THE JANUSIAN FACE OF FACIAL RECOGNITION, PART 2: IN MARNIX DE NIJS'S BIOMETRIC ART[1]

Devon Schiller
University of Vienna
devonschiller@gmail.com

Abstract

With his biometric art, Marnix de Nijs makes *visible*, and thereby *knowable*, the *Janusian* face of facial recognition. By his interventions with our interactions, through a semiotic machine and its algorithmic signs, De Nijs *plays with* this facial recognition. He *performs* the ways facial recognition technology systems work *on stage*. And he puts such technology *on trial* for us all to see—and *judge* for ourselves. Toward this end, from the critical

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standpoint of a computational semiotics both Peircean and pragmatist, I apply a method of *semiotic deblackboxing*. I divide my inquiry between two distinct investigations: first in part one, I explicated this theoretical approach; here in part two, I explore its practical application. Across these two articles, I probe how, and in what ways, the artificial intelligence of facial recognition, its subface, interface, and surface, characteristically composes a semiotic system. De Nijs's *Physiognomic Scrutinizer*, *Mirror_Piece*, and *15 Minutes of Biometric Fame*, each of which utilizes Neurotechnology's VeriLook, serve as my privileged case studies. The fundamental question of semiotic agency, that is to say, of who—*or what*—constitutes a sign interpreter and consequently sign producer, extends across the many subfields of the semiotic metadiscipline, encompassing both the computational semiotics of an artificial intelligence and the biosemiotics of our natural intelligence. As I argue here, the responsibility for the analytics of the recognition and its application in a reality ultimately rests not with the machines but with the humans. A machine still cannot see faces *like* a human (*simulation*), a human still cannot see faces *better* with a machine (*prosthesis*), and a machine and a human still cannot see faces *more* together (*augmentation*), unless a human teaches a machine how it must interpret these signs, that is, what the face *is* in the first place.

Keywords: biometric art, computational semiotics, facial recognition technology, media art, semiotic deblackboxing

> "'Why,'" Ovid asks Janus, do I worship you first before "'other divinities?'" "'So that through me,'" Janus answers Ovid, "'the guardian of the threshold, you can have access to whichever gods you want.'" […] And when Janus spoke, "raising his eyes that saw in opposite directions, he looked on all there was in the whole world" (Ovid [8 CE] 2011: I.171–174, I.282–I.284), and on all the many faces…

1. Introduction

Facial recognition has a *Janusian* face, as I initially argued in the first part of this two-part inquiry (Schiller 2025: 104–105). At least analogically speaking, the probabilistic artificial intelligence of facial recognition technology has not one but two faces. One face looks backward into the past and its *input*. And one gazes forward into the future and its *output*. Both so-called "faces" principally serve as a spatiotemporal passage to yet another face. The Janusian face of facial recognition is, therefore, not only visually

representational but also computationally *re*presentational. In an instant of its interaction, a facial recognition technology system brings far more than one or two faces together into relationalities. There are the human faces of its designers, users, and targets. And there are the machine faces of its subface, interface, and surface. There are the images of faces used to train its artificial intelligence, computer vision, and machine learning. And there are the faces of individuals that it detects, extracts, and classifies. There are the frontal views of dynamic faces detected from the face, its muscles, and movements. And there are the thin slices of static faces extracted from the continuous flow of this behavioral stream. There are the faces of the individuals who are being recognized. And there are the faces of the community who are doing the recognizing. For this reason, to make facial recognition *knowable*, one needs first to make its many faces *visible*. One must expose, so to say, the functional relationalities between rhizomatic facialities within these commercial products and their proprietary computing. Only then can the ways facial recognition technology systems work, and how they are either adversely misused or beneficially used, be subversively challenged or tactically critiqued.

Toward this end, from the critical standpoint of a computational semiotics both Peircean and pragmatist, I apply a method of *semiotic deblackboxing* to facial recognition, its subface, interface, and surface (see, for example, Andersen, Hasle, and Brandt 1997; Nöth 2002; Nake 2008; Irvine 2022). The works of Marnix de Nijs (Netherlands, b. 1970) serve as the privileged case studies for this critical semiotic deblackboxing. De Nijs is a premier media artist who utilizes installation and interaction and pioneering *biometric artist* who utilizes facial recognition technology system intervention. From the late 2000s to the early 2010s, De Nijs developed three different interactive media art installations based on facial recognition technology system intervention, including *Physiognomic Scrutinizer* (2008), and *Mirror_Piece* (2010), which are two iterations of the same artwork, as well as *15 Minutes of Biometric Fame* (2011). Across this biometric oeuvre, De Nijs utilizes a black, opaque boxed facial recognition technology, both advancing its affordances and challenging its constraints, which, in turn, makes his biometric artworks directly suitable for semiotic deblackboxing.

The question is this, as I framed it originally in part one (Schiller 2025: 106): Does the artificial intelligence system of a facial recognition technology have *semiotic agency*? That is, can facial recognition create *in and of itself* "[t]he action of a sign," which, in Peirce's own terms, is not only "dyadic" but also "triadic" and not only "dynamical" but also "intelligent" (CP 5.472)?

Can facial recognition create "a *genuine* triadic relation" rather than a non-genuine "collocation of dyadic relations," or, as Peirce himself phrases it, "a 'degenerate' form of triadic relationship" (CP 6.322)? Inside the black box, is artificial intelligence actually either *artificial* or *intelligent*? With facial recognition technology during human-computer interaction, the human act of sign interpretation is brought into relation with the computer operation of signal determination. But the human interactor and the facial recognition are not equals in this relation. As I argue here, advancing my theoretical approach across this practical application, *this Janusian or multiple relation* is the intelligent result, not of the semiotic machine, its efficient causation, and allopoiesis, but of the semiotic animal, our final causation, and autopoiesis.

2. The Subface: Classifiers, Databases, and Templates

De Nijs utilizes several different technologies, or combinations of technologies, in his different artworks. At first in 2008, to select a software for the basic apparatus of his biometric art, De Nijs simply "Googled it."[2] From the search results then available, De Nijs selected VeriLook from Neurotechnology, a company founded in Vilnius, Lithuania in 1990, that first released their facial recognition in 2004—just four years before De Nijs's biometric artwork.[3] A commercial product with proprietary computing, Neurotechnology's VeriLook is a black box. Given the blackness of this box, however, it is difficult, if not impossible, to *see just by looking* the way it works. For the critical semiotic deblackboxing of this facial recognition technology, therefore, one must look into how it is used, played with, or applied.

