New Media from Borges to HTML

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year: 2001

New Media Field: a Short Institutional History

The appearance of *New Media Reader* is a milestone in the history a new field that, just a few years ago, was somewhat of a cultural underground. Before taking up the theoretical challenge of defining what new media actually is, as well as discussing the particular contributions this reader makes to answering this question, I would like very briefly to sketch the history of the field for the benefit of those who are newcomers to it.

If we are to look at any modern cultural field sociologically, measuring its standing by the number and the importance of cultural institutions devoted to it such as museum exhibitions, festivals, publications, conferences, and so on, we can say that in the case of new media (understood as computer-based artistic activities) it took about ten years for it to move from cultural periphery to the mainstream. Although SIGGRAPH in the U.S. and Ars Electronica in Austria have already acted as annual gathering places of artists working with computers since the late 1970s, the new media field begin to take real shape only in the end of the 1980s. At the end of the 1990s new institutions devoted to the production and support for new media art are founded in Europe: ZKM in Karlsruhe (1989), New Media Institute in Frankfurt (1990) and ISEA (Inter-Society for the Electronic Arts) in the Netherlands (1990). (Jeffrey Shaw was appointed to be director of the part of ZKM focused on visual media while Frankfurt Institute was headed by Peter Weibel). In 1990 as well, Intercommunication Center in Tokyo begins its activities in new media art (it moves into its own building in 1997.) Throughout the 1990s, Europe and Japan remained to be the best places to see new media work and to participate in high-level discussions of the new field. Festivals such as ISEA, Ars Electronica, DEAF have been required places of pilgrimage for interactive installation artists, computer musicians, choreographers working with computers, media curators, critics, and, since the mid-1990s, net artists.

As it was often the case throughout the twentieth century, countries other than the States would be first to critically engage with new technologies developed and deployed in the U.S. There are a few ways to explain this phenomenon. Firstly, the speed with which new technologies are assimilated in the U.S. makes them "invisible" almost overnight: they become an assumed part of the everyday existence, something which does not seem to require much reflection about. The slower speed of assimilation and the higher cost gives other countries more time to reflect upon new technologies, as it was the case with new media and the Internet in the 1990s. In the case of Internet, by the end of the 1990s it became as commonplace in the U.S. as the telephone, while in Europe Internet still remained a phenomenon to reflect upon, both for economic reasons (in the U.S. subscribers would play very low monthly flat fee; in Europe they had to pay by the minute) and for cultural reasons (more skeptical attitude towards new technologies in many European countries which slows down their assimilation). (So, when in the early 1990s Soros Foundation has set up contemporary art centers throughout the Eastern Europe, it wisely gave them a mandate to focus their activities on new media art, both in order to support younger artists who had difficulty getting around the more established "art mafia" in these countries; and also in order to introduce general public to the Internet.)

Secondly, we can explain the slowness of the U.S. engagement with new media art during the 1990s by the very minimal level of the public support for the arts there. In Europe, Japan, and Australia, festivals for media and new media art such as the ones I mentioned above, the commissions for artists to create such work, exhibition catalogs and other related cultural activities were funded by the governments. In the U.S. the lack of government funding for the arts left only two equally commercial art and culture (i.e., the art market). For different reasons, neither of these players would support new media art nor would they foster intellectual discourse about it. Out of the two, commercial culture (in other words, culture designed for mass audiences) has played a more progressive role in adopting and experimenting with new media, even though for obvious reasons the content of commercial new media products had severe limits. Yet without commercial culture we would not have computer games using Artificial Intelligence programming, network-based multimedia, including various Web plug-ins which enable distribution of music, moving images and 3-D environment over the Web, sophisticated 3-D modeling, animation and

rendering tools, database-driven Web sites, CD-ROMs, DVD, and other storage formats, and most other advanced new media technologies and forms.

