

DIGITAL ART NOW: HISTORIES OF (IM)MATERIALITIES

CHRISTIANE PAUL

ABSTRACT | The multifaceted history of digital art has also entailed an evolution of understanding the complex relationships between the material and immaterial in the digital medium. This text traces the histories of digital objects and systems from the 1960s to the so-called 'post-digital' era, which finds its artistic expression in works shaped by digital technologies and networks, yet taking the material form of objects such as paintings, sculptures, or photographs. The term neomateriality is used here to capture an objecthood that reflects back the data of humans and the environment, or reveals the way in which digital processes perceive and shape our world. Digital materialities are considered in relation to network cultures and politics, as well as art institutions.

KEYWORDS | digital art, media art, network analysis, GLAM institutions, immateriality, post-digital

As digital technologies have infiltrated almost all aspects of art making, many artists, curators, and theorists have already pronounced an age of the 'post-digital' and 'post-Internet' that finds its artistic expression in works both deeply informed by digital technologies and networks, yet crossing boundaries between media in their final form. The terms post-digital and post-Internet attempt to describe a condition of artworks and 'objects' that are conceptually and practically shaped by the Internet and digital processes — taking their language for granted — yet often manifest in the material form of objects such as paintings, sculptures, or photographs. Clement Valla's *Surface Proxy* series (2015), for example, consists of objects literally wrapped in their own representation. The artist used 123d catch, an app that lets users create 3D scans of objects, to produce 3D models of architectural fragments from museum collections, digitally draped them with cloth by means of 3D graphics software and imprinted the surface of the original object on the virtual cloth. The cloth depicting the image was then printed using an inkjet printer and wrapped around a 3D print of the object's form. The final object is re-skinned by its own image in an analog version of texture-mapping. The resulting sculptures capture an objecthood that reflects their process of creation and the way in which technologies perceive and render the world. The multifaceted history of digital art has been an evolution of understanding the complex relationships between the material and immaterial, as well as the new materials manifestations of the post-digital, which I define as neomateriality.

The terminology for technological art forms has always been extremely fluid and what is now known as digital art

has undergone several name changes since it first emerged. Originally referred to as computer art, then multimedia art and cyberarts (from the 1960s-90s), art forms using digital technologies became digital art or so-called new media art at the end of the 20th century. The term new media art co-opted the label that, at the time, was used mostly for film / video, sound art, and various hybrid forms, and had been used throughout the 20th century for media that were emerging at any given time. The problematic qualifier of the 'new' always implies its own integration, datedness, and obsolescence and, at best, leaves room for accommodating the latest emerging technologies. Some of the concepts explored in 'new' media art date back almost a century and have previously been addressed in various other traditional arts. The terms digital art and new media art are sometimes used interchangeably, but new media art is also often understood as a subcategory of a larger field of digital art that comprises all art using digital technologies at some point in the process of its creation, storage, or distribution. It is highly problematic to classify all art that makes use of digital technologies somewhere in its production and dissemination process as digital art, since it makes it almost impossible to arrive at any unifying statement about the art form.

Walking into any given gallery or museum today, one will presumably encounter work that involved digital technologies at some point in its production: photographs that are digital chromogenic prints; videos that were filmed and edited using digital technologies; sculptures that were designed using Computer-Aided Design (CAD) or produced using digital manufacturing processes etc. At the same time, these works

present themselves in the form of finite objects or sequences of images as they would have done decades or even centuries ago when they were produced by means of various analog technologies. Most importantly, works that involved digital technologies as a production tool do not necessarily reflect on these technologies. The materiality and aesthetics of these digitally produced works are still radically different from those of an interactive website that could be presented as an installation or projection, or experienced on a screen; or a sensor-based interactive installation that needs to be 'performed' by the audience; or a work that takes a material form but involved and critically addresses digital technologies. One needs to distinguish between art that uses digital technologies as a tool for the production of a more traditional art object — such as a photograph, print, or sculpture; and the digital-born art that employs these technologies as a tool for the creation of a less material, software-based form that utilizes the digital medium's inherent characteristics, such as its participatory and generative features.

