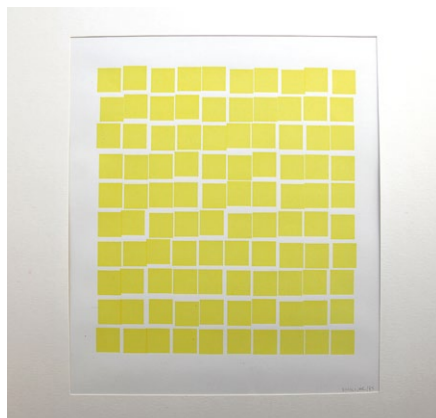
261 See Braun, 'Véra Molnar: Atlas génératif' [Vera Molnár: Generative atlas]. Translation by Mara-Johanna Kölmel.

262 Braun, 'Véra Molnar: Atlas génératif' [Vera Molnár: Generative atlas]. Translation by Mara-Johanna Kölmel.

263 See Patric D. Prince, 'Women and the search for visual intelligence', in Judy Malloy (ed.), *Women, Art, and Technology* (Cambridge, Massachusetts: MIT Press, 2003), 6.

264 See C. J. Davisson and L. H. Germer, 'Reflection of electrons by a crystal of nickel', *Proceedings of the National Academy of Sciences of the United States of America* 14, no. 4 (April 1928), 317–322.

265 Lillian F. Schwartz on her work *Waves* (1987). See Lillian Schwartz, 'Sculpture', artist's website (date unknown), <http://lillian.com/sculpture-2/>, accessed 13 December 2024.



95 | Clockwise from top left:

Vera Molnár, *9 rectangles rouges*, 1987; plotter drawing on paper; 25 × 25 cm.

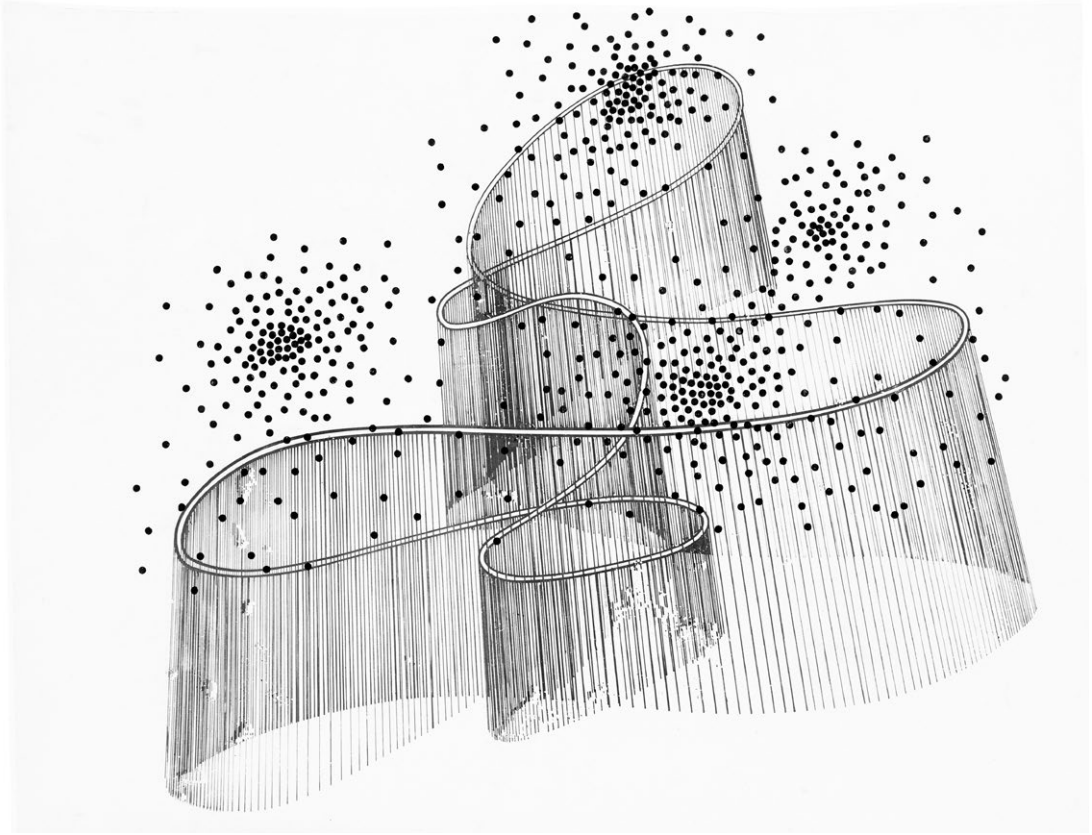
Vera Molnár, *Interstices orange*, 1989; plotter drawing on paper; 49.5 × 37.5 cm.

Vera Molnár, from the series *Ostinato*, 1985; plotter drawing on paper; 45 × 35 cm.

Vera Molnár, from the series *Structure de quadrilatères*, 1987; plotter drawing on paper; 45 × 45 cm.

scientist at Bell Communications Research. This update was carried out in preparation for an exhibition at the Morris Museum of Art and Science in New Jersey. The panels were painted matte black on one side to create a distinctive appearance when light (now slides) was projected onto the moving surfaces. Nachbar constructed a computer using 'Programmable Read-Only Memories' (P-ROMs) to oversee a new and more extensive choreography for the work, and additional features such as magnets and switches were incorporated.²⁶⁶ Arno Penzias replaced the motors as part of the preparation for the *Waves* exhibition at the Computer Museum in Boston. A microprocessor programmed the computer to rotate any of the panels

²⁶⁶ Schwartz, 'Sculpture'.



96 | Lillian Schwartz, *Waves*, 1987; design of a five-storey high entrance to the computer-controlled kinetic sculpture. The Henry Ford, Dearborn (USA).

a full 360 degrees in accordance with any mathematical expression. Using precise feedback mechanisms, the sculpture demonstrated complex, interactive behaviours, resulting in the creation of new intricate choreographies. For instance, the computer was programmed so that the reflective side of all sixteen panels could point directly at a spectator, who could passively or actively determine the presentation of the work. The sixteen panels would then follow the person as they moved back and forth in front of the sculpture. The flexibility of constructing a work the programming of which could be changed and updated to accommodate future variables and/or additions is an example of artists exploring early digital plasticity.

In 1954, artist Victor Vasarely had observed: 'The era of plastic projections on the screen, two-dimensional and in-depth in daylight or darkness, is beginning.'²⁶⁷ Meredith Hoy writes

267 Victor Vasarely, 'Notes for a manifesto' in Anthony Hill (ed.), *Data: Directions in Art, Theory and Aesthetics* (London: Faber & Faber, 1968), 102.

that in his writings and his experiments with abstraction, Vasarely, who reportedly never used a computer in his practice, developed crucial 'artistic forays into digital systems using analogue tools'.²⁶⁸ His optical paintings foreshadowed the 'graphical indexes of computation' before they became established in the early years of computer art, as seen in Mohr's or Molnár's practice.²⁶⁹ In 1954, Vasarely realized that he was able to build spaces 'which no longer owed anything to Euclidean perspective, or to any other kind of perspective' simply by superimposing thin layers of plexiglass that contained delicate tracings of drawings, which he called 'networks'.²⁷⁰ Vasarely's work *Helios* (1967) displays a complex interplay of superimposed, silk-screen-printed layers containing green optical shapes against a transparent background. The networked structure appears to warp and bend, constantly creating new forms capable of being viewed from all angles. Shifting slightly from each point of observation, the images present a captivating visual puzzle, engaging the viewer in efforts to comprehend its complexity. Consequently, the structure casts shadows against the white background, combining and diverging to create the illusion of three-dimensionality.

In a conversation with the art critic Jean Louis-Ferrier, the artist elaborates on this series:

Here I was combining two spaces, and the transparency permitted me to inscribe the plane in real space and to translate real space into a plane. The very condition of illusionism had been radically changed....²⁷¹

One could argue that the artist pioneered an early version of digital plasticity, as the superimposition of two-dimensional layers 'produces an illusion of three-dimensionality or virtualization,' as noted by Hoy. This achievement is accomplished without relying on Cartesian perspectival spatializing techniques, ultimately resembling computer graphics.²⁷² Indeed, as the images shift slightly from each point of observance, one is reminded of Crispin's static and algorithmically evolved production images that form the creative process of his *Data-Masks* (fig. 65).

Five years later, Vasarely pointed out significant parallels between art and the applied technical sciences by drawing a vivid comparison between the scientists who are 'building electronic chess-playing "brains"' and the artists 'also engaging in their own assays with the possibility of a new visuality governed by binary code'.²⁷³ He followed up by stating: 'For quite a long time now, one branch of the plastic arts has been working on plastic language that can be encoded as a binary system'.²⁷⁴ This focus on 'cybernetic-influenced pan-computalism' reached its peak in a series constructed as 'rigorous machines,' adopting the form of notational schemata that incorporated a decimal-based scale of colour-form permuta-

268 Meredith Anne Hoy, *From Point to Pixel: A Genealogy of Digital Aesthetics* (Hanover, New Hampshire: Dartmouth College Press, 2017), 81.