The 1990s U.S. art world proved to be the most conservative cultural force in contemporary society, lagging behind the rest of cultural and social institutions in dealing with new media technologies. (In the 1990s a standard joke at new media festivals was that a new media piece requires two interfaces: one for art curators, and one for everybody else.) This resistance is understandable given that the logic of the art world and the logic of new media are exact opposites. The first is based the romantic idea of authorship which assumes a single author; the notion of a unique, one-of-a-kind art object; and the control over the distribution of such objects which takes place through a set of exclusive places: galleries, museums, actions. The second privileges the existence of potentially numerous copies, infinitely large number of different states of the same work, author-user symbiosis (the user can change the work through interactivity), the collective, collaborative authorship, and network distribution (which bypasses the art system distribution channels). Moreover, exhibition of new media requires a level of technical sophistication and computer equipment which neither U.S. museums nor galleries were able to provide in the 1990s. In contrast, in Europe generous federal and regional funding allowed not only for mountings of sophisticated exhibitions but also for the development of a whole new form of art: interactive computer installation. It is true that after many years of its existence, the U.S. art world learned how to deal with and in fact fully embraced video installation, but video installations require standardized equipment and they don't demand constant monitoring, as it is the case with interactive installations and even with Web pieces. While in Europe equipment-intensive form of interactive installation has flourished throughout the 1990s, U.S. art world has taken an easy way by focusing on "net art" i.e., Web-based pieces whose exhibition do not require much resources beyond an off-the-shelf computer and a Net connection.

All this started to change with the increasing speed by the end of the 1990s. Various cultural institutions in the U.S. finally begun to pay attention to new media. The first were education institutions. Around 1995 Universities and the art schools, particularly on the West Coast, begin to initiate program in new media art and design as well as open faculty

positions in these areas; by the beginning of the new decade, practically every University and art school on the West Coast had both undergraduate and graduate programs in new media. A couple of years later museums such as Walker Art Center begun to mount a number of impressive online exhibitions and started to commission online projects. 2000 Whitney Biannual included a room dedicated to net art (even though its presentation conceptually was ages behind the presentation of new media in such places as Ars Electronica Center in Linz, Intercommunication Center in Tokyo, or ZKM in Germany). Finally in 2001, both Whitney Museum in New York and San Francisco Museum of Modern art (SFMOMA) have mounted large survey exhibitions of new media art ("Bitstreams" at the Whitney, "010101: Art in Technological Times" at SFMOMA). Add to this the constant flow of conferences and workshops mounted in such bastions of American Academia as the Institute for Advanced Studies in Princeton; fellowships in new media initiated by such prestigious funding bodies as Rockefeller Foundation and Social Science Research Council (both were started in 2001); book series on new media published by such well-respected presses as the MIT Press (this book is a part of such a series). What ten years ago was a cultural underground, became an established academic and artistic field; what has emerged from on the ground interactions of individual players has solidified, matured, and acquired institutional forms.

Paradoxically, at the same time as new media field has started to mature (the end of the 1990s), its very reason for existence came to be threatened. If all artists now, regardless of their preferred media, also routinely use digital computers to create, modify and produce works, do we need to have a special field of new media art? As digital and network media are rapidly becoming an omni-presence in our society, and as most artists came to routinely use them, new media field is facing a danger of becoming a ghetto whose participants would be united by their fetishism of latest computer technology, rather than by any deeper conceptual, ideological, or aesthetic issues – a kind of local club for photo enthusiasts. I personally do think that the existence of a separate new media field now and in the future makes very good sense, but it does require a justification – something that I hope the rest of this text that will take up more theoretical questions will help to provide.

Software Design and Modern Art: Parallel Projects

Ten years after the appearance of first cultural institutions solely focused on new media, the field has matured and solidified. But what exactly is new media? And what is new media art? Surprisingly, these questions remain to be not so easy to answer. The book you are now holding in your hands does provide very interesting answers to these questions; it also provides the most comprehensive foundation for new media field, in the process redefining it a very productive way. In short, this book is not just a map of the field as it already exists but a creative intervention into it.