Digital art is now predominantly understood as digital-born, computable art that is created, stored, and distributed via digital technologies and uses the features of these technologies as a medium. Digital artworks are computational, and can be process-oriented, time-based, dynamic, and real time; participatory, collaborative, and performative; modular, variable, generative, and customizable, among other things. While these characteristics are not exclusive to digital art (some of them apply to different types of performative events or even video and installation art), they are not intrinsic to objects such as digital photographs or prints.

Born-digital art still is far from a unified category but can take numerous forms: interactive and/or networked installations; software or Internet art without any defined physical manifestation; virtual reality or augmented reality; locative media art distributed via mobile devices or using location-based technologies such as the Global Positioning System (GPS).

Whether one believes in the theoretical and art-historical value of the post-digital and post-Internet concepts or not, their rapid spread throughout art networks testifies to a need for terminologies that capture a new, important condition of cultural and artistic practice in the early 21st century: a post-medium condition in which media in their originally defined format — for example, video as a linear electronic image — cease to exist and new forms of materiality emerge. However, the label itself is highly problematic in that it suggests a temporal condition while we are by no means after the Internet or the digital. Internet art and digital art, like good old-fashioned painting, are not obsolete and will continue to thrive.

At the core of the post-digital seems to lie a twofold operation: first, the confluence and convergence of digital technologies in various materialities; and second, the ways in which this merger has changed our relationship with these materialities and our representation as subjects. The post-digital captures the embeddedness of the digital in the objects, images, and structures we encounter on a daily basis and the way we understand ourselves in relation to them. It denotes the process of seeing like and being seen through digital devices. The post-digital provides us with a blurry picture or perhaps the equivalent of a "poor image" as Hito Steyerl would understand it, a "copy in motion" with substandard resolution, a "ghost of an image" and "a visual idea in its very becoming," yet an image that is of value because it is all about "its own real conditions of existence."¹

The merger and hybridity of forms that has brought about the need for the current post-digital culture raises profound questions about medium-specificity and its usefulness in general. While we certainly live in a convergence culture in which content flows across multiple media platforms, it seems dangerous to abandon medium-specificity at a point where the intrinsics and aesthetics of the digital medium are far from understood or integrated into the artworld at large.

The era of the post-digital marks a new stage in the relationship between digital technologies and materiality. In the late 1960s and early 70s, Lucy Lippard theorized the dematerialization of the art object.² While Lippard did not explicitly talk about digital art, the art forms she examines — such as Fluxus and happenings — are today considered part of the lineage of digital art and emerged in a cultural climate that was infused by cybernetics and systems aesthetics.

Over the following decades a slow process of rematerialization occurred. While Jean-François Lyotard's exhibition *Les Immatériaux* (1985, Centre Georges Pompidou, Paris) seemingly highlighted immateriality, it in fact also argued that the immaterial is matter subjected to interaction and conceptual processes. Bernard Stiegler equally believes that there is nothing that is not ultimately in a material state, and the immaterial therefore does not even exist on a nanolevel. Stiegler discusses "hypermateral" as a complex of energy and information where it is no longer possible to distinguish matter from form — a process where information presented as form is in reality a sequence of states of matter produced by materials and apparatuses, by "techno-logical" devices in which the separation of form and matter is totally devoid of meaning.³ This, Stiegler concludes, is not dematerialization but hypermaterialization. While Stiegler's term grasps the gathering, monitoring and processing of information through material devices, it focuses on sequences of states rather than, for example, the affective aspects of materials that are shaped by data and mirror and reflect us and the environ-

ments we inhabit back to ourselves. Stiegler's hypermaterialization does not highlight the state of materials waving back at us or objects representing how the machine and software we created perceive us. I propose the notion of neomateriality to capture an objecthood that incorporates networked digital technologies and embeds, processes, and reflects back the data of humans and the environment, or reveals its own coded materiality and the way in which digital processes perceive and shape our world. The term neomateriality is understood as different from the theories of neomaterialism that emerged in the 1930s and investigated relationships between human activities and the productive capacity of the environment in the concept of anthropology and evolution. Neomateriality describes the embeddedness of the digital in the objects, images, and structures we encounter on a daily basis and the way we understand ourselves in relation to them. It finds different kinds of expression within contemporary culture and artistic practice in the form of objects or artworks that