269 Hoy, *From Point to Pixel*, 100.

270 Vasarely quoted in Gaston Diehl, *Vasarely* (New York, New York: Crown, 1979), 55.

271 Vasarely quoted in Diehl, *Vasarely*, 55.

272 Hoy, *From Point to Pixel*, 82.

273 Hoy, *From Point to Pixel*, 70.

274 Hoy, *From Point to Pixel*, 82.

tions.²⁷⁵ His goal was to create a 'plastic unity' based on instantiations of his 'plastic alphabet'.²⁷⁶ He notated discrete, articulate, and interchangeable elements, out of which, often through algorithmic processes, an image or a visual field could be constructed. The duality of form and colour was resolved and propounded as the binary equation $1 = 2 \cdot 2 = 1$. This 'combination, which is both formal and coloured [...] ... I call algorithm or permutation', the artist concluded.²⁷⁷

His architectonic, rather than mimetic, approach involves breaking images into grammatical units and constructing them in complex architectures, not unlike the voxels in the raster-based 3D computer models of Crispin's *Data-Masks*. As Hoy concluded, Vasarely's art and writing are permeated by 'an understanding of a world that is fundamentally calculable, that all natural and artificial forms and all events are susceptible to calculation'.²⁷⁸ According to the artist, this would eventually culminate 'in the development of a new visuality aligned with and attributable to a numerical/numericized universe'.²⁷⁹ This visionary thinking is exemplified in a comment made by Vasarely in 1968:

The celebrated transition from representational to non-representational art is only one of the stages in a profound transformation taking place in the plastic arts. The term 'abstract' in painting refers not to an established fact, but to an irresistible trend toward plastic creation different from the kind we already know.²⁸⁰

This statement can be directly associated with what I have termed digital plasticity. Vasarely continues:

The abstract movement will inexorably pass through the following phases ... 1) the plastic unit becomes unidentifiable (that is, non-representational) [see the works of Crispin and his peers, where the plasticity of their work is partly negotiated beyond the sphere of the visible]; 2) exterior vision is transformed into interior vision (early abstract phase); 3) abandonment of the conventional workmanship of painting – touch, glazes, materials, and other elements – for pure colour, pure composition; 4) abandonment of all inherited techniques – canvases, pigments, brushes – and the advent of new materials [in Crispin's case, inherited techniques are replaced

275 Diehl, *Vasarely*, 60.

276 Vasarely quoted in Diehl, *Vasarely*, 64.

277 'Once I had discovered my alphabet, I hastened to put it into material form. I selected six basic colours: a chrome yellow, an emerald green, an ultramarine, a cobalt violet, a red, and a grey. From it I obtained six scales, each with 12 or 13 nuances, ranging from light to dark, and I added coloured blacks – a blue black, a red black, a green black, and so on. Then I had tens of thousands of sheets printed by the serigraphic process, and had all the units of my alphabet punched out of them. Placed in cases, like type characters, they are so many form-colours, which form the surest and fastest method of realizing my programming executed on scale paper. By simple collage, I obtain exactly what I want, that is, a combination which is both formal and coloured, and which I call algorithm or permutation. But these collages are not yet definitive plastic functions. They constitute the tangible results of basic research, they are starting point "prototypes".' Vasarely quoted in Diehl, *Vasarely*, 64.

278 Hoy, *From Point to Pixel*, 81.

279 Hoy, *From Point to Pixel*, 81.

280 Vasarely quoted in Diehl, *Vasarely*, 13.

with genetic facial detection and recognition algorithms]; 5) abandonment of the two-dimensional surface as an end in itself, thus opening up the supradimensions of space–movement–time (urban and architectonic functions, telecinematic projection, expansion through the Museum without Walls).²⁸¹

Alongside his artistic attempts to produce an encodable, binary, electronically storable plastic language, Vasarely's significant contribution was the production of an exhaustive archive of all plastic possibilities discoverable within the breakneck computations of the electronic brain.²⁸² In imagining and articulating a theory of plasticity in digital terms, he foreshadowed an altered understanding of matter and form that marked the dawning digital age and is of central concern in recent plastic productions. 'There are groups of young artists among whom everything happens as if they were feverishly taking inventory of all of plasticity's possibilities. This is a matter for an electronic brain, for a future plastic bank,' Vasarely concluded, with an almost prophetic quality.²⁸³

Code to contour

As the technical abilities of digital media expanded over the decades from pixelated, discrete bitmapped graphics to perspectival illusionism, so did the potential of a digital plasticity and its possibilities for a realization in three dimensions. While the early pioneers of digital plasticity rehearsed the plastic potential of code on the image plane, building two-dimensional object worlds through plotters or printers, the introduction of digital prototyping technologies to the field of arts allowed such digital plasticity to be translated into the third dimension.

As early as 1967, Robert Mallary, then a professor in the arts department at the University of Massachusetts, began to turn to computer programmes for designing sculptures. Doing so allowed him to update earlier reflections on sequential contour projection and to apply them to computerized sculpture. To this end, he developed a computer programme called TRAN2, a computer-assisted tool for sculptural modelling and shaping. He summarized it as follows.

TRAN2 is a computer graphics program[me] with twenty sub-routines to generate sculpture. The program[me] presupposes a means of compiling form description data for use by the computer. This is done by breaking down the solid into a regular series of parallel cross-sections, or contour 'slices', which are then graphed and digitized as X, Y, and Z coordinates and transferred to punch cards. A sequence of mathematical transformation procedures is brought to bear on the contour sections whereby the computer, in effect, models and reshapes the contour sections into an original sculpture. The computer plotter reproduces a series of perspective views of the generated form together with a complete set of the transformed contour sections. These are used as patterns to complete the sculpture in some appropriate material.²⁸⁴

281 Vasarely quoted in Diehl, *Vasarely*, 13.

282 In 2019, the Centre Pompidou dedicated a retrospective to his work; see Michel Gauthier Collectif, Arnaud Pierre, Serge Lasvignes, and Bernard Blistène (eds.), *Vasarely: Le partage des forms* [Vasarely: Sharing forms] (Paris: Centre Georges Pompidou Service Commercial, 2019), exhibition catalogue.

283 Diehl, *Vasarely*, 15.

284 Robert Mallary quoted in Paul Crowther, *Digital Art, Aesthetic Creation: The Birth of a Medium* (Abingdon-on-Thames: Routledge, 2018), 136–137.

Mallory's series *Quad 1–3* notably documents this pioneering use of computer technology, allowing him to match his digitally created sculptural forms with a physical counterpart. To this end, Mallory generated a sequence of 48 forms derived from four ellipses on the computer along a vertical axis. The input was varied in three different ways to produce three different sculptural objects. The designs were then plotted and formed the basis for his patterns. This set of contours was subsequently 'photographed as an 8×10-inch positive transparency, inserted into an overhead projector, projected onto some appropriate material such as wood or plastic, and traced'.²⁸⁵ The process was followed by cutting the patterns out in laminated veneer and stacking them over a metal rod on top of each other. Finally, they were glued and laminated together, smoothed, and polished.

In its aesthetic appearance, marked by strict concentricity and a smooth, mechanical surface, the work suggested a computerized principle of organization. It could thus be seen as an early manifestation of a digitally driven plasticity. *Quad 1* (1968; fig. 97) was first shown at *Cybernetic Serendipity*, curated by Jasia Reichardt in London in 1968. *Quad 3* (1968; fig. 98) was showcased at the Whitney Museum in 1968 and now forms part of the collection at Tate Modern.²⁸⁶ Like Jack Burnham, Mallory saw sculpture as the reflection of 'the technological level and character of the society in which the sculptor worked'.²⁸⁷ In his contribution to *Artforum* 1969, he argued that there would be a shift on the horizon in which the computer would no longer be merely the sculptor's tool but a co-author, eventually even stimulating living systems.²⁸⁸

Around the same time, Alfred Duca, an IBM programmer, made a large spherical sculpture carved directly out of steel by a tape-driven machine tool. Similarly, Charles Csuri – who would later become a professor of arts education and, in 1986, a professor of computer information science at Ohio State University – produced a wooden sculpture called *Numeric Milling* (1968; fig. 99). Csuri recalled:

This work made use of the Bessel function to generate the surface. The computer program then generated a punched tape to represent the coordinate data. Included were instructions to a 3-axis, continuous-path, numerically controlled milling machine. While the device was capable of making a smooth surface, I decided it was best to leave the tools marks for the paths.²⁸⁹

285 Robert Mallory, 'Computer sculpture: Six levels of cybernetics', *Artforum* 7, no. 9 (May 1969), 32.

286 Robert Mallory, 'Computer art', artist's website (date unknown), <https://www.robertmallory.com/computer-art>, accessed 12 December 2024.