At the foundation of its functionality, facial recognition is object recognition. The object being recognized could be anything—whether building, environment, vehicle, weapon, or, in this context, face. The task of the machine then is to identify the category of the object from an image or a video. There are, of course, numerous different methods for doing facial recognition. The approach in De Nijs's artworks is known as *template matching*; simply put, this face here and now is *like* that face there and then. To schematize this process, the facial recognition then functions triadically, that is, across three distinct stages, which are both progressive and sequential: First, the facial recognition *detects* a facial image within a digital image of a face and its environment, whether in a still image or in a motion video either recorded

[2] Unless otherwise cited, all references to De Nijs are to communications with the author, including, but not limited to, on 14 February 2017, 4 January 2024, and 4 April 2024.

[3] I extend my gratitude to Irmantas Naujikas, the Director of Neurotechnology since 2007, for his assistance with my research.

or live, by localizing a region within an image or segmenting a period within a video. Second, the facial recognition *extracts* the appearance features from this image data by the location and value of pixels, the geometric features from this image data by the points and vectors between landmarks, or the hybrid features from this image data by the appearance and the geometry between eyes, nose, and mouth, which includes, for instance, texture, shape, and color. By so doing, the facial recognition normalizes these features by reducing their dimensionality, such that features are then projected independently within the image plane from the position, rotation, and scale of a face. Third, the facial recognition *classifies* a face by matching the query image of a face taken with a camera to the template images of faces stored in a database.

In *Physiognomic Scrutinizer*, *Mirror_Piece*, and *15 Minutes of Biometric Fame*, De Nijs utilizes two different "components" from Neurotechnology's VeriLook Version 3.2 Standard software development kit (SDK): first, the Face Extractor, which "creates face templates from face images;" and second, the Face Matcher, which performs facial recognition in two possible modes, including one-to-one (1:1) "verification," and one-to-many (1:n) "identification" (Neurotechnology 2024: 3). When De Nijs exhibits his artworks, the input, probe, or *query* faces from the images of the interactors taken with a camera are one-to-many (1:n) identified with the output, probability, or *template* faces from the images of the individuals stored in a database. In this way, facial recognition technology systems function through multifarious strata of sign relations. That is, these systems function through the physical tokenization of a symbolic typology, or, at least, an electronic tokenization and digital tokenization.

A facial recognition technology system, like most, if not all, other computer systems, as Martin Irvine traces in Peircean terms, is a "dynamic system of unlimited *retokenization*," with old "'tokens in,'" such as captured faces, and "new 'tokens out,'" such as matched faces, across "'the strata of signs'" (2022: 222). Because each and every sign "determin[es] an Interpretant, which is itself a sign," Peirce defines, a sign "overl[ies]" a sign, which can, at least "in its immediate exterior, be one of the three [phenomenological] classes" of icon, index, or symbol, but which, in turn, "determines a[nother] sign" (CP 2.94). The infinite semiosis of sign interpretation, Peirce describes, must carefully be considered if *order* is going to be then "brought into the relations [between] the strata of signs" (CP 2.94). In the case of such computing, information both digital and binary at the strata of the subface, that is, in the "semiotic subsystem," Irvine characterizes, advances by "[t]okenization and [its] retokenization," whether between storage and

memory, or between data and operations, such that each component at this foundational level implements "a mapping of symbol[s]" across structures and functions, "the outputs of which are communicated 'up' the system stack" (2022: 209). In his foundational text on such artificial intelligence, philosopher of mind John Haugeland classifies the computer as "an *interpreted automatic formal system*" (1985: 48). To specifically delineate his systems depiction, Haugeland goes on to construe the way such technologies "positively" produce tokens, "or configurations of tokens, from some prespecified set of types" (1985: 53). As Haugeland himself argues, the "[d]igital techniques" of formal systems are fundamentally "write/read techniques," where "'[w]riting' a token" produces a token of a type, while "'reading' a token" determines the type of this token (1985: 54), whether it be a token or a configuration, that is, whether simple or complex. With "a likelihood of success" at least "*reliabl[e]*" if not "*perfec[t]*," the concern, Haugeland cautions, is not "whether […] or how often, but rather how well" a technique can succeed (1985: 54). Haugeland contends that "[a] 'write/read cycle,'" that writes a token and then reads it "at some later time," may be considered to be *"successful* if the type determined by the read technique is the same as the type" produced by the write technique (1985: 54). The write/read functionality of facial recognition can be considered to be accurate when the input type of a written token matches an output token of the read type—to put it simply, when *this* face can be seen to be like *that* face.

Although this SDK is a black box, the "client," "developer," or "integrator," as they have been variously termed—in this case, the artist De Nijs himself—then integrates this software within the applications which they create in accordance with its "system requirements" and "supported cameras" (Neurotechnology 2024: 4, 11, 12). Given such constraints with the integration of their software, Neurotechnology assures their clients, the "integrator" of the software "has complete control over SDK data input and output" (Neurotechnology 2024: 4), that is, over the black box. This is to say, the developer De Nijs determines the parameters for recognizing a face based on its facial features, whether by "facial attributes," or by "feature points" (Neurotechnology 2024: 3, 4). De Nijs *supervises* these classifiers. The human *teaches*. And the machine *learns*. In other words, he supplies it with training datasets of prelabeled images. De Nijs, like any other developer, enrolls "multiple samples of the same face," taken "from different sources," and "at different times" (Neurotechnology 2024: 3). Indeed, perhaps the most significant difference that makes a systematic difference in the ways such a facial recognition technology system works are its classifiers and its templates. The *classifier* is the algorithm that assigns one or more categories from a set of categories to an

image, a video, or, more specifically, the information detected and extracted from an image or a video. That is, the classifier maps the input, probe, or query variables onto the output, probability, or template variables. The *template* is trained using the classifier, as the end result of this machine learning, such that, structurally, the template then classifies the information detected and extracted from images. In these biometric artworks, the classifier is Neurotechnology's VeriLook SDK. And the templates are De Nijs's prelabeled datasets.