- 1) use embedded networked technologies, reflecting back their surrounding human and non-human environment;
- 2) reveal their own coded materiality as part of their form, thereby becoming themselves a residue of digital processes;
- 3) reflect the way in which digital machines and processes (seemingly autonomously) perceive us and our world.

What distinguishes most digital art — and software art, in particular — from other artistic practices, is that its medium resides in distinct materialities. Paintings, for example, allow us to perceive the brush stroke or paint splatter that created them and film consists of consecutive frames of images. In digital art the visual results of the artwork — no matter how 'painterly' or 'cinematic' — are derived from code and mathematical expression.

The back end of the work and its visual front end typically remain disconnected. Code has also been referred to as the medium, the 'paint and canvas,' of the digital artist but it transcends this metaphor in that it even allows artists to write their own tools — to stay with the metaphor, the medium in this case also enables the artist to create the paintbrush and palette. Artistic practice engaging with conditions of neomateriality often highlight this condition by turning code and abstraction into the material framework of an object. The history of digital art can be written as one of the inherent tensions between the material and immaterial, objects and systems.

Histories of Digital Objects and Systems

Artists have always quickly adopted and reflected on the culture and technologies of their time, and began to experiment with the digital medium decades before the "digital revolution" was officially proclaimed in the 1990s.

The years from 1945 onwards were formative forces in the evolution of digital media, marked by major technological and theoretical developments: digital computing and radar; Cybernetics, formalized 1948 by Norbert Wiener; Information Theory and General Systems Theory; as well as the creation of ARPANET, the first manifestation of the Internet, in 1969. In the 1940s Norbert Wiener pointed out that the digital computer raised the question of the relationship between the human and the machine and coined the term "cybernetics" (from the Greek term "kybernetes" meaning "governor" or "steersman") to designate the important role that feedback plays in a communication system. In *Cybernetics: or, Control and Communication in the Animal and the Machine* (1948), Wiener defined three central concepts which he maintains were crucial in any organism or system — communication, control, and feedback — and postulated that the guiding principle behind life and organization is information, the information contained in messages.

The 1950s and 1960s saw a surge of participatory and/or technological art, created by artists such as Ben Laposky, John Whitney Sr., Max Mathews, and Lillian Schwartz at Bell Labs; John Cage, Alan Kaprow and the Fluxus movement; or groups such as Independent Group / IG (1952 / 54: Eduardo Paolozzi, Richard Hamilton, William Turnbull et al.), Le Mouvement (Galerie Denise Rene in Paris 1955); ZERO (1957/59: Otto Piene, Heinz Mack et al.); GRAV / Groupe de Recherche d'Art Visuel (1960-68: Francois Morellet, Julio le Parc et al.); and The Systems Group (1969: Jeffrey Steele, Peter Lowe et al.). The fact that the relationship between art and computer technology at the time was often more conceptual was largely due to the inaccessibility of technology (some artists were able to get access to or use discarded military computers). Among the most prominent initiatives that began to explore the relationship between art, science, and technology in the 1960s were New Tendencies (1961-1973) and Experiments in Art and Technology (E.A.T.), conceived in 1966. Starting out in Zagreb in 1961 as an international exhibition presenting instruction-based, algorithmic, and generative art, New Tendencies became an international network that provided an umbrella for a certain type of art and ultimately struggled with delineating its many forms.