287 Mallory, 'Computer sculpture: Six levels of cybernetics', 29.

288 'So far the discussion has dealt with a single area of potential computer sculpture involvement – namely kinetic light-and-sound environments. But the computer will be used in a great variety of ways, in connection with many different kinds of sculpture, and new mediums will be developed to exploit in different ways the many-sided capabilities of the computer itself.' Mallory, 'Computer sculpture: Six levels of cybernetics', 31.

289 Charles A. Csuri, 'Charles A. Csuri Project', *Ohio State University College of Arts and Sciences* website (date unknown), <https://csuriproject.osu.edu/index.php/Detail/objects/768>, accessed 11 December 2024.



97 | Robert Mallery, *Quad I*,
1968; TRAN 2 computer-gen-
erated sculpture constructed
with layered plastic disks;
82 × 55 cm.

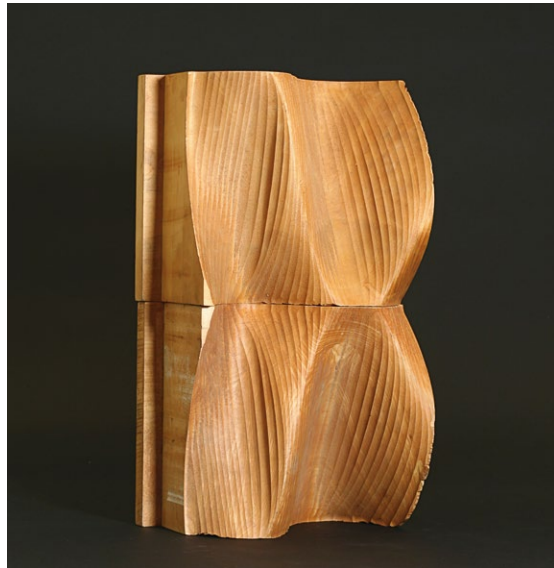


98 | Robert Mallery,
Quad III, 1968; plywood,
metal and resin on
plywood base; 213 × 35 ×
33.6 cm.

Numeric Milling stands out as one of the early computer sculptures, crafted using a computer-controlled milling machine.

It is important to highlight that during his tenure as a professor at Ohio State University, Csuri received funding from the National Science Foundation. The objective was to implement innovative technological infrastructures, enabling artists to subject drawings to mathematical transformations, construct multi-dimensional pictorial spaces, virtually render sculptures for automated milling, and create objects capable of movement in space, allowing real-time manipulation.²⁹⁰ Between 1965 and 1972, Csuri actively collaborated with programmer James Shaffer and mathematics professor Dr Leslie Miller to write computer programmes that could realize his vision.²⁹¹ Csuri was, therefore, pivotal in adapting computer technologies, at this time used mainly in the military and automobile industries, for artistic production. He defined new goals for interactive graphic systems and computer simulation that would also shape the plasticity of subsequent artistic objects. Even though the early digital sculptural works by Mallery, Csuri, Duca, and others involved several steps, their aesthetics and production methods crucially resemble and anticipate the 3D sculpted and printed topological surfaces that have come to mark our digital age.

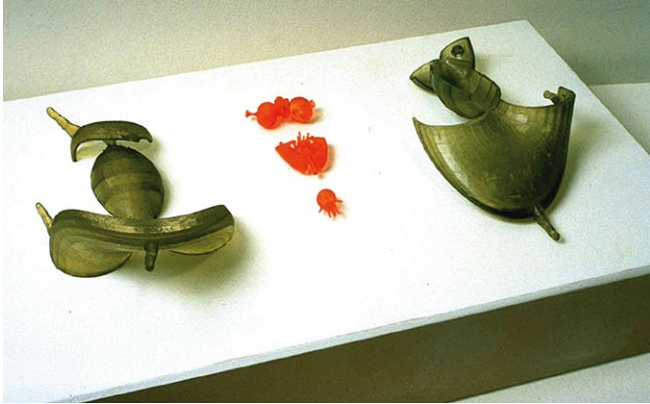
Around 1993, the American sculptor and pioneer of 3D printing Michael Rees started using rapid prototyping to create a series of objects that borrowed from medical anatomo-



99 | Charles Csuri, *Numeric Milling*, 1968; wood, 3-axis milling machine; 33 × 56 × 22 cm. In the collection of Ms. Csuri of the CsuriVision Estate.

290 See Margit Rosen, 'A record of decisions', in Janice M. Glowski (ed.), *Charles A. Csuri: Beyond Boundaries, 1963–present* (Columbus, Ohio: College of the Arts, Ohio State University, 2006), 27.

291 See Rosen, 'A record of decisions', 35.



100 | Michael Rees, *The Aqualine Creature*, 1995; stereolithography, SLA 500 from 3D systems; 46 × 36 × 15 cm.



101 | Michael Rees, *Ajna Spine*, 1996; stereolithography and CAD drawing, SLA 500 from 3D systems.

my to explore what he referred to as 'spiritual/psychological' themes. His surrealist *Aqualine Creature* (1995; fig. 100) and *Ajna Spines* (1996–2011, fig. 101) combine anatomical illustrations of Western science with the metaphysical imageries of Eastern mysticism, reflecting Rees's interest in Indian art. They were modelled in Platform C, a 3D modelling programme co-developed by modernist architect Peter Eisenman, one of the precursors of topological architecture.²⁹² Not only was the programme's point-line-plane geometry 'rather clumsy'

292 This is based on a verbal statement by the artist on 5 March 2018 in New York City.

102 | Karin Sander, *Persons 1:10*, 1998–2006; 3D body scans of living persons, FDM (fused deposition modelling), ABS (acrylonitrile butadiene styrene), airbrush; scale 1:10, ca. 16–18 cm each. Installation view, Galería Helga de Alvear, Karin Sander, Madrid, 1999–2000.



compared to digital sculpting programmes like Z-Brush, employed by Crispin, Rafman, or Blas, materializing the virtual work was also highly challenging.²⁹³

Similar observations have been made by the German artist Karin Sander. Notably, as one of the pioneering female sculptors to embrace 3D scanning and prototyping technology, Sander began exploring these then-burgeoning technologies in the mid-1990s.²⁹⁴ For the *7th Triennale for Small-scale Sculpture* in the German town of Fellbach, she proposed to develop a 3D printed sculpture – that is, to 3D scan the curator of the show, Werner Meyer, with laser beams and translate the data set into a 3D print of Meyer. His scanned countenance was reconstructed on a 1:10 scale and exhibited on a pedestal in the show (fig. 102). The artist thus exhibited the curator, rather than the curator exhibiting the artist, turning the typical relationship between artist and curator on its head. More scans of friends, fellow artists, colleagues, acquaintances, and even visitors to Sander's exhibitions

293 This is based on a verbal statement by the artist on 5 March 2018 in New York City.

294 See in this context, for example, Friedrich Meschede, '1:1 vs. 1:10, oder wie Werner Meyer einer Veränderung im Werk Karin Sanders Modell stand / 1:1. vs. 1:10: Werner Meyer as the model for a new direction in the art of Karin Sander', in Gudrun Inboden (ed.), *Karin Sander: Staatsgalerie Stuttgart* (Ostfildern: Hatje Cantz, 2002), 68–79, exhibition catalogue.

followed and attracted worldwide attention to her work. In line with her previous sculptural interventions, Sander's body scans stage and transform relationships between the human and the technological gaze. As a viewer, one closely examines Sander's scans, focusing on individuals' features and unique traits. Simultaneously, there is an attempt to understand why each person chose to be captured and willingly placed themselves in the mise-en-scène of Sander's project. The experience transforms one into both a voyeur and an empathetic observer.

With each work named after its protagonists, Sander's body scans are as much portraits as self-portraits. Her sculptures are in some sense neutral and objective, as Sander is not physically involved in their production process. The works explore the elusive nature of a machine gaze while still retaining a profound sense of humanity. In this process, Sander's personal interpretation or subjectivity takes a back seat to a seamlessly advanced technological approach. This involves the meticulous scanning of bodies using up to twenty-six cameras, translating the scans into 3D wire models, reconstructing these models three-dimensionally in layer upon layer of ABS plastic using a computer-driven extruder, and finally having a skilled technician apply finishing touches with airbrush colours.