To compose his templates and train his classifiers, De Nijs utilizes different image sources, or combinations of sources, in his different artworks. In principle, however, De Nijs *harvests* the facial images for his datasets from various heterogenous website sources. Thus, De Nijs downloads the images from the internet either by hand or with help from a web-scraping software tool. For *Physiognomic Scrutinizer*, the dataset of templates is imagistically constituted from curated individuals, both living and dead, whom De Nijs identifies to be particularly infamous for their "hedonistic pursuit[s]" to "*feel better*" (n.d.). This includes, for instance, images of artists and authors who struggle with substance addiction or suicidal behavior; conspiracy theorists and cult leaders, among other convicted criminals; actors, models, and other celebrities recorded during intimate activities in sex tapes, made privately but shared publicly, and frequently without consent; as well as nonbinary persons, either persecuted for their sexuality, or prominent for their transvestitism. For *Mirror_Piece*, the dataset of templates is the same as for *Scrutinizer*, only expanded to "more than 250" controversial contributors to contemporary culture (De Nijs n.d.). And for *15 Minutes of Biometric Fame*, the dataset of templates is imagistically constituted from "75,000" celebrities taken from the internet across "twelve categories [and] eleven languages" (De Nijs n.d.). This includes, for instance, images of porn stars, social media stars, reality television stars, and rock stars, among many other faces. With each of these artworks, the interactors are identified on the basis of the match between these archived, past faces and their animated, present face.

To expressively achieve his aesthetic ends in *15 Minutes of Biometric Fame*, De Nijs utilizes recognition technologies in addition to VeriLook and database templates in addition to celebrities:

First, to control the robotics of the crane and its camera, De Nijs applies an object tracking algorithm from the Open-Source Computer Vision Library (OpenCV). This free and open software library was originally launched by Intel Research in 1999. And today, it offers more than 2,500 algorithms, including facial recognition and object tracking algorithms

(OpenCV n.d.). Over the course of his installation, De Nijs discovered how a significant parameter is the *confidence value*—and even more so in some facial recognition technology software than others. That is, the specification of accuracy results in the absence of speed. Simply put, being more right means being less fast; that is the trade-off. As a consequence of this constraint, De Nijs concludes, OpenCV's object tracking, when compared to Neurotechnology's facial recognition, fundamentally implements an increased functionality, if not in recognition applications, at least in robotic applications. Therefore, De Nijs divides the operations of the artwork between two different classifiers, with one a white box, and one a black box. He utilizes the white-boxed object tracking from OpenCV to detect the faces and direct both crane and camera. And he utilizes the black-boxed facial recognition from Neurotechnology to extract and classify the faces. Because of this integration, OpenCV tracks the motion trajectories for the bodies and the faces of the interactors when they enter the exhibition and approach the artwork. This tracking affords a higher accuracy for moving the crane and camera into position.

Second, the biometric dataset is a *living dataset,* which further complicates classifier functionality in *15 Minutes of Biometric Fame*. The query faces extracted from the images of the interactors taken with the camera on the crane are one-to-many identified with the template faces matched from the images stored in a database. The templates in this database are either from an image of a celebrity, an image of the interactor themself, or the image of some other interactor. In this family tree of a fame taxonomy, the match is tagged in lineage position with generation labels. That is, the original dataset of celebrity templates is annotated with a first-generation tag. A more or less direct match between the interactor's own facial image and a famous individual's facial image is annotated with a second-generation tag, then a third-generation tag, and on down the ancestral line. Once an interactor is detected, extracted, classified, and *tagged*, their image is enrolled in the templates of this dataset. Each subsequent interactor enrollment is also matched against every previous interactor template. The faces of interactors are therefore not only matched according to their identification with a celebrity but also matched according to their closeness between this celebrity and other individuals. Here, the function of *likeness* is not a binary function but rather a distance function. To match a face, to put it simply, is not about one's own face and another's face being either *different* or *similar* but rather about the *degree of similarity* between one's own face and another's face.

At the level of the subface, therefore, the dyadic reality of these sign relations, with representamen and interpretant but without object, is visible in how mechanical stimuli in turn lead to automatic reactions. Computer scientists Terry Winograd and Fernando Flores, in their phenomenological appraisal of such artificial intelligences, refer to *signals* when they write: "one could describe the operations of a digital computer merely as a sequence of electrical impulses traveling through a complex net of electronic elements, without considering these impulses as symbols for anything" (1986: 86–87). Indeed, "[w]hat is a sign to humans, is a signal to computers," Nake states (1997: 33).[4] When "a sign enters a computer in the form of its software," Nake specifies, that sign is reduced to a dyadic or bi-relative sign, with its "ever-present material part" or representamen, and "its syntactic component" or interpretant, thereby entirely losing its "actual semiotic nature" or object (1997: 33). From the critical standpoint of a computational semiotics both pragmatist and Peircean, as Nake also explores, the necessary purpose of a sign and the "pragmatic nature" of its meaning is for it "to be constantly open to an unlimited interpretability" (1997: 33). However, a sign in a computer is considered to be a sign only to the extent that it consists of a representamen and interpretant. Degenerated to "a signal," Nake expands, such a sign "no longer points beyond itself, but only towards itself" (1997: 33). The "ongoing compulsion to create interpretants," Nake then further explicates, is different in the machine than in the human, that is, in "semiotische Tiere" (semiotic animals) (1997: 33). But then of course, the sign in a computer, which is "harmless as a signal, has a beneficial effect," in Nake's own estimation, because it "trigger[s]" the function "we intended for it" (1997: 33), neither more nor less, with automaticity but without agency. One would "not *want* [the sign that is a signal] to achieve something else," Nake evaluates (1997: 33). In Nake's Peircean view, "the mystery of apologists" for artificial intelligence is that no matter "from which depths of the machine's belly," that is, from where inside the black box, "its claimed ability to create interpretants" rises to the surface, it is the human who "puts therein" something other than signals (1997: 33). What is still absent in the presence of these signs, for them to mature from dyadicity to triadicity, is an object relation. The "'source code'" or "metasymbolic code" in programming language, Irvine maintains, is intersemiotically "translated by *interpretant* programs" only for "active processes to be directed [then] by semiotic agents" (2022: 209). In De Nijs's biometric art and its facial recognition technology, the homological one-to-one correspondence between the invisible subface and

[4] Nake (1997) translated from the German by the author.

the visible surface is purposefully designed to make possible the interface between human and computer as a constitutive component of this semiotic system.