While computers and digital technologies were by no means ubiquitous in the 1960s and 70s, there was a sense that they would change society. It is not surprising that systems theory — as a transdisciplinary and multi-perspectival domain comprising ideas from fields as diverse as the philosophy of science, biology, and engineering — became increasingly important during these decades. In an art context it is interesting to revisit the essays "Systems Esthetic" (1968) and "Real Time Systems" (1969) by Jack Burnham, who was contributing editor of *Artforum* from 1971-73 and whose first book, *Beyond Modern Sculpture: The Effects of Science and*

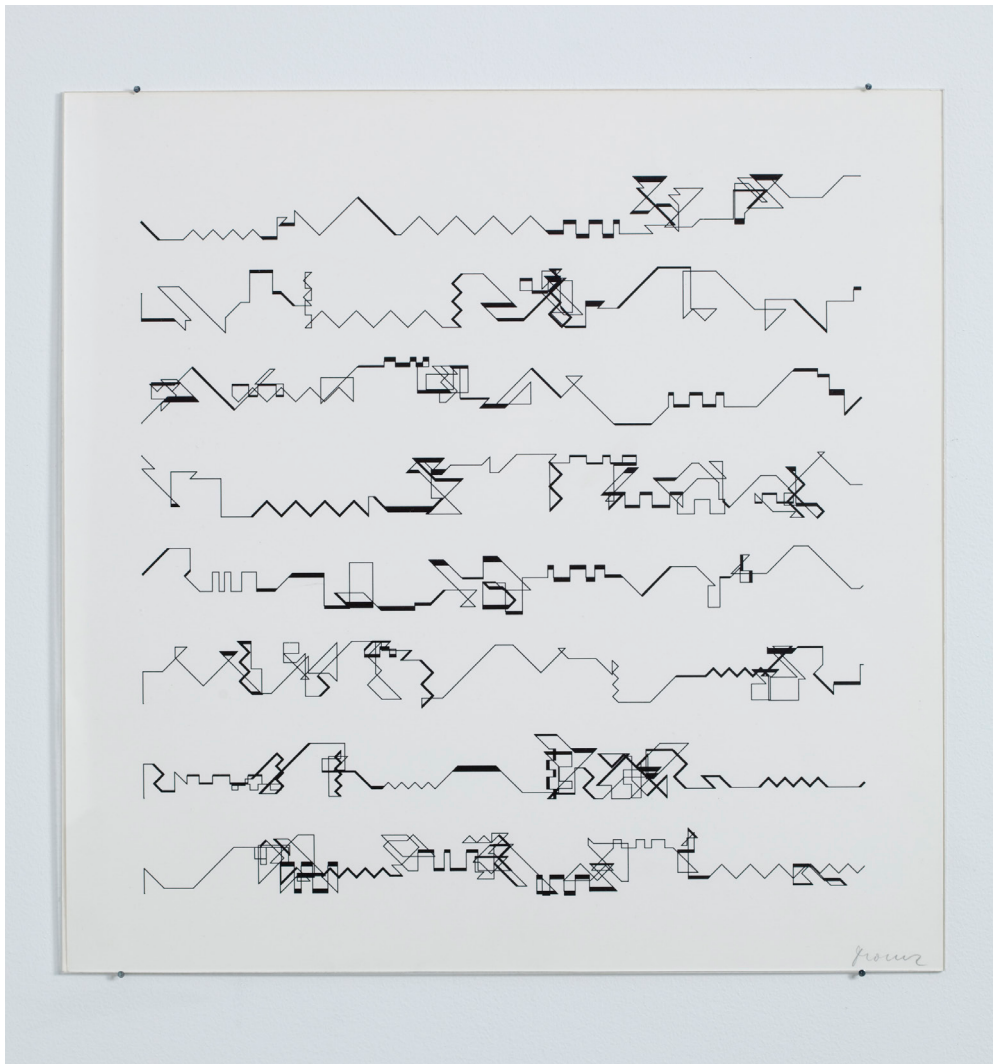


Figure1. Manfred Mohr, P-021-U (1970-1983). Plotter drawing ink on paper. 22 1/2 x 22 1/2in. (57.2 x 57.2 cm)