She sees her series as 'self-portraits' realized by the 'most precise [means] that technology can do right now.'²⁹⁵ This goal becomes evident in her use of 3D scanning and printing possibilities and the way she approaches her exhibition sites. Her artistic strategy involves working in dialogue with materials, objects, and occasionally people found on site. In her series *Visitors on Display. 981 Museum Visitors and 3 dogs 1:8* (2008–2013; fig. 103), Sander puts the museum's audience on display – they are no longer mere observers but active participants in her work. Visiting the museum, they not only visit Sander's work but themselves. For Sander, her 3D body scans serve not only to document the state of the technology she employs but, more significantly, to capture the process of transmitting and rendering reality. Early on, by urging her technical collaborators to innovate new software tools and production methods, Sander's approach was groundbreaking not just for adopting emerging technologies, but also for leveraging them in sculpture production, paving the way towards a novel plasticity.²⁹⁶

In 1981, Dr Hideo Kodama of the Nagoya Municipal Industrial Research Institute in Japan developed a rapid prototyping technique that is considered one of the first forerunners of today's 3D printing technology. Terry Wohlers writes that Kodama's experiments involved projecting UV rays from a Toshiba mercury lamp onto a photosensitive resin called *Tevis-tar*, manufactured by Teijin.²⁹⁷ Kodama used black-and-white film 'to mask and control the

295 Karin Sander quoted in Adrienne Gagnon, 'Science finds, industry applies, man conforms' in John S Weber, Aaron Betsky, and Benjamin Weil (eds.), *010101: Art in Technological Times* (San Francisco, California: San Francisco Museum of Modern Art, 2001), 128, exhibition catalogue.

296 For further reading see also Ursula Ströbele, *Hans Haacke und Pierre Huyghe: Non-Human Living Sculptures seit den 1960er-Jahren* [Hans Haacke and Pierre Huyghe: Non-human living sculptures since the 1960s] (Boston, Massachusetts: De Gruyter, 2024), especially 410–430.

297 See Terry Wohlers, 'Early research and development', *Wohlers Associates* website (2015), <https://wohlersassociates.com/wp-content/uploads/2022/08/history2015.pdf>, accessed 7 July 2019, 7.



103 | Karin Sander, *Visitors on Display*. 981 Museum Visitors and 3 dogs 1:8, 2008–2013; 3D body scans of living people in the colour of their choice, monochrome 3D printing, plaster material; scale 1:8, statues: ca. 10–22 cm each, plinth: MDF 1,3 × 1,0 × 35,7 m. Installation view, Lehmbruck Museum, Karin Sander: *Visitors on Display*, Duisburg (Germany), 2013.

region of exposure, corresponding to each cross-section'.²⁹⁸ In the research paper accompanying his 3D printing experiments, Kodama also discusses using an X–Y plotter device and optical fibre to deliver a spot of UV light.²⁹⁹ In November 1981, Kodama published a second paper titled 'Automatic method for fabricating a three-dimensional plastic model with photo-hardening polymer' in the *Review of Scientific Instruments*.³⁰⁰ He 'describes three basic techniques that he used to create plastic parts by solidifying thin, consecutive layers of photopolymer. In the paper, Kodama claims, "If the solidified layer is immersed into the liquid with the top at a depth equal to the thickness of the layer to be solidified, its top surface is covered with unsolidified liquid polymer," essentially describing a key element of the stereolithography process.'³⁰¹

298 Wohlers, 'Early research and development'.

299 See Hideo Kodama, 'A Scheme for Three-Dimensional Display by Automatic Fabrication of Three-Dimensional Model', *IECE J64-C*, no. 4 (1981), 237–241.

300 Hideo Kodama, 'Automatic method for fabricating a three-dimensional plastic model with photo-hardening polymer', *Review of Scientific Instruments* 52, no. 11 (1981), 1770–1773.

301 Wohlers, 'Early research and development', 7, referencing Kodama, 'Automatic method for fabricating a three-dimensional plastic model', 1170.

Kodama's experiments were the first instance in which digital plasticity reached a counterpart in actual material, which I term 'formal plasticity'. Although the earliest patents for industrial robotics were filed in the 1950s and early experiments in the creation of solid objects using photopolymers solidified with a laser were made in the late 1960s at Battelle Memorial Institute, these new technologies did not see rapid diffusion until the 1980s.³⁰²

In 1984, Charles Hull took Kodama's technology a step further, inventing the stereolithography apparatus (SLA), 'a printing process that enables a tangible 3D object to be created from digital data.'³⁰³ Hull's patent 'describes a process of photo hardening a series of cross-sections using a computer-controlled beam of light.'³⁰⁴ In 1986, Yehoram Uziel, then working at Operatech in Israel, invented a machine resembling a stereolithography apparatus. After hearing about Hull's work, Uziel travelled to the US to visit Hull and Ray Freed. In January 1989, he joined 3D Systems as vice president of engineering and developed several patented versions of stereolithography.³⁰⁵ In late 1987, 3D Systems, the company Michael Rees used to materialize his work, shipped its first beta unit, the SLA-1, to customer sites in the U.S. These were 'the first commercial RP system installations in the world' followed by a slowly growing 3D printing industry.³⁰⁶

Notably, from their inception, SLS and 3D printing technologies have been deeply entwined with the military-industrial complex. This was one of the first sectors to sponsor and apply related research including its use in missile prototyping. An example of such a partnership is 3D Systems' large-scale printing lab with the US Army for 'joint material and applications research'. Here, 'army and 3D scientists work together on-site at Aberdeen Proving Ground to develop, evaluate and qualify new materials ... catalyzing innovations for American soldiers and industry through private/public partnership.'³⁰⁷ For artists such as Karin Sander or Michael Rees, access to prototyping technology in the 1990s was still very expensive (the price of a small piece being around 10.000–15.000 USD), and few commercial

302 See Wohlers, 'Early research and development', 7. In this pioneering experiment, researchers sought to solidify a photopolymer resin by intersecting two laser beams with different wavelengths at the centre of a resin-filled container. The resin used in this process was created by DuPont in the 1950s. For further reading, see Shimon Y. Nof (ed.), *Handbook of Industrial Robotics*, 2nd edn (Hoboken, New Jersey: Wiley, 1999), 33.

303 See Hannah Bensoussan, 'The history of 3D printing: From the 80s to today', *Sculpteo* blog (14 December 2016), <https://www.sculpteo.com/en/3d-learning-hub/basics-of-3d-printing/the-history-of-3d-printing/>, accessed 11 December 2024.

304 Wohlers, 'Early research and development', 7; see also 3D Systems, 'Our story', *3D Systems* website (date unknown), <https://www.3dsystems.com/our-story>, accessed 10 December 2024.

305 See Wohlers, 'Early research and development', 7; see also Justia Patents, 'Yehoram Uziel inventions, patents, and patent applications', *Justia Patents* archive (date unknown), <https://patents.justia.com/inventor/yehoram-uziel>, accessed 12 December 2024.

306 Wohlers, 'Early research and development'.

307 3D Systems, '3D Systems launches 3D printing lab with U.S. Army', *Globe Newswire* website (30 October 2025), <https://www.globenewswire.com/news-release/2015/10/30/781939/10154631/en/3D-Systems-Launches-3D-Printing-Lab-With-U-S-Army.html>, accessed 7 January 2025.

companies offered the technology.³⁰⁸ According to Rees, around 50 patents on 3D printing existed in the US in 1993.³⁰⁹ Rees materialized his first *Ajna Spines* – objects caught somewhere between animal, human, and plant worlds – in dialogue with an engineer who, prior to transitioning to the commercial sector, had previously worked for the military.³¹⁰ In that capacity, the engineer employed rapid prototyping technology to create precise prototypes of bombs, guaranteeing the absence of complications or issues in the final product. After one of his prototype missiles went off target in Iran and hit a group of civilians, his moral concerns made him change careers. The plasticity of Rees' *Ajna Spines* and his *Aqualine Creature* is interwoven with such complex histories, a silent reminder of the origins of 3D printing in the military applications and industrial prototyping.³¹¹

From objectiles to object-events

In 1988, the same year stereolithography first hit the market, Gilles Deleuze published *The Fold: Leibniz and the Baroque*. Without referencing stereolithography itself, his text framed a novel type of object based on a morphogenic understanding of matter. Referencing his colleague Bernard Cache, Deleuze states:

This new object we can call objectile. As Bernard Cache has demonstrated, this is a very modern conception of the technological object: it refers neither to the beginnings of the industrial era nor to the idea of the standard that still upheld a semblance of essence and imposed a law of constancy ('the object produced by and for the masses'), but to our current state of things, where fluctuation of the norm replaces the permanence of the law; where the object assumes a place in a continuum by variation; where industrial automation or serial machineries replace stamped forms. The new status of the object no longer refers its condition to a spatial mould – in other words, to a relation of form–matter – but to a temporal modulation that implies as much the beginnings of a continuous variation of matter as a continuous development of form.³¹²

Deleuze's 'objectile' thus characterizes the shift from mould to modulation occurring when the object is no longer withdrawn from a mould but expressed as a variation of morphing matter. With the 'objectile', the binary of form and matter, propelled by an idealist art-historical understanding, becomes, according to Deleuze, a 'temporal expression of an event–affect continuum'.³¹³ Modernist works such as Rosso's or Rodin's certainly anticipated this shift with their mutable matters. Yet, those artists still upheld 'a semblance of essence' by producing objects by hand, in ways neither standardized nor normed. Deleuze's notion of the objectile, which he notably developed based on the object's morphogenic and *plastic*

308 This is based on a verbal statement by the artist on 5 March 2018 in New York City.

309 This is based on a verbal statement by the artist on 5 March 2018 in New York City.

310 This is based on a verbal statement by the artist on 5 March 2018 in New York City.

311 See Berenice Baker, 'Made to measure: The next generation of military 3D printing', *Army Technology* blog (23 January 2018, last updated 20 January 2020), <https://www.army-technology.com/features/made-measure-next-generation-military-3d-printing/>, accessed 10 December 2024.