3. The Interface: Spatial Frontality, Temporal Fracturing, and the Semiotic Niche

In De Nijs's biometric artworks, the interface is the face of the facial recognition technology system, namely, the face of Neurotechnology's VeriLook SDK Version 3.2, its Face Extractor, and Face Matcher. This interface between human and computer is a "coupling of surface and subface," Nake illustrates, in which "both are faces" (2008: 107), where one process ends, and another process begins. Through interfaces, Irvine traces, "[s]emiotic agents direct the input/output structures" in the black, white, or gray box and its "physical subsystems" that is, its programmatic subface, that "enac[t] dialogic [sign] interpretations" and then "project" onward at this "next level" (2022: 209). For each of these artworks, once the surface has been intersemiotically translated into the subface, the program starts its signal process, which denotatively consists of determination chains, like any process on a computer.

If facial recognition technology, like De Nijs's biometric art, is going to work, then humans must interact with it. Whether on human levels or on quantum scales, all systems of signs must have physicality to be perceptible at specific points across semiotic processes. The interface, Irvine traces, affords for "symbolic pattern recognition" of any "token → type relations" and the "dialogic interpretation" of these "symbol representations" (2022: 223). Consequently, Irvine illuminates, computers must include "*built-in interfaces* that enable inferences" between structural prostheses and symbolic programs (2022: 223). In De Nijs's biometric art and its facial recognition, the particular token of the query image taken with a camera *is recognized in relation to* the general types of the template images stored in a database. These images are interpreted to either constitute, or not constitute, a match. However, this interpretation would not be possible without an interface, the interactors, and the *interaction* between them. Computer scientists, like those at Neurotechnology, functionally design their facial recognition so as to include what Irvine terms the "'meta' layer" of the interface (2022: 224). The interface intersemiotically translates between the program in the subface and the display on the surface. This interface is semiotic, Irvine states, more because it actively conveys "semiotic agency" than because it "passively display[s]" symbolic representations (2022: 224). For this reason, the critical explication of facial recognition in terms of its Janusian face or its

facial triadicity proves to be fruitful. The design of facial recognition and design of biometric art, like the design of any software, Frieder Nake and Susanne Grabowski argue, by definition must include the "design of its face" (2006: 67). That is, the interface, Nake and Grabowski analyze, is "*part of*, not [in] addition to, *the design* of software" (2006: 67). What is more, the *face(s)* of the human-computer interface afford for dual techno-social relations, in Nake and Grabowski's appraisal: first, the *design* of these "artifacts for others to use;" and second, the *use* of those "artifacts designed by others" (2006: 67). In De Nijs's biometric art, the interface then informs this interaction, between the faces of the human interactors and the faces of the artwork itself, in two principal ways: both spatially and temporally.

Today, the *semiotic niche* of the human animal and our facial behavior is becoming increasingly more spatially frontal. Indeed, anthropologist Josh Berson infers, "a reorientation is underway" (2015: 105), from the three-quarter view, like in Renaissance, Baroque, and Neoclassical portraits, to the *full-frontal view*, like in mug shots, news media, and video conferencing. In other words, this niche is positioned between the personal, situational contexts and the interpersonal, social communications that we must interpret in order to live. The perspectivization of "*frontality*," to use Berson's term, is one of not only "confrontation," or even "intimacy," but also "surveillance" (2015: 105). And, at least until recently, as traced by Berson, frontality has been understood to be "artific[ial]," that is, a "submission to measurement" (2015: 105). Of course, this so-called technical photography and its supposedly objective epistemology did not originate with facial recognition. Rather, this way of seeing gradually developed across the long nineteenth century through work by Francis Galton, Cesare Lombroso, and Alphonse Bertillon, among other physiognomists, ethnographers, and anthropometrists.

Taken as a whole, however, facial recognition still carries forward this fundamental constraint, both in facial image datasets and templates, and in facial recognition software and applications. First and foremost, "[p]ose remains a major challenge," Berson posits, because frontal photography and frontal videography more often than not results in "epistemic purification" (2015: 111, 112). Reciprocally, the human being and their behavior may soon begin to conform with the machine and its schemas. That is, the face and its motion may soon begin to conform with the specificized requirements and the standardized restrictions of the very facial recognition technology system itself, not only in the laboratory, but also in the wild. With De Nijs's biometric art, the faces of the interactors who are being recognized will act in accordance with the biometric artwork and its facial recognition

that is doing the recognizing. The audience *shows* with their faces that which they infer the artwork needs to *see*, as it were. In this way, the behavior of these faces becomes more artificial than natural. It becomes more staged than spontaneous. And it becomes more volitional than nonvolitional.

To anthropomorphize this interfacing, the human interactor and biometric artwork have to come *face-to-face* with one another for De Nijs's art to do its work. The human *stands up before* the machine. And the human and the machine *look at each other straight in the eye*. Or rather, anatomically speaking, the camera for the artwork must be at a level angle with the sagittal plane and a perpendicular alignment with the coronal plane of the face and its motion. De Nijs instigates this interactivity in different ways across his artworks:

In *Physiognomic Scrutinizer* (Fig. 1), the design of the artwork references the omnipresent security gates of contemporary public spaces, like airports, performance centers, shopping malls, or sport arenas. The interactor approaches the gate, moving along the barricades and into the spotlight. For their face to be recognized, the interactor must gaze *upward* toward the camera and the display that screens their live image. At the same time, the match between the query images taken with the camera and the template images stored in the database is displayed side-by-side on the reverse of the gate for all the audience to see and judge—perhaps even laugh at.

In *Mirror_Piece* (Fig. 2), the design of the artwork references the catoptrics in the home, whether the bath or the vanity. The interactor approaches the mirror, which is hung on the wall with a hidden camera behind it. For their face to be recognized, the interactor must gaze *forward* upon their reflection. At the same time, an image of their face and an image of its match are displayed side-by-side, underlying their reflection, along with biographical information about the infamous celebrity whom the classifier has identified them with.

In *15 Minutes of Biometric Fame* (Fig. 3), the design of the artwork references the camera cranes used to make television and movies. The interactor approaches the crane, which is mounted on a track and moves in circles. For their face to be recognized, the interactor must gaze *into* the gesticulating camera below the display that screens their live image. At the same time, the interactor's own facial image and their lookalikes' or their doppelgangers' facial images, whether the facial images of famous individuals or the facial images of previous interactors, are projected onto the wall, in lineage position, with generation labels.