Technology on the Sculpture of Our Time (1968) established him as a leading advocate of art and technology.⁴ Burnham used [technologically driven] systems as a metaphor for cultural and art production, pointing to the “transition from an object-oriented to a systems-oriented culture. Here change emanates not from things but from the way things are done.”⁵ The systems approach during the late 1960s and the 70s was broad in scope and addressed issues ranging from notions of the art object to social conditions, but was deeply inspired by technological systems. The notion of communication networks as open systems also formed the foundation of telematics — a term coined by Simon Nora and Alain Minc for a combination of computers and tele-communications in their 1978 report to French president Giscard d’Estaing (published in English as *The Computerization of Society*). During the 1970s artists started using “new technology” such as video and satellites to experiment with “live performances” and networks that anticipated the interactions that would later take place on the World Wide Web.

What is now understood as digital art has extremely complex and multi-faceted histories that interweave several strands of artistic practice. One of these art-historical lineages can be traced from early instruction-based concep-

tual art to ‘algorithmic’ art and art forms that set up open technological systems. Another lineage links concepts of light and the moving image from early kinetic and Op Art to new cinematic forms and interactive notions of television and cinema. Embedded in the latter is the evolution of different types of optical environments from illusion to immersion. All of these lineages are not distinct strands, but interconnected narratives that intersect at certain points.

Instruction- and rule-based practice, as one of the historical lineages of digital art, features prominently in art movements such as Dada (which peaked from 1916 to 1920), Fluxus (named and loosely organized in 1962), and conceptual art (1960s and 70s), which all incorporated variations of formal instructions as well as a focus on concept, event, and audience participation as opposed to art as a unified object. This emphasis on instructions connects to the algorithms that form the basis of any software and computer operation — a procedure of formal instructions that accomplish a ‘result’ in a finite number of steps. Among the early pioneers of digital algorithmic art were Charles Csuri, Manfred Mohr, Vera Molnar, and Frieder Nake, who started using mathematical functions to create “digital drawings” on paper in the 1960s. The first two exhibitions of computer art were held in 1965: Comput-

er-Generated Pictures, featuring work by Bela Julesz and A. Michael Noll at the Howard Wise Gallery in New York in April 1965; and *Generative Computergrafik*, showing work by Georg Nees, at the Technische Hochschule in Stuttgart, Germany, in February 1965.

There also is a strong historical lineage connecting digital art to kinetic and Op Art works employing motion, light, optics, and interaction for the creation of abstract moving images. In scientific terms, kinetic energy is the energy possessed by a body by virtue of its motion, and kinetic art, which peaked from the middle 1960s to the middle 1970s, often produced movement through machines activated by the viewer. Kinetic art overlaps with the optical art or Op art of the 1960s, in which artists used patterns to create optical illusions of movement, vibration, and warping. There was a direct connection between Op art and the work of the Groupe de Recherche d'Art Visuel (GRAV). Inspired by Op artist Victor Vasarely and founded in 1960 by Julio Le Parc, Vera Molnar, and Vasarely's son Yvaral, GRAV created scientific and technological forms of art by means of industrial materials, as well as kinetic works and even interactive displays. The term Op art first appeared in print in *Time* magazine in October 1964, but works falling into the Op art category had been produced much earlier. Duchamp's *Rotary Glass Plates (Precision Optics)*, for example, which was created in 1920 with Man Ray, consisted of an optical machine and invited users to turn on the apparatus and stand at a certain distance from it in order to see the effect unfold. The influence of these pieces, such as Laszlo Moholy-Nagy's kinetic light sculptures and his concept of virtual volumes as an outline or trajectory presented by an object in motion can be traced in quite a few digital art installations.

From the 1990s until today, the rapidly evolving field of digital art again went through significant changes. In the early 90s digital interactive art still was a fairly new field within the artworld at large, and many artists developed their own hardware and software interfaces to produce their work. In the new millennium off-the-shelf systems increasingly began to appear and broadened the base for the creation of digital art. In addition, digital media programs, departments, and curricula were formed and implemented around the world, often spearheaded by leading artists in the field. Since digital art did not play a major role on the art market and artists were not able to support themselves through gallery sales, many of them started working within academic environments. The proximity to academic research centers and laboratories provided an ideal context for many of these artists. From 2005 onwards, so-called social media platforms gained momentum and exploded and, at the same time, the Do It Yourself (DIY) and Do It With Others (DIWO) movements, supported by access to cheap hardware and software interfaces, became increasingly important forces.