312 Gilles Deleuze, *The Fold: Leibniz and the Baroque*, tr. Tom Conley (London: Athlone Press, 1993), 19.

313 Deleuze, *The Fold*, 19.

features, points to an altered understanding of the object in the digital age. The 'objectile' thus prefigured what has now been termed a digital plasticity.

In his book *Algorithm and Architecture*, the architect Mario Carpo traces how Deleuze's notion of the objectile entered the architectural discourse of the 1990s via the architect Peter Eisenman, 'in part as a reaction against the deconstructivist cult of the fracture, crossed paths with the computer revolution of the mid-nineties, and evolved into a theory of mathematical continuity'.³¹⁴ Referencing Deleuze and Cache, Carpo reasons: 'The "objectile" is not an object but an algorithm – a parametric function which may determine an infinite variety of objects, all different (one for each set of parameters) yet all similar (as the underlying function is the same for all)'.³¹⁵ He concludes: 'The objectile thus becomes a function that contains an infinite number of objects. Each different and individual object eventualizes the mathematical algorithm, or objectile, common to all'.³¹⁶ Eisenman, who co-developed the modelling software Form C used by Michael Rees and other digital sculptors in the 1990s, transformed the objectile into the concept of the 'object-event'. In an essay for *Folding in Architecture*, published in 1993, he writes:

[Deleuze] argues that in the mathematical studies of variation, the notion of object is change. This new object for Deleuze is no longer concerned with the framing of space, but rather a temporal modulation that implies a continual variation of matter. ... 'No longer is an object defined by an essential form.' He calls this idea of an object, an 'object-event'.³¹⁷

The present publication is notably the first to connect Deleuze's reading of Leibniz's fold with Cache's interpretation of the same, exploring the collective influence of these three philosophers on Eisenman's writings and the realm of post-deconstructive architecture.³¹⁸ With the 'object-event' borrowed from Deleuze, Eisenman argues that form becomes formation and the object an event. As Betti Marenko observes in her reading of Deleuze in the context of design theory:

The object ceases being the fixed representation of a relation between matter and form to become instead the temporal expression of an event-affect continuum, that is, the active and affective dynamism that permeates matter.³¹⁹

314 Mario Carpo, *The Alphabet and the Algorithm* (Cambridge, Massachusetts: MIT Press, 2011), 91.

315 Carpo, *The Alphabet and the Algorithm*, 40.

316 Carpo, *The Alphabet and the Algorithm*, 91.

317 Peter Eisenman, 'Folding in time: The singularity of Rebstock', in Greg Lynn (ed.), *Folding in Architecture* (London: Academy Editions, 1993), 24.

318 See Carpo, *The Alphabet and the Algorithm*, 39.

319 Betti Marenko, 'Digital materiality, morphogenesis and the intelligibility of the technodigital object', in Betti Marenko (ed.), *Deleuze and Design* (Edinburgh: Edinburgh University Press, 2015), 112.



104 | Claudia Hart, *The Brides*, 2010; rapid prototype printed acrylonitrile butadiene-styrene plastic; 5.08 × 30.48 × 8.25 cm.

It is unsurprising that Deleuze's theories linked to Leibniz and Cache appealed to many digital designers, architects, and artists of the 1990s. Enabled by new software programmes and rapid prototyping technologies, they could now design works that resembled morphing organisms and evolving bodies.

Such developments in the 1990s also captured the imagination of American artist Claudia Hart.³²⁰ After studying art history, Hart trained as an architect at Columbia University, where she found herself interested in the same digital tools and multimedia approaches used by Peter Eisenman, Michael Graves, Charles Gwathmey, John Hejduk and Richard Meier, who together later became known as the pioneers of digital topological architecture. Here, while working between practice and its theorization, Hart began to explore the symbolic and cultural meaning of digital tools. The objects in her artistic cosmos are generated from computer models instead of being captured with a camera.³²¹ It is the tension in using genetic algorithms to approach the naked female body outside a sexualized and objectified image that interests Hart and positions her practice from its beginnings as an important

320 Claudia Hart's practice is discussed more thoroughly in chapter 3.2.

321 At SAIC, Hart developed an educational programme based on this concept. Called 'Experimental 3D', it is considered the first art-school curriculum teaching simulation technologies in the art world. 'I also created a class called "Virtual Installation", inspired by the contemporary-art strategy of site-specific installation but one where I imagined virtual installations made digitally and ... installed into photographs or videos.' Claudia Hart, 'Claudia Hart' in Donna Cox, Ellen Sandor, and Janine Fron (eds.), *New Media Futures: The Rise of Women in the Digital Arts* (Champaign, Illinois: University of Illinois Press, 2018), 186.

counterbalance to male-centric digital cultures of the 1990s and early 2000s (see her 2010 work *The Brides*; fig. 104).³²²

Alongside Hart, several other female artists, including Joan Truckenbrod (born 1945 in Greensboro, North Carolina, USA) and Vibeke Sorensen (born 1951 in Copenhagen, Denmark), were early adaptors of virtual imaging to make media installations and projections or other forms of VR, AR, and computer-fabricated objects. Joan Truckenbrod employed a video digitizer which transformed analogue video stills into digital images using the aid of Apple II and then Apple IIe computers. As Tina Sauerlaender highlights, 'the artist understands the video digitizer as a sculpting tool for time and light and the self-image as a tool to inject humanness into the digital. Truckenbrod aims to create a fusion of woman and machine and to address the (inner) conflicts females had due to social constraints.'³²³

In Joan Truckenbrod's paper 'Tears in the connective tissue', the artist argues for the importance of sensory and physical experiences such as touch when conceptualizing digital devices like the computer: 'Computing is obsessed with creating virtual experiences that simulate forms, materials, and behaviours from nature. Cyberspace disengages from physical reality. Sensory experience is reduced to a mono-medium of digital coding,' she writes.³²⁴ To Truckenbrod, the scanning motion of the video digitizer introduced fluidity, tactility, or perhaps even plasticity into her image, as evident in her early works *Ripped Distance* (1982; fig. 105) and *Morphic Reasoning* (1982; fig. 106). These bear some resemblance to Sterling



105 | Joan Truckenbrod, *Ripped Distance*, 1982; black and white photograph; 33.65 × 48.89 cm.

322 'Even in an established art school like Pratt ... there were still art places in the late twenty-first century where a hyper-misogynistic culture was still in place,' she explains while describing her aesthetic as a 'counter shooter aesthetic'. Hart, 'Claudia Hart', 188.

323 Tina Sauerlaender, 'Tina Sauerlaender on a pioneer of self-portraiture in computer art: Joan Truckenbrod', *ZI Spotlight* blog (18 November 2020), <https://www.zispotlight.de/tina-sauerlaender-on-a-pioneer-of-self-portraiture-in-computer-art-joan-truckenbrod/>, accessed 13 December 2024.

324 Joan Truckenbrod, 'Tears in the connective tissue', in Linda Candy, Ernest Edmonds, and Fabrizio Poltronieri (eds.), *Explorations in Art and Technology* (London: Springer, 2018), 71.



106 | Joan Truckenbrod, *Morphic Reasoning*, 1982; black and white photograph; 69.96 × 76.2 cm.

Crispin's approach in producing his *Data-Masks*. In Truckenbrod's works, a facial image is captured in transformation, distorted, and practically torn to shreds. It has become a mask. Truckenbrod altered the scan's orientation and lighting, resulting in diverse transformations of the facial image. The final output was produced using either a dot matrix printer or a laser printer. She created a layered construction by superimposing digital compositions on live video images of her face, which were then photographed in real time.

Embedded into these early digital works are personal experiences of the onset of the AIDS crisis, questions regarding motherhood, and other personal experiences related to change, rebirth, and transformation. In later works, Truckenbrod employed digital painting techniques and created digital prints using a dye sublimation process on silk or other fibres. She describes her body of work as electronic 'totemism' and states that the 'screen, the digital print, digital fibre creates portals to electronic worlds, spiritual dimensions, and personal realms.'³²⁵

For the artist, her work with computer-generated images is intended to 'bridge the physical and the virtual worlds by using languages of both body and mind. The gesture of the hand with the stroke of a digital brush is an agent of the inside world, a portal between worlds.'³²⁶

325 Truckenbrod, 'Tears in the connective tissue', 72.

326 Truckenbrod, 73.



107 | Dan Collins, *Headdrop*, 1994; digital image.