Across these interactions between interactor and artwork, the face is dynamic. In addition, it is adaptive to its interactions. During his exhibitions,





Figure 1 (left): Marnix de Nijs, 2008, *Physiognomic Scrutinizer*. Exhibit view. September 11–13, 2009, De Wereld van Witte de With Contemporary Art Festival, V2_Lab for the Unstable Media, Rotterdam, Netherlands. Photo © Marnix de Nijs. Used with permission.

Figure 2 (right): Marnix de Nijs, 2010, *Mirror_Piece*. Exhibit view. 2013, Artspace, Beijing, China. Photo © Marnix de Nijs. Used with permission.



Figure 3: Marnix de Nijs, 2011, *15 Minutes of Biometric Fame*. Exhibit view. July 26 – August 17, 2011, Translife: International Triennial of New Media Art, at the National Art Museum of China, Beijing, China. Photo © Danwen Xing. Used with permission.

for example, De Nijs casually observed a gender-typical dimorphism across interactor facial behavior. Of course, De Nijs's particular expertise is neither animal ethology nor human psychology. And his subjective observations are therefore implicitly biased as a result of his own biology, culture, experience, and society, that is, his codes of interpretation. De Nijs himself notes, however, that when the interactors engage with the artwork: female-identified interacting individuals are more likely to display auto-grooming facial behaviors (clothes adjusting, hair brushing, and self-inspecting, for example); and male-identified interacting individuals are more likely to display agonistic facial behaviors (chin thrusting, eye widening, and puffing up, for example); while female and male interactors are equally likely to display courtship facial behaviors (face orienting, gaze holding, and self-touching, for example). After the facial match is then functionally made, according to De Nijs at least, interactors, *once they see others seeing them*, more often than not display "nervous laughter," whether self-conscious or self-defensive. The point is this: In the wild, faces may be performative. They may be playful. But natural faces are rarely frontal.

However, in De Nijs's biometric art, the interface between the human interactor and the biometric artwork is only made possible by the frontal view of a face's behavior, its enrollment, and matching with the live video of an interactor's face, its dynamics, and movements. As I analyze here, De Nijs facilitates this frontality in the design of his artworks. But the technology has its constraints. The latest version of Neurotechnology's VeriLook affords for tolerance of "face posture" from "frontal position" by allowing for "roll" or "tilt" sideways (in the image plane) "±180°," "pitch" or "nod" up-and-down "±15°," and "yaw" or "bobble" from-side-to-side "±90°" (Neurotechnology 2024: 17). All the more constrained, the earlier version of Neurotechnology's VeriLook, as utilized in the first three artworks of De Nijs's biometric oeuvre, affords for a "tolerance" of only "up to 10 degrees from frontal in each direction" (Neurotechnology 2009: 3), including roll, pitch, and yaw. Given these constraints in spatial variability and these affordances in spatial manipulation, the accuracy of algorithms still noticeably decreases under non-frontal deviations. Simply put, facial recognition technology systems work if, *and only if*, the face is visible. And the regular failure of such facial recognition is due not only to partial occlusion, image quality, and other such factors, but also to the near-constant motion of the living human face.

In addition to being more spatially frontal, the semiotic niche of the human animal and our facial behavior is becoming increasingly more temporally fractured. As Berson points out, "the predictive value of 'thin slices,'"

which are relatively short in their sample duration, ostensibly appear to afford observers without specialist training with "evidence to characterize" dynamic human facial behavior, and therefore have been "enthusiastically received" in the computer sciences (2015: 115). Although so-called *thin slicing*, that is, epistemic judgments based on time-limited impressions, is widely discussed and highly debated, thin slices of behavioral streams have predictive utility for behavioral analytics. With Neurotechnology's VeriLook SDK in De Nijs's biometric art, Version 3.3, the most similar version to that utilized by De Nijs which explicitly documents temporality, *detects* multiple faces in "0.07" seconds, *extracts* single faces in "0.13" seconds, and *classifies* "100,000" faces per second (Neurotechnology 2009: 7). When applying Version 13.1, the most recent version at the time of this writing, Face Extractor creates a template in "1.34" seconds and Face Matcher identifies a template at a rate of "40,000" faces per second (Neurotechnology 2024: 19). With improved efficacy over fifteen years, VeriLook has decreased in speed but increased with accuracy. But the only facial behavior that is being recognized is from the duration of the interaction—a very thin slice, indeed.

Of course, the interpretant made by an interactive machine is not the same thing as the interpretant made in the act of its use. The use of a machine, even a semiotic machine like the facial recognition technology in De Nijs's biometric art, Andersen, Hasle, and Brandt challenge, "implies a mobilisation of mental images" (1997: 566). That is to say, Andersen, Hasle, and Brandt contend, in the "specific instance of [an interactional] semiosis," the interactor relies upon "interpretive representations" about the multifarious controls behind "the machine's computations," that is, its black box and inner workings, which then, in turn, "shape [their] own performance" (1997: 566). Andersen, Hasle, and Brandt claim "the Peircean […] concept" of sign categories is usable for understanding "the general principle[s] of interactional semiosis" (1997: 566). This "sign is temporal," Andersen, Hasle, and Brandt characterize, because it consists of "the durative representamen" perceived by the interactor during the "process running" through what is, from their perspective at least, an "unknown sequence," and the explicative interpretant "that bridge[s] this cognitive gap between the initial and terminal instances of the sign" (1997: 566). "A change," or, in this context, "a sign," Andersen, Hasle, and Brandt construe, "must be intelligible to have any effect" upon the interactor and their actions (1997: 567). Human-computer interaction, like in the artwork *15 Minutes of Biometric Fame* during the exhibition Translife, "establishes an interpretative context," that is, "a semiosis," in Andersen, Hasle, and Brandt's conception, actually because "the regulation of the flow" between agents, at least in part, is then based upon what the

interactor "believe[s] to be really happen[ing] 'inside'" the black box itself (1997: 567). "[T]o manipulate the machine," Andersen, Hasle, and Brandt conclude, the interactor "must visualize," that is, they must "iconize" for themselves, "the 'inner,' black box world of the local [computational] process[es]" (1997: 567). In this way, for the interactor with De Nijs's artworks, the reaction of a representamen, because of its relation to a sign object, will inform their interpretant, whereby they orient their adaptations and thereby reorient their actions.