Network Cultures: The Politics of Digital Art

The history and aesthetics of digital art obviously cannot be separated from its social and political context. The technological history of digital art is inextricably linked to the military-industrial complex and research centers, as well as consumer culture and its associated technologies. From simulation technologies and virtual reality to the Internet (and consequently World Wide Web), digital technologies were developed and advanced within a military context. In 1957, the USSR's launch of Sputnik at the height of the Cold War had prompted the United States to create the Advanced Research Projects Agency (ARPA) within the Department of Defense (DOD) in order to maintain a leading position in technology. In 1964, the RAND corporation, the foremost Cold War think-tank, developed a proposal for ARPA that conceptualized the Internet as a communication network without central authority. By 1969, the infant network was formed by four of the 'supercomputers' of the time — at the University of California at Los Angeles, the University of California at Santa Barbara, the Stanford Research Institute and the University of Utah. Named after its Pentagon sponsor, ARPANET came into existence in the same year Apollo landed on the moon.

John Whitney — whose work gained him the reputation of being the father of computer graphics — used tools that perfectly capture the digital medium's roots in the military-industrial complex. He employed an M-5 Antiaircraft Gun Director as the basic machinery for his first mechanical, analog computer in the late 1950s. Whitney would later use the more sophisticated M-7 to hybridize both machines into a twelve-foot-high device, which he used for his experiments in motion graphics. The machine consists of multiple rotating tables, camera systems, and facilitated the pre-programming of image and motion sequences in a multiple-axis environment.⁶

Given the deep connections between the digital medium and the military-industrial-entertainment complex, as well as the multiple ways in which digital technologies are shaping the social fabric of our societies — to a point where political action was named after the social media platform supporting it, as in 'Twitter Revolution' — it does not come as a surprise that many digital artworks critically engage with their roots. Digital (art) activism has been an important field of engagement, spanning radical art practices and strategies from tactical media (interventions into the media based on an immediacy of action) and "hacktivism" (the blend of hacking and activism) to electronic civil disobedience.

Activist engagement shifted from tactical media to the notion of the commons in the 2000s, both due to the rising



Figure 2. Installation view of *Programmed: Rules, Codes, and Choreographies in Art, 1965-2018* (Whitney Museum of American Art, New York, September 28, 2018-April 14, 2019). From left to right: Casey Reas, *{Software} Structure #003 A*, 2004 and 2016; Casey Reas, *{Software} Structure #003 B*, 2004 and 2016; Sol LeWitt, *4th Wall: 24 lines from the center, 12 lines from the midpoint of each of the sides, 12 lines from each corner*, 1976. Photograph by Ron Amstutz.

importance of intellectual property that needed protection in the digital domain and artists' realization that Free and Open Source Software (FOSS) was crucial in achieving sustainability. Another important area of engagement for network culture that evolved along with Web 2.0 has been the rise of 'big data' — the massive data sets that cannot be easily understood by using previous approaches to data analysis — and data mining. The use of machine learning for data processing has resulted in activist engagements in the areas of data privacy and encoded biases in data sets.

Digital Materialities and the Institution

For decades the relationship between digital art and the mainstream art world and institutions has been notoriously uneasy. When it comes to an in-depth analysis of the complexities of this relationship, a lot of groundwork remains to be done. Key factors in this endeavor are investigations of art-historical developments relating to technological and participatory art forms and their exhibition histories; as well as continuous assessment of the challenges that digital media art poses to institutions and the art market in terms of presentation, collection, and preservation.