Many other women have made significant contributions in this field, including Agnes Hegedüs (born 1964 in Budapest, Hungary). Her deep fascination with video and the synesthetic aspects of audio-visual media developed into a passionate commitment to stereoscopic imagery and animated three-dimensional creations notable for their robust sculptural quality, as showcased in her work *Memory Theatre VR*.³²⁷ These efforts can be seen as arising from a common context with the prevalence of virtual computer sculptures and topological architectural approaches during the 1980s and 1990s.

The absence of research on any female protagonist in the field of digital sculpture around this time becomes evident in an article published in 1999. In this study, Christiane Paul scrutinizes the realm of 'digital sculpture' and dates its official inception to the early 1990s. While delving into the formation of this field, Paul identifies various groups and organizations operating at the intersection of art, design, and architecture across Europe and the US. However, her analysis does not acknowledge any women in this context. She lists Bruce Beasley (born 1939 in Los Angeles, California, USA), Rob Fisher (1939–2006, born in Shaker Heights, Ohio, USA), and David Smalley (1940–2015, born in Middlebury, Vermont, USA) (the founders of the Computers and Sculpture Forum, or CSF); the French organization *Ars Mathematica*, a biennial computer exhibition organized by Christian Lavi-gne (born 1959 in France) and Alexandre Vitkine (1910–2014, born in Berlin, Germany) from *Intersculpt*; and the group *FasT-UK* (Fine Art Sculptors & Technology in the UK) founded by the sculptor Keith Brown (born 1947 in Hexham, United Kingdom) from Manchester Metropolitan University.³²⁸ She further references Derrick Woodham (1940–2023, born in Blackburn, England) of the College of Design, Architecture, Art, and Planning at the University of Cincinnati, and the *PRISM* (Partnership for Research In Stereo Modelling) Lab at Arizona State University in Phoenix, run by Dan Collins (born 1953 in San Mateo, California, USA) and Mark Henderson (born 1953 in Campbell River, British Columbia, Canada).³²⁹ By presenting a snapshot of the field, Paul's essay, 'Fluid borders: The aesthetics evolution of digital sculpture', centres on questions related to the aesthetics, forms, and genres of digital and virtual sculpture of the late 1990s. While (digital) plasticity is not discussed in the article, the dis-

327 After obtaining her diploma as a ceramicist, Agnes Hegedus studied Photography and Video Art at the Budapest Academy of Applied Arts from 1986 to 1988. Subsequently, she pursued further studies at the Minerva Academy in Groningen, the AKI in Enschede, and the Institute of New Media at the Städelschule in Frankfurt/Main.

328 See Christiane Paul, 'Fluid borders: The aesthetics evolution of digital sculpture', *Sculpture Magazine* web special (July 1999), reproduced at <https://rms-art.com/fluid-borders/>, accessed 13 December 2024.

329 See Paul, 'Fluid borders: The aesthetics evolution of digital sculpture'.

cursive field Paul outlines helps cast light on the redistribution of artistic concerns around plasticity in recent art production.

While the digital/virtual sculptors of the 1990s had diverse approaches to the medium, Paul observes, 'most of the sculptor[s] don't feel that the label "digital" distracts from the specifics of art they are creating ... and seem to understand themselves primarily as sculptors minus classifying additions such as computer, virtual, or digital.'³³⁰ The artists' traditional sculptural training and the absence of any New Media art programmes at their time of education certainly contributed to the fact that their early digital sculptures centred on formal aesthetic concerns closely related to those of modernist sculpture.³³¹ 'Scaling operations, proportional shifts, eccentric vantage points, morphing processes, and 3D montage are some of the techniques explored by this body of work,' the artist Dan Collins (faculty member at the School of Art at Arizona State University) writes in an artist statement on his webpage (see his 1994 piece *Headdrop*; fig. 107).³³² In a conference presentation in 2014, Keith Brown, now a professor at Manchester School of Art, confirmed, 'I don't address the sociopolitical issue of post-modernist art which the majority of artists are engaged with at the moment. I probably date back more to a classical formal way of working' (see his 1998 *Continuity of Form*; fig. 108).³³³

While the artists acknowledge the profound impact of digital media on their work and understanding of sculpture, 'for all of the sculptors, the possibility of designing and creating sculptures that couldn't be realized with traditional practices is the primary reason for their



108 | Keith Brown, *Continuity of Form*, 1998; SLS DuraForm manufactured at the Keyworth; 20 × 16.4 × 10.7 cm.

330 Paul, 'Fluid borders'.

331 'As of yet, there are no art schools dedicated to the discipline of digital/virtual sculpture, and labs such as PRISM are still an exception,' in Paul, 'Fluid borders'.

332 Dan Collins, 'bionarrative', *Ars Mathematica* website (date unknown), https://www.arsmathematica.org/is2005/4dsc-jury/dan_collins.htm, accessed 11 December 2024.

333 Keith Brown, 'From virtual to real' [video], *YouTube* (23 December 2014), <https://www.youtube.com/watch?v=CmrG8MGiZJc>, accessed 11 December 2024.

use of digital technologies.³³⁴ The emphasis on digital technologies as an art-intrinsic tool rather than an initial point for reflection on their broader societal implication is also evident in Dan Collins's summary of the field of digital sculpture in the 1990s. It may shed light on what has changed for a younger generation of artists:

Most of what I am aware of being produced under the rubric of 'digital sculpture' merely mimics the formal strategies of traditional sculpture – bound as it is in an 'upright universe' dependent on gravity, the material limits of particular media, and the scale of the human body. Even the sculpture parks dedicated to a 'virtual' sculptural experience to a large extent maintain the phenomenological constraints of traditional sculpture.³³⁵

While the widely overlooked pioneers of 3D prototyping technology discussed above explored the interfaces of actual and virtual worlds two decades before the so-called 'post-internet' generation, Collins's and Paul's observations intimate that much has changed. As digital technologies have moved from the margins of our society to become part of the fabric of everyday life, the focus of artistic and critical discourse has significantly changed. Art incorporating digital technologies is no longer a discrete cultural entity. It has ceased to occupy a niche ignored by the art market or curators, as with the virtual/digital sculpture of the 1990s.³³⁶ In a way, the prophecies of artists such as Keith Brown, who saw the potential of such technology 'in increased access for all, the dissipation and decentralization of the marketplace, the means of production, and the way they have previously been controlled by institutions and the art market', have come true.³³⁷ Cultural discourse has evolved into discussions about conscious reconfiguration of *all* culture through the digital and the internet.³³⁸

This reorientation has been termed 'post-internet' or 'post-digital'. In this context, the prefix 'post' is understood not in the sense of a linear idea of process marking a concept 'after' the internet or the digital.³³⁹ Instead, the term refers to a cultural shift of the digital and the internet as an encompassing condition. It does not denote an end of the internet or digital, but rather describes a persistent mutation. Post-digital and post-internet discussions are intertwined, as they describe a condition of artworks that have been shaped by the internet and digital processes, both in theory and in application, yet manifest in material form.

The digital plasticity of Oliver Laric's sculptures demonstrates such an 'internet state of mind', resulting from a 'complete embeddedness in a ubiquitous network culture'.³⁴⁰ For his

334 Paul, 'Fluid borders'.

335 Dan Collins quoted in Paul, 'Fluid borders'.

336 'It's easy to agree with the opinion that, in terms of artworld credibility, the "status" of digital sculpture remains low and that there still is a need for educating the critics, curators, connoisseurs, and collectors who define terms for the artificially "closed shop" of the professional art world.' See Paul, 'Fluid borders'.

337 Keith Brown paraphrased in Paul, 'Fluid borders'.

338 See Michael Connor, 'Post-internet: What it is and what it was', in Omar Kholeif (ed.), *You Are Here: The Art of the Internet* (Manchester: Cornerhouse, 2014), 61.

339 See Cramer, 'What is "post-digital"?' 13.

340 Karen Archey and Robin Peckham, 'Art post-internet', *UCCA Center for Contemporary Art* exhibi-



Artist: Gibson, John
Period: 19th Century
Material: Stone, marble
Location: The Usher Gallery, Lincoln
Inscription: *I Gibson ne fecit Roma*
Object Number: LCNUG: 1927/142
Physical Dimensions:
Object height: 123.5cm
Object length: 65cm
Object width: 58cm
Plinth height: 44.5cm
Plinth length: 78cm
Plinth width: 82cm

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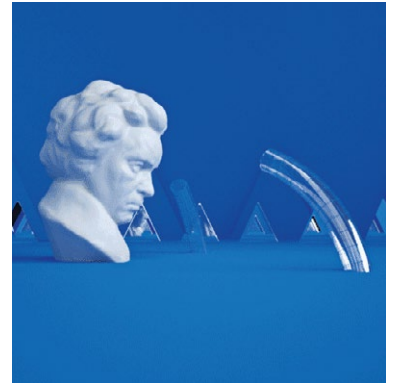
109 | Oliver Laric, *Lincoln 3D Scans*, 2012–ongoing; series of 3D scanned sculptures downloadable as .STL files.

ongoing project, *3D Lincoln Scans* (2012–ongoing), the Austrian artist digitizes the collections of the Lincoln Museum and Usher Gallery in Lincoln, UK (fig. 109). The scanned open-source models are published on a website where they can be freely downloaded without being subject to copyright restrictions. This has empowered extensive DIY online communities beyond the conventional reach of museums to engage with the available scans. Laric's 3D scans permit others to modify the form of the object by altering the source code of the original scan or materializing it in similar or new versions (fig. 110). Consequently, some 3D models have found their way into video games, architectural renderings, and new artworks, which are showcased in a dedicated gallery on the webpage for the *Lincoln 3D Scans*. Classical sculptural values such as authenticity and originality are radically relativized and 'rebooted'. The endless malleability of Laric's sculptures is the effect of a digital plasticity that can circulate effortlessly on the web, only one click away from being materialized in actual material form.