4. The Surface: Algorithmic Bias, the Coded Gaze, and Implicit Permission

De Nijs's biometric art, in and of itself, offers no sign to interactors who engage with it. At least, from the critical standpoint of a computational semiotics both pragmatist and Peircean, facial recognition technology systems afford not a "'sign'" but a "'quasi-sign,'" in Peirce's terminology, with neither "the *interpretant* of the sign" nor "all that is explicit in the sign itself apart from its context and circumstances" (CP 5.473). Certainly, a quasi-sign functions *as if* or *as though* a sign functions. However, a quasi-sign functions *like* a sign only in appearance, not in reality. Which is to say, a quasi-sign functions like a sign in certain, but not all, respects. Therefore, some criteria of semiosis are present, while others are absent, in facial recognition technology like De Nijs's biometric art. The quasi-sign concept, as Nöth contends, "suggests degrees of semioticity" (2002: 84), that is, a continuum between what *is* a sign and what is *not* a sign. And quasi-semiosis may be found in all manner of artifacts, devices, instruments, machines, and tools, from the relatively simple to the highly complex, which include, for instance, the cognitive artifact of facial recognition. Historically, Peirce himself exemplifies the quasi-sign with thermometers (CP 5.473). In the case of a thermometer, as Peirce argues himself, or the case of the facial recognition technology in De Nijs's biometric art, as I argue here, quasi-semiosis constitutes a "degeneration," to use Peirce's term (CP 2.91), or "reduction," to use Nöth's term (2002: 85), from a tri-relative sign process that involves a representamen, object, and interpretant, to a bi-relative sign process that involves a representamen and its object. To demonstrate this degeneration, Peirce distinguishes between the mechanical, quasi-interpretation made by a thermometer and the mental, genuine interpretation made of a temperature. Whether the pulse rate of the fever "*symptom*" in a human body or the thermal expansion of the temperature "indication" in a mercury thermometer, in Peirce's own estimation, "an *index* [only] acts upon [the sign] in a purely brute and dyadic way," so that the "mental representation of an

index" is but an "*immediate object* of the sign" (CP 5.473). Then, Peirce further traces, the sign object only signifies the "intended, or proper, effect of the sign," in this instance, "an indication […] of an increase" in atmospheric or bodily temperature, "by means of another mental sign" (CP 5.473), that is, a *dynamic object* of the sign. The signs, Nöth states, whether "iconic, indexical, [or] symbolic," whereby "the computer operates are quasi-signs" (2002: 85). This includes, for instance, on the level of its surface, whereby nonvisible input and invisible black box then become visible output, and, in turn, are intersemiotically translated, extensively, but not exclusively, into *iconicities of faciality*. Indeed, "[c]ause and effect," Nöth illustrates, merely "constitute a dyadic relationship" between representamen and sign object (2002: 85). Only when an interpretant is also then included, Nöth specifies, "does semiosis begin to take place" (2002: 85). As with the thermometer and with its temperature in Peirce's own example, the facial recognition technology in De Nijs's biometric art causally reacts to input variables. Deep within its black box, the recognition thereby matches the causal image of a face taken with a camera to the effectual images of faces stored in a database. Here, the machine only identifies. It does not interpret. The human must still infer the *meaning* of this face.

In De Nijs's *Physiognomic Scrutinizer* and *Mirror_Piece*, as the human interactor engages with the biometric artwork, their clothing, expression, lighting, and movement all affect the recognition. Depending upon these and other variables, the faces of the interactors and faces of the templates can be matched in many ways. During the exhibitions of these artworks, De Nijs has casually observed how interactors who cover part of their face, have darker skin coloration, make playful facial behaviors, or proceed through recognition collectively rather than individually, receive wildly variable results (Figs. 4–7). What is more, to find a balance humorous-*cum*-satirical between accurate face matches and erroneous false positives, De Nijs plays with parameters like confidence value and liveness detection for the dramatic purposes of this digital performativity.

Over the course of his exhibiting *15 Minutes of Biometric Fame*, De Nijs also encountered other challenges in the ways facial recognition technology systems work and how they can be not only beneficially used but also adversely misused. There are today what computer scientist Joy Buolamwini terms an "*algorithmic bias*" and "*coded gaze*" against racial, gender, age, and other diversities in facial recognition, its template images, and training datasets (2023: 44). Perhaps first and foremost, to optimize the functionality in this biometric artwork and its facial recognition, De Nijs discovered that he needed to *scrub* the dataset between his iterations of the artwork.



Figures 4–7: Marnix de Nijs, 2008, *Physiognomic Scrutinizer*. Detail view. September 11–13, 2009, De Wereld van Witte de With Contemporary Art Festival, V2_Lab for the Unstable Media, Rotterdam, Netherlands. An interactor is matched, from top left to bottom right, with Kate Moss, Grigori Rasputin, Frank Sinatra, and Tilda Swinton. Screenshots © Marnix de Nijs. Used with permission.

To do so, he saves the enrolled images of celebrity faces originally scraped from the internet. And he deletes the enrolled images of interactor faces previously videographed during an exhibition. By doing so, De Nijs preserves his templates, but only so far as the first generation of facial imagery and the consequent stage of classifier training. For instance, De Nijs *cleaned* his artwork, *after* its exhibition at Translife: International Triennial of New Media Art, at the National Art Museum of China (NAMOC), in Beijing, China in 2011, where the interactors were mostly Asian, and *before* its exhibition at the Dutch Electronic Art Festival (DEAF), at the V2_Lab for the Unstable Media, in Rotterdam, the Netherlands in 2012, where the interactors were mostly White. The reason is simple, practically speaking: the artwork works better if the artist does this; its facial recognition is more accurate. But such a scrubbing—or *whitewashing*, one might perhaps say—also speaks to principal ethical concerns with facial recognition applications.