In the 21st century, contemporary art has increasingly been shaped by concepts of participation, collaboration, social connectivity, and performativity, as seen in the works of Tino Seghal, Rirkrit Tiravanija, Carsten Höller and many others. One could argue that the participatory, "socially networked" art projects of the 21st century, which have received considerable attention by art institutions, all respond to contemporary culture, which is shaped by networked digital technologies and social media — from the WWW to locative media, Facebook and YouTube — and the changes they have brought about. However, art that uses these technologies as a medium still remains largely absent from major exhibitions in the mainstream art world. While art institutions and organizations now commonly use digital technologies in their infrastructure — connecting and distributing through their websites, facebook pages, YouTube channels, and Twitter tours — exhibitions devoted to digital art and its history have largely been exceptions. There was a watershed moment for new media art exhibitions in the US in the early 2000s, when several major museums mounted digital art shows, but is only now that these exhibitions are organized more frequently.

From an art-historical perspective, it seems difficult or dubious to not acknowledge that the participatory art of the



Figure 3. Installation view of *Programmed: Rules, Codes, and Choreographies in Art, 1965-2018* (Whitney Museum of American Art, New York, September 28, 2018-April 14, 2019). From left to right: Nam June Paik, *Fin de Siècle II*, 1989 (partially restored, 2018); Sol LeWitt, *Five Towers*, 1986; Josef Albers, *Homage to the Square V*, 1967; Josef Albers, *Homage to the Square IX*, 1967; Josef Albers, *Homage to the Square XII*, 1967; Josef Albers, *Homage to the Square X*, 1967; Josef Albers, *Variant V*, 1966; Josef Albers, *Variant VI*, 1966; Josef Albers, *Variant X*, 1966; Josef Albers, *Variant IV*, 1966; Josef Albers, *Variant II*, 1966; Josef Albers, *Variant VII*, 1966; John F. Simon Jr., *Color Panel v1.0*, 1999; Rafaël Rozendaal, *Abstract Browsing 17 03 05 (Google)*, 2017. Photograph by Ron Amstutz.

1960s and 70s and the 1990s and 2000s were responses to cultural and technological developments — computer technologies, cybernetics, systems theory and the original Internet/Arpanet from the mid-40s onwards; and the WWW, ubiquitous computing, databasing/datamining, and social media from the 1990s onwards. While different in their scope and strategies, the new media arts of the 1960s and 70s and today faced similar resistances and challenges that led to their separation from the mainstream art world, respectively.

Apart from historical baggage, the reasons for the continuing disconnect between digital art and the mainstream art world lie in the challenges that the medium poses when it comes to the understanding of its aesthetics; its presentation and reception by audiences; as well as its preservation. The process-oriented nature of the digital medium often is at the core of these challenges. The standards for presenting, collecting and preserving art have been tailored to objects for the longest time and few of them are applicable to new media works, which constitute a shift from object to process and substantially differ from previous process-oriented or dematerialized art forms. Digital art in its multiple manifestations has become an important part of contemporary artistic practice that the art world cannot afford to ignore, but accommodating

this art form within the institution and raises numerous conceptual, philosophical, as well as practical issues. New media art seems to call for a distributed, information space that is open to artistic interference — a space for exchange, collaborative creation, and presentation that is transparent and flexible. The latter certainly does not describe the framework of the average museum today, and in order to make a commitment to digital art, institutions have started to develop alternative approaches to presentation, collection, documentation and preservation.

The challenges posed by digital art are often discussed in the context of the art form's 'immateriality' — its basis in software, systems, and networks. However, many of the issues surrounding the presentation and particularly preservation of new media art are related to its materiality. For example, museums and galleries commonly have to build structures or walls to hide computers and need to assign staff to the ongoing maintenance of hardware. Bits and bytes are ultimately more stable than paint or video, and preservation challenges all too often arise from the fact that ever-faster computers and displays with higher resolution are released on the market at short intervals, profoundly changing the experience of artworks that were created for slower computers and lower screen resolutions.