Like Jon Rafman's *New Age Demanded* busts, Laric's work is not about creating an authentic sculptural object but about 'post-producing, launching, and accelerating' it.³⁴¹ Hito

tions website (February 2014), <http://ucca.org.cn/en/exhibition/art-Post-Internet/>, accessed 10 December 2024.

341 Hito Steyerl, 'Too much world: Is the internet dead?', *e-flux* online journal 49 (November 2013), <https://www.e-flux.com/journal/49/60004/too-much-world-is-the-internet-dead/>, accessed 13 December 2024.



110 | Examples of re-appropriation of Oliver Laric's *Lincoln 3D Scans* by other artists: Pedro Perex, *Laric Nymph Toilet*; Ryan Coster, *Mercury on Mercury*; Spyro, *Untitled*.

Steyerl has termed such a gesture 'circulationism'.³⁴² Her terminology describes a condition in which images (potentially turning into objects) are deeply inflected by the networked paths on which they circulate. 'An image in circulation is less about its content than about its charge, its drive, its directions. It is about being intensely quantifiable and trackable, too. ... It is about public relations of images in social networks, about advertisement and alienation, conformism and quantified spread and velocity.'³⁴³

Inscribed into the digital plasticity of Laric's and Rafman's objects is this 'circulationism', which is linked to the application, use, and consequences of digital technologies in our so-called 'post-internet' era. Artie Vierkant has defined this moment as 'the development of attention as currency, the collapse of physical space in networked culture, and the infinite reproducibility and mutability of digital materials'.³⁴⁴ Whereas the plasticity of prototype sculptures from the 1990s – as well as that of early pioneers of European and American computer art – was largely tied to aesthetic and conceptual concerns within art discourse, the digital plasticity of Blas's and Crispin's objects is much more explicitly shaped by political and commercial forces.

Crispin, Laric, Rafman, and Blas are artists who work internationally, with gallery representation and a presence on major art fairs. In the art market, their work has been associated with the 'post-internet' art label that has become co-opted as a superficial shorthand used by writers, curators, and gallerists to describe contemporary art inspired by the internet. Here, the mechanism of circulationism conveys a potential for 'recoding or rewiring

342 Steyerl 'Too much world'.

343 Hito Steyerl quoted in Van Abbe Museum, 'Circulationism discussion with Hito Steyerl', event website (date unknown), <https://hitosteyerl.vanabbe.nl/discussion/>, accessed 16 December 2024.

344 Vierkant, 'The image object post-internet'.

the system by exposing state scopophilia, popular compliance, and wholesale surveillance.³⁴⁵ On the other hand, 'it is quite likely that circulationism – instead of restructuring circulation – will just end up as ornament to an internet that is finally dead enough to make it into contemporary art.'³⁴⁶ The peril of such work is thus that it can be simply disguised as a trendy style categorized by curators and gallerists as 'contemporary art working with digital technology'. The artists thereby run the risk of producing a 'homogenous, abundant output for market-ready net art' consumers.³⁴⁷

As this sub-chapter has highlighted, the characteristics of processuality, mutability, and malleability inherent in digital code resonate strongly with the history of plasticity at the turn of the twentieth century. The same characteristics continue to feature prominently in debates throughout the twentieth and twenty-first centuries. Themes include process-oriented, generative, and self-replicating cellular automata, perceptrons, and their role in the early days of computer art in the 1960s, as well as parametric architecture and design of the 1990s. Foreshadowing the sculptural practices of the recent generation of artists, the works of early digital practitioners Vera Molnár, Lillian Schwartz, and Manfred Mohr, among others, rehearsed the malleability of code that comes from reducing one's referent to binary data. As early as the 1960s, Robert Mallary and Charles Csuri materialized their digital sculpture using early numeric control procedures. They fused mechanics with computational mathematics and shifted the artist's creation process towards the programmes' writing.

In this context, this subsection also cast light on the American artists Robert Mallary, Charles Csuri, Claudia Hart, Michael Rees, and Barry X Ball, each of whom pioneered the use of software and rapid prototyping technologies to realize digital sculptures. These widely overlooked pioneers of 3D prototyping technology explored the various interfaces of actual and virtual worlds two decades before the 'post-internet' generation. Similarly, Deleuze's 'objectile' refers not to the unmoulding of an object but to its emergence as a variation of morphing matter. Deleuze is thus characterizing this early shift away from the mould to modulation, from object to object-event. Coined in the 1970s, the notion of the 'objectile' emphasized the morphogenic and *plastic* features of an object, pointing to an altered understanding of matter and form in the digital age. The 'objectile' thus anticipated what is now termed digital plasticity.

With the proliferation of physical objects that are conceptually or practically shaped by digital processes, there comes not only a deeper reflection on the deep embeddedness of the digital in the material world but equally a reflection of digitality's firm presence and circulation in the art market. The works of artists like Crispin or Blas thus not only carry the imprint of the technological forces that shaped them but also purposefully seek to aesthetically communicate to viewers the profound implications inherent in their creation.

345 Hito Steyerl quoted in Van Abbe Museum, 'Circulationism discussion with Hito Steyerl.'

346 Hito Steyerl quoted in Van Abbe Museum, 'Circulationism'.

347 Jennifer Chan, 'Notes on post-internet', in Omar Kholeif (ed.), *You Are Here: Art After the Internet*, 117.

Interim conclusion: Digital plasticity from surface phenomena to contemporary architectures of power

Theoretically, I am concerned with the aggressive overdevelopment of surveillance technology, how this is changing human identity, and how humanity interacts with technology.... Technically, my specific focus has been on reverse engineering facial recognition, facial detection, and image correlation techniques in order to reveal how they represent human identity.³⁴⁸

Sterling Crispin's *Data-Masks* not only bear the imprint of the technological forces that have processed them but also aesthetically reflect on those forces' larger implications. Crispin's objects thus open up a discussion of the 'digital plasticity' of surveillance systems in which recent governmental, military, and commercial endeavours entwine. What appear as pixelated, inhuman masks emerging from mirrors are in reality representations of what the facial detection, recognition, and machine learning algorithms employed by Facebook – and the US military – perceive as the human face. As Crispin explained to me in an interview, one of his main motivations for the work came from Edward Snowden's 2013 leaks of classified NSA files. Snowden's whistle-blowing revealed that the data of ordinary citizens had been collected with authorization through various secret treaties signed by members of the UK/USA intelligence community. This information was gathered through platforms such as Google and Facebook using a range of sophisticated data-capturing programmes, including PRISM, XKeyscore, Tempora, Muscular, Five Eyes, Stateroom, and Lustre.

The artist Zach Blas also highlights the importance of Snowden's leaks for his work with masks and masking:

I began this project [his *Facial Weaponization Suite* (figs. 70–71)] in 2011, but interest in the work came in 2013, after the Snowden leaks.... In my studio practice, I wanted to develop artwork that pushed the ability to biometrically capture the face, and I found the mask a simple yet powerful example of this. Masking in social movements, protests, and autonomous communities (like Anonymous, black blocs, and the Zapatistas) popularly indicate [sic] a political stance that is anti-capture or anti-biometrics. These groups not only refuse the biometric gaze through masking, but their use of the mask is also a larger refusal of being politically visible to the state or to power. The mask here is not just an individual disappearing act; it is a catalyst for collective transformation, a collective demand. The Zapatistas articulate this sentiment well when they claim that they hide their faces so that they may be seen.³⁴⁹

Encoded into the plasticity of the works of Crispin, Blas, and their peers are the effects of being created in a post-9/11 era, in which Zygmunt Bauman observes 'global space has assumed the character of a frontier-land' that expands into the digital space.³⁵⁰ In this context, threats and responses become increasingly diffuse rather than centralized, and alliances are in a constant state of flux – much like the morphogenic and genetic algorithms that constitute Blas' and Crispin's mask-themed works.

348 Crispin, 'Data-masks', iv.

349 Zach Blas in Katrina Sluis, 'Artist profile: Zach Blas', *Rhizome* blog (1 March 2017), <https://rhizome.org/editorial/2017/mar/01/artist-profile-zach-blas/>, accessed 13 December 2024.