Like with many, if not most, facial recognition technology systems, De Nijs has observed that his biometric art does not perform optimally on phenotypic subgroups of *Homo significans* with higher melanin pigmentation and darker skin coloration. Simply put, the error rate and false positives

are disproportionately high among racial demographics like persons with African or Asian heritage. This functional constraint in recognition performance is as much a technological problem in machine vision and lighting effects as it is a social issue in discriminatory colorism and institutional racism. With *15 Minutes of Biometric Fame* (Fig. 8), the more diminished the lighting in the exhibit and its space, the more persons of color are not only *invisible* but also *unseen*. Further, the more persons of one color are enrolled from the camera and its images to the database and its templates, the more persons of another color are not only *undetected* but also *misclassified*. To exhibit *15 Minutes of Biometric Fame* in China, De Nijs discovered that he needed to teach the facial recognition in his biometric artwork how to see Asian faces by adjusting parameters and enrolling templates. Once he did so, however, it then struggled to see White faces. Consequently, to exhibit in the Netherlands, De Nijs chose to wipe the memory of his artwork. He started it over with a *tabula rasa*, as it were. In this way, De Nijs perpetuates the very prejudice for which facial recognition is most commonly banned. At one and the same time, De Nijs also problem-solves potential solutions for addressing this constraint, like training such technology both *contextually* and *differentially*.

The difference that makes a difference, or at least one of the principal differences that makes a pragmatic difference, between artificial, machine facial recognition and natural, human facial perception is the question of control, or, more specifically, the question of *self-control*. To Peirce, Nöth posits, "genuine semiosis" is qualified by "*self-control*" (2002: 91). But as Nöth asserts, "[a] machine lacks self-control" when absolutely "controlled by its input" stimuli (2002: 91). Of course, Neurotechnology's facial recognition in De Nijs's biometric art does exert a degree of control over its own self. In its black box, it identifies, matches, and outputs. By exerting this control, however, the biometric art merely extends De Nijs's agency as a cognitive artifact and a semiotic prosthesis. As the user of this technology, De Nijs retains control. For a machine to have a mind, not just a quasi-mind, but really a genuine mind, it must itself be able to pursue semiotic processes separately, that is, more by *auto*poiesis (self-making) than by *allo*poiesis (other-made). As Peirce himself claims, "[e]fficient causation," a defining characteristic both of deterministic machines and of indeterministic machines, is "determined by the particular condition of things," which act "to make a situation begin to change in a perfectly determinate way" (CP 1.212). In contrast, to Peirce, "[f]inal causation," a defining characteristic of genuine semiosis, "may be brought about at one time in one way, and at another time another way," because it "does not determine in what particular way a general result is to be



Figure 8: Marnix de Nijs, 2011, *15 Minutes of Biometric Fame*. Detail view. July 26 – August 17, 2011, Translife: International Triennial of New Media Art, at the National Art Museum of China, Beijing, China. Screenshot © Marnix de Nijs. Used with permission.

brought about, but only that the result shall have a certain general character," (CP 1.211). Through an anecdote about shooting an eagle with a rifle, Peirce distinguishes between human semiosis and machine quasi-semiosis when he distinguishes between the "shoot[er]," who "make[s] allowance for […] change," and the "bullet," which "simply obey[s] orders blindly" (CP 1.212). Today, of course, some things are not so simple. Artificial intelligence, like in smart weapons which may be "much better [at] striking a moving target than any hunter," as Nöth also notes, can indeed be "a genuinely semiotic machine" (2002: 95). But even the smartest of such artificial intelligences can still be stupid, blindly conforming to encoded laws. From the perspective of this pragmatism, both first and foremost, semiosis must be *purposeful*. Peirce himself proposes how "purpose, or rather, final causation, of which purpose is the conscious modification, is the essential subject of psychologists' own studies," where "consciousness is a special, and not a universal, accompaniment of mind" (CP 7.366). By way of analogy with Peirce's own example of shooting a bird, *Physiognomic Scrutinizer*, *Mirror_Piece*, and *15*

Minutes of Biometric Fame, after the training of their templates, are controlled by another through an efficient causation. They are operated by De Nijs, his mind, and purpose.

5. Conclusion

By his interventions with our interactions, through a semiotic machine and its algorithmic signs, De Nijs makes visible, and thereby knowable, the Janusian face of facial recognition. De Nijs's biometric art looks to the past, its classifiers, their datasets, and templates. And his biometric art looks to the future, its faces, their behaviors, and identifications. Facial recognition technology affords predictive behavior analytics. We model future behavior by past behavior measures. That is, through future forecasting technologies, we analyze the past to adapt our future. *Then and there*, a face like *that* behaved like *this*. So maybe, just maybe, a face like *this* behaves like *that*, *here and now*. That is the technopositivist hope, at least. Today, however, De Nijs's facial recognition technology-based biometric art could not be more relevant, timely, or urgent. In our Information Age with its Orwellian phantasms and its panoptical overwatch, there is far more to this oracular eye-in-the-sky than optically meets the eye. Facial recognition technology systems and their machine-generated technical images cannot be, and should not be, taken at face value. Over the past decade, facial recognition has diversified into omnipresence. Whether embedded in devices or distributed in environments, facial recognition has become integrated building-wide, citywide, nationwide, and worldwide. Corporations, governments, and institutions promote facial recognition applications in criminal justice, domestic exit-entry, and immigration enforcement, among many other areas. But the ubiquitous application of facial recognition has raised concerns over accountability and transparency, especially given the overall absence of ethical oversight, and given the underlying presence of scientific uncertainty. Through his biometric art, De Nijs *plays with* this facial recognition. He *performs* the ways facial recognition technology systems work *on stage*. And he puts such technology *on trial* for us all to see—and *judge* for ourselves.

However, it is the artist De Nijs and the interactors with his artworks who decide what a face is and the ways of seeing it for his biometric artwork, its facial recognition technology, and how this black box then works. To put it simply, the responsibility for the analytics of the recognition and its application in a reality then rests not with the machines but with the humans. Certainly, the fundamental question of semiotic agency, that is,

of who—*or what*—constitutes a sign interpreter and consequently sign producer, extends across the many subfields of the semiotic metadiscipline, encompassing both the computational semiotics of an artificial intelligence and the biosemiotics of our natural intelligence. Theoretical biologist and preeminent biosemiotician Marcello Barbieri, for instance, contends that "a computer has codes but is *not* a semiotic system" because these codes originate "from a 'codemaker' which is outside it" (2008: 578), which is to say, their codes originate from humans. Indeed, the artificial intelligence of facial recognition, like any other such intelligence, in and of itself "is neither *artificial* nor *intelligent*," as appraised by Kate Crawford, the co-founder and former director of the AI Now Institute in New York (2021: 8). Rather, Crawford critically reflects, "artificial intelligence is both embodied and material," requiring "training with large datasets" under "predefined rules and rewards," which "depen[d] entirely" on social practices and political structures (2021: 8), in other words, on codes, their contexts, and cultures.