Immateriality is an important element of digital art that has profound effects on artistic practice, cultural production, and reception, as well as the curatorial process. At the same time, this immateriality cannot be separated from the material components of the digital medium. A more productive approach to understanding this tension may be Tiziana Terranova's definition of immateriality as "links between materialities."⁷

Probably more than any other medium for art, the digital is embedded in various layers of commercial systems and technological industry that continuously define standards for the materialities of any kind of hardware components. At the same time, the immaterial systems supported by the digital medium and its network capabilities have opened up new spaces for cultural production and DIY culture. From the macrocosm of cultural practice to the microcosm of an individual artwork, the (immaterial) links between materialities are at the core of digital

media. The presentation and preservation of new media art therefore needs to consider tensions and connections between the material and immaterial.

New technologies of representation always introduce new complexities and render image flow and materiality problematic in different ways. Digital technologies have introduced new ways of seeing the world and of rendering objects. Digital materiality in the age of the Internet of Things — as the network of physical objects or 'things' embedded with electronics, software, sensors and connectivity — and the quantified self — as data acquisition on aspects of a person's daily life through wearable sensors and computing— means that objects are constructed by and understood through the language of the digital. The new digital materiality is characterized by processes of seeing like and being seen through digital devices and has profoundly changed our relationship with objecthood and our representation as subjects.

NOTES

¹ Steyerl, Hito. 2009. In Defense of Image. E-flux Journal. No. 10 (November 10), <https://www.e-flux.com/journal/10/61362/in-defense-of-the-poor-image/> (accessed January 5, 2015).

² See Lippard, Lucy R., and Chandler, John. 1968. "The Dematerialization of Art." *Art International* (February 1968), p. 31–36.; Lippard, Lucy. *Six Years: The Dematerialization of the Art Object from 1966 to 1972*. New York: Praeger 1973, p. 5-9.

³ See Stiegler, Bernard. *Economie de l'Hypermatériel et Psychopouvoir* (Economy of hypermaterial and psychopower). Paris: Mille et une Nuits 2009, p. 110-112.

⁴ See Burnham, Jack. 1969. "Real Time Systems." *Artforum* 8,

No. 1 (September 1969), p. 49-55.; Burnham, Jack. *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of Our Time*. New York: George Braziller 1968.

⁵ Burnham, Jack. "Systems Esthetics", *Artforum* 7, No. 1 (September 1968), p. 31.

⁶ See Youngblood, Gene. *Expanded Cinema*. Toronto and Vancouver: Clarke, Irwin & Company Limited 1970, p. 208-210.

⁷ Terranova, Tiziana. "Immateriality and Cultural Productions", presentation at the symposium "Curating, Immateriality, Systems: On Curating Digital Media", Tate Modern, London, June 4, 2005. Quoted in Paul, Christiane. "The Myth of Immateriality – Presenting and Preserving New Media", in *MediaArtHistories*, ed. Oliver Grau. Cambridge, MA: MIT Press 2007, p. 252.

BIBLIOGRAPHY

Burnham, Jack. *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of Our Time*. New York: George Braziller 1968.

Burnham, Jack. "Systems Esthetics", *Artforum* 7, No. 1 [September 1968], p. 31-35.

Burnham, Jack. 1969. "Real Time Systems." *Artforum* 8, No. 1 [September 1969], p. 49-55.

Lippard, Lucy and Chandler, John. 1968. "The Dematerialization of Art," *Art International* (February 1968), 31–36.

Lippard, Lucy. *Six Years: The Dematerialization of the Art Object from 1966 to 1972*. New York: Praeger 1973.

Paul, Christiane. "The Myth of Immateriality – Presenting and Preserving New Media". *MediaArtHistories*, ed. Oliver Grau. Cambridge, MA: MIT Press, 2007, p. 251- 274.

Steyerl, Hito. 2009. In Defense of Image. *E-flux Journal*. No. 10 [November 10], <https://www.e-flux.com/journal/10/61362/in-defense-of-the-poor-image/> [accessed January 5, 2015].

Stiegler, Bernard. *Economie de l'Hypermatériel et Psychopouvoir* [Economy of hypermaterial and psychopower]. Paris: Mille et une Nuits 2009.

Youngblood, Gene. 1970. *Expanded Cinema*. Toronto and Vancouver: Clarke, Irwin & Company Limited 1970.

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