350 Zygmunt Bauman, *Society under Siege* (Hoboken, New Jersey: Wiley, 2002), 90.

Despite critical legislative changes after Snowden's leaks, Crispin's *Data-Masks* and Blas' *Facial Weaponization Suite* have retained their relevance. In January 2018, the *Washington Post* first reported on the pilot phase of an ambitious Chinese government plan known as *Xue Liang* (which can be translated as 'Sharp Eyes'):

The intent is to connect the security cameras that already scan roads, shopping malls, and transport hubs with private cameras on compounds and buildings and integrate them into one nationwide surveillance and data-sharing platform.³⁵¹

By the end of 2020, China was able to spy on all of its key public spaces with facial recognition technology.³⁵² The omnipresence of such a surveillance network raises significant questions about our human existence and the boundaries between privacy and general perceptibility – echoing Crispin's and Blas's masks' reflection on Western data surveillance. The omnipresent *Xue Liang* network not only keeps track of 1.4 billion civilians, like the darkest version of Foucault's panopticon, but also allows the government to build statistical models of citizens' behaviour through the mutable matters of information. This is a 'proactive panopticon, which tries to figure out ahead of time who is a danger', as Albert Fox Cahn, founder of the Surveillance Technology Oversight Project, states.³⁵³

Given this context, Crispin's *Data-Masks* are not merely technological 'deep dream' hallucinations but reveal the current disposition of our technological predicament. Inscribed into his work is the digital plasticity of a ubiquitous surveillance apparatus. Digital plasticity in art evolves in constant, reciprocal feedback with the shaping and modeling of our contemporary moment.

Writing on the fluid forms of modernist sculpture, Georg Simmel saw artworks, which he considered the 'surface' phenomena of modern life, as not only modernity's imprint or 'impression', but its 'condensation'.³⁵⁴ Simmel developed the notion of the surface as the initial point for his analysis of the 'inner life', the psyche and working mechanism of the metropolis. He thereby shifted the implicit imagery of surface, namely that one must look beyond it in order to find depth: For Simmel, surface signals depth. Extending this idea, art historians Rosalind Krauss and Gottfried Boehm concluded that the plasticity of an object manifests on its surface, which they understood as a membrane to the outside and thus the space for

351 Simon Denyer, 'China's watchful eye', *Washington Post* online (7 January 2018), https://www.washingtonpost.com/news/world/wp/2018/01/07/feature/in-china-facial-recognition-is-sharp-end-of-a-drive-for-total-surveillance/?utm_term=.c1c83adf0dbb, accessed 11 December 2024.

352 See Jessica Batke and Mareike Ohlberg, 'State of surveillance', *ChinaFile* blog (30 October 2020), <https://www.chinafile.com/state-surveillance-china>, accessed 11 December 2024.

353 Albert Fox Cahn, quoted in Batke and Ohlberg, 'State of surveillance'.

354 It is the distance that art establishes from life, through its own symbolic forms, that allows art to 'more completely, consistently, and realistically reveal the deepest nature of ... reality than could any attempt at grasping it more directly'. Georg Simmel, 'Sociability: An example of pure, or formal, sociology', tr. Kurt H. Wolff, in *The Sociology of Georg Simmel*, tr. and ed. Kurt H. Wolff (New York, New York: The Free Press, 1964), 56.

communication.³⁵⁵ Like Simmel, the two art historians viewed the surface not as a smooth, flat, or depthless plane but rather as the site for poly-sensory experience. It is the experience of an artwork's surface that allows for a dynamic encounter between viewer and work. The surface serves as a 'plastic space' where creators and viewers engage with their embodied experiences of the artwork.³⁵⁶

Siegfried Kracauer went a step further than Simmel, Boehm, or Krauss. For the German theorist, the ability to diagnose an era could be acquired exclusively by observing and analyzing its surfaces – the primary source of historical and social information. In his essay collection *The Mass Ornament*, published in the 1960s, Kracauer writes:

The position that an epoch occupies in the historical process can be determined more strikingly from an analysis of its inconspicuous surface-level expressions than from the epoch's judgements about itself. Since these judgements are expressions of the tendencies of a particular era, they do not offer conclusive testimony about its overall constitution. The surface-level expressions, however, by virtue of their unconscious nature, provide unmediated access to the fundamental substance of the state of things. Conversely, knowledge of this state of things depends on the interpretation of these surface-level expressions. The fundamental substance of an epoch and its unheeded impulses illuminate each other reciprocally.³⁵⁷

In Kracauer's approach, lived experience, such as the experience of visual art, is a 'surface' phenomenon. Even if its importance is not always entirely clear to us, this is not because the 'truth' is purposely obscured or strategically positioned beneath a symbolic 'surface'. Rather, the 'surface-level expression' provides the ornamental clues which enable us to decipher the complex and often contradictory cultural mode of a time. In Kracauer's reading, artworks – and, following Krauss and Boehm, their plasticity – can provide direct access to the character of an epoch. It is in the overt, casual, unmediated, surface expressions and experiences of art, therefore, that the continually elusive workings of power must be traced.

As recent sculptural objects emerge from the surfaces of our computer screens into three-dimensional space, they could be seen as examples of Kracauer's 'surface-level expression' par excellence. Crispin's *Data-Masks* become, in Kracauer's words, 'a cypher, a surface subject to a variety of physiognomic readings'.³⁵⁸ They provide access to our reality through a physiognomic reading of various human (sur)faces. This understanding becomes even plainer in Kracauer's reflections on photography. What an old photograph conveys, he writes in *The Mass Ornament*, is not 'the knowledge of the original but the spatial configuration of an instant; it is not the person who stands forth in his or her photograph, but the sum of that which can be abstracted from him or her. The photograph annihilates the per-

355 See Gottfried Boehm, 'Plastik und plastischer Raum' [Sculpture and plastic space], in Klaus Bußmann and Kasper König (eds.), *Skulptur: Ausstellung in Münster 1977* [Sculpture: Exhibition in Münster, 1977] (Münster: Westfälisches Landesmuseum für Kunst und Kulturgeschichte, 1977), 23–44; Krauss, *Passages in Modern Sculpture*, 20.

356 Boehm, 'Plastik und plastischer Raum' [Sculpture and plastic space], 20.

357 Siegfried Kracauer, *The Mass Ornament: Weimar Essays*, reprint edn (Cambridge, Massachusetts: Harvard University Press, 1995), 75.

358 Kracauer, *The Mass Ornament*, 20.

son by portraying him or her and, where person and portrayal converge, the person would cease to exist.³⁵⁹ Did Kracauer anticipate today's pervasive facial recognition and detection technology with its attendant dehumanization? The human face extruded from thousands of photographs has become input data for a multi-layered deep neural network. The verification of a person – a persona, as explored in 2.1 – relies on abstraction: the summing of pixel values used as a feature set to describe identity. Dissolved into data, the individual is annihilated. It ceases to exist.

This process of annihilation is also one of power and control. In their evocation of digital plasticity, Crispin's objects thus articulate the presence of an apparatus of power, a type of mimetically evolved intelligence that spies on you in the shape of morphing organisms. Digital plasticity thereby becomes more than just an art-historical phenomenon. It hints at the style of an era, the architecture of the now, familiar yet invisible, apparently immaterial but much more in-material, seemingly neutral yet profoundly political. Do its malleability, transformability, and ability to change states still convey a potential for resistance?

This question offers an important subtext to the final chapter of this book, which focuses on Morehshin Allahyari's work. Allahyari uses digital sculptural technologies to enact sculptural and commemorative structures that highlight the memories and trajectories of those forgotten, hijacked, erased, or left behind. Like Crispin's works, Allahyari's objects are underpinned by a digital plasticity driven by and deeply imbued with algorithmic processes. Such plasticity is made physical and durable when Allahyari materializes her work with 3D printing technology.

Allahyari, much like Alice Channer, links such plasticity to reflections on corporeality. In her examination of jinns and goddesses, Allahyari not only invokes the ancient sculptural relationship to the body discussed earlier, but links her depictions' regained corporeality to marginalized female and queer bodies of and from the SWANA region.³⁶⁰ By playing on sculpture's fluid boundaries between text and object, fiction and reality, death and life, Allahyari evokes sculpture's ancient association with the monument and rethinks its function for our present. As such, the artist explicitly addresses the dynamic that strongly informs sculptural concepts of monuments and memorials. Through an analysis of Allahyari's work, this final part aims to investigate the particular monumentality that recent sculptural practices call forth.

359 Kracauer, *The Mass Ornament*, 56–57.

360 SWANA is a decolonial acronym for the region encompassing South West Asia and North Africa. It is used in place of terms such as Middle Eastern, Near Eastern, Arab World, or Islamic World, which have colonial, Eurocentric, and Orientalist origins. See SWANA Alliance, 'What is SWANA?', *SWANA Alliance* website (date unknown), <https://swanaalliance.com/about>, accessed 7 January 2025.