After all, the machine learning in such facial recognition is supervised learning. Facial recognition that is artificial intelligence, whether in a technology system like Neurotechnology's VeriLook, or in a biometric artwork like De Nijs's *15 Minutes of Biometric Fame*, must first be taught *how to see*, whether in an image or in a video, what information does, and does not, constitute a face. In contrast to Barbieri, biosemioticians Alexei Sharov and Morten Tønnessen counter that "there is no theoretical reason why semiosis cannot be automated," if "semiotic agency is involved" therein, given, after all, that "[a]utomated processing" of sign functions is "common[ly found] in living organisms" (2021: 214), like in protein complexes or in ribosomal structures. Indeed, "computers," in Sharov and Tønnessen's consideration, "can be autonomous, goal-directed agents" as extended "components of […] human agency" (2021: 4). However, the novel creation of new interpretations between signs emerges by the combination or the modification of presently extant sign relations. Therefore, "semiogenesis" is "typically gradual," Sharov and Tønnessen go on to characterize, because a pattern then requires "time for stabilization," if it is "to become consistent with the long-term goals of [a semiotic] agent," through "experience via trial and error" (2021: 227). For this reason, among many others, as Sharov and Tønnessen classify, "[s]emiogenesis is not a universal feature of [semiotic] agents," but is present in "primary agents," such as humans and other organisms, and is absent in "[s]econdary agents, such as computers" and most artificial intelligences, which persist in their functions "by following a program supplied by [their] parental primary agents" (2021: 227). At this stage in the Fourth Industrial Revolution, facial recognition has been accelerated forward by

fundamental advances in the digital economy, big data, and artificial intelligence. But a machine still cannot see faces *like* a human (*simulation*), a human still cannot see faces *better* with a machine (*prosthesis*), and a machine and a human still cannot see faces *more* together (*augmentation*), unless a human teaches a machine how it must interpret these signs, that is, what the face *is* in the first place.

References

Andersen, P. B., P. Hasle and P. A. Brandt. 1997. Machine Semiosis (*Maschinensemiose*). In Posner, R., K. Robering and T. A. Sebeok (eds.). *Semiotik: Ein Handbuch zu den zeichentheoretischen Grundlagen von Natur und Kultur / Semiotics: A Handbook on the Sign-Theoretic Foundations of Nature and Culture*, Vol. 1. Berlin and New York: Walter de Gruyter, 548–570.

Barbieri, M. 2008. "Biosemiotics: A New Understanding of Life". *Naturwissenschaften*, Vol. 95, No. 7, 577–599. Available at: https://doi.org/10.1007/s00114-008-0368-x.

Berson, J. 2015. *Computable Bodies: Instrumented Life and the Human Somatic Niche*. Bloomsbury Advances in Semiotics 11. London: Bloomsbury Academic.

Buolamwini, J. 2023. *Unmasking AI: My Mission to Protect What Is Human in a World of Machines*. New York: Random House.

Crawford, K. 2021. *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*. New Haven: Yale University Press.

De Nijs, M. n.d. Summary of Works. Marnix de Nijs. Available at: http://www.marnixdenijs.nl/ (accessed 14 March 2024).

Haugeland, J. 1985. *Artificial Intelligence: The Very Idea*. Cambridge, MA: The MIT Press.

Irvine, M. 2022. Semiotics in Computation and Information Systems. In Pelkey, J., S. W. Matthews (eds.). *Bloomsbury Semiotics*, Vol. 2: *Semiotics in the Natural and Technical Sciences*. London: Bloomsbury Academic, 203–237.

Nake, F. 1997. Der semiotische Charakter der informatischen Gegenstände [The Semiotic Character of Information Technology Objects]. In Bayer, U., K. Gfesser and J. Hansen (eds.). *Signum um Signum*. [Special issue]. *Semiosis: Internationale Zeitschrift für Semiotik und Ästhetik*, No. 85–90. Baden-Baden: Agis-Verlag, 24–35.

Nake, F. 2008. Surface, Interface, Subface: Three Cases of Interaction and One Concept. In Seifert, U., J. H. Kim and A. Moore (eds.). *Paradoxes of*

Interactivity: Perspectives for Media Theory, Human-Computer Interaction, and Artistic Investigations. Bielefeld: transcript Verlag, 92–109.

Nake, F., S. Grabowski. 2006. The Interface as Sign and as Aesthetic Event. In Fishwick, P. A. (ed.). *Aesthetic Computing*. Cambridge, MA: The MIT Press, 53–70.

Neurotechnology. 2009. *VeriLook SDK 3.3: Face Identification for PC or Web Solutions*. Vilnius: Neurotechnology.

Neurotechnology. 2024. *VeriLook SDK 13.1: Face Identification for Stand-Alone or Client-Server Applications*. Vilnius: Neurotechnology.

Nöth, W. 2002. "Semiotic Machines". *S.E.E.D. Journal (Semiotics, Evolution, Energy, and Development)*, Vol. 3, No. 3, 81–99.

OpenCV. n.d. Object Tracking. Available at: https://docs.opencv.org/4.x/dc/d6b/group__video__track.html (accessed 14 April 2024).

Ovid. 2011 [8 CE]. *Times and Reasons: A New Translation of Fasti*. (transl. Anne Wiseman and Peter Wiseman). Oxford: Oxford University Press.

Peirce, C. S. 1931–1958. *The Collected Papers of Charles Sanders Peirce*. Vols. 1–6, Hartshorne, C., P. Weiss (eds.), 1931–1935; Vols. 7–8, Burks, A. W. (ed.), 1958. Cambridge, MA: Harvard University Press. (Cited as CP.)

Schiller, D. 2025. "The Janusian Face of Facial Recognition, Part 1: Its Subface, Interface, and Surface". *Digital Age in Semiotics & Communication*, Vol. 8, 103–125. Available at: https://doi.org/10.33919/dasc.25.8.6.

Sharov, A., M. Tønnessen. 2021. *Semiotic Agency: Science Beyond Mechanism*. Biosemiotics 25. Cham: Springer.

Winograd, T., F. Flores. 1986. *Understanding Computers and Cognition: A New Foundation for Design*. Norwood, NJ: Ablex.