Through the particular selections and their juxtaposition this book re-defines new media as parallel tendencies in modern art and computing technology after the World War II. Although the editors of the anthology may not agree with this move, I would like to argue that eventually this parallelism changes the relationship between art and technology. In the last few decades of the twentieth century, modern computing and network technology materialized certain key projects of modern art developed approximately at the same time. In the process of this materialization, the technologies overtake art. That is, not only new media technologies – computer programming, graphical human-computer interface, hypertext, computer multimedia, networking (both wired-based and wireless) – have actualized the ideas behind the projects by artists, but they extended them much further than the artists originally imagined. As a result, these technologies themselves have become the greatest art works of today. The greatest hypertext text is the Web itself, because it is more complex, unpredictable, and dynamic than any novel that could have been written by a single human writer, even James Joyce. The greatest interactive work is the interactive human-computer interface itself: the fact that the user can easily change everything which appears on her screen, in the process changing the internal state of a computer, or even commanding reality outside of it. The greatest avant-garde film is software such as Final Cut Pro or After Effects which contains the possibilities to combining together thousands of separate tracks into a single movie, as well as setting various relationships between all these different tracks – and it thus it develops the avant-garde idea a film as an abstract visual score to its logical end – and beyond. Which means that computer scientists who invented these technologies – J.C. Licklider, Douglas Engelbart,

Ivan Sutherland, Ted Nelson, Seymour Papert, Tim Berners-Lee, and others – are the important artists of our time – maybe the only artists who are truly important and who will be remembered from this historical period.

To prove the existence of historical parallelism, *New Media Reader* systematically positions next to each other the key texts by modern art that articulate certain ideas and the key texts by modern computer scientists which articulate similar ideas in relation to software and hardware design. Thus, we find next to each other the story by Jorge Borges (1941) and the article by Vannevar Bush (1945) which both contain the idea of a massive branching structure as a better way to organize data and to represent human experience. [1]

The parallelism between texts by artists and by computer scientists involves not only the ideas in the texts but also the form of the texts. In the twentieth century artists typically presented their ideas either by writing manifestos or by creating actual art works. In the case of computer scientists, we either have theoretical articles that develop plans for particular software and/or hardware design or more descriptive articles about already created prototypes or the actual working systems. Structurally manifestos correspond to the theoretical programs of computer scientists, while completed artworks correspond to working prototypes or systems designed by scientists to see if their ideas do work, to demonstrate these ideas to colleagues, sponsors and clients. Therefore *New Media Reader* to a large extent consists of these two types of texts: either theoretical presentations of new ideas and speculations about projects or types of projects that would follow from them; or the descriptions of the projects actually realized.

Institutions of modern culture that are responsible for selecting what makes it into the canon of our cultural memory and what is left behind are always behind the times. It may take a few decades or even longer for a new field which is making an important contribution to modern culture to "make it" into museums, books, and other official registers of cultural memory. In general, our official cultural histories tend to privilege art (understood in a romantic sense as individual products of individual artists) over mass industrial culture. For instance, while modern graphic and industrial designers do have some level of cultural visibility, their names, with the exception of a few contemporary celebrity designers such as

Bruce Mau and Philippe Starck are generally not as well-known as the names of fine artists or fiction writers. Some examples of key contemporary fields that so far have not been given their due are music videos, cinematography, set design, and industrial design. But no cultural field so far remained more unrecognized than computer science and, in particular, its specific branch of human-computer interaction, or HCI (also called human-computer interface design, or HCI).

It is time that we treat the people who have articulated fundamental ideas of human-computer interaction as the major modern artists. Not only they invented new ways to represent any data (and thus, by default, all data which has to do with "culture," i.e., the human experience in the world and the symbolic representations of this experience) but they have also radically redefined our interactions with all of the old culture. As a window of a Web browser comes to supplement cinema screen, a museum space, a CD player, a book, and a library, the new situation manifest itself: all culture, past and present, is being filtered through a computer, with its particular human-computer interface. Human-computer interface comes to act as a new form through which all older forms of cultural production are being mediated.

New Media Reader contains essential articles by some of the key interface and software designers in the history of computing so far, from Engelbart to Berners-Lee. Thus in my view this book is not just an anthology of new media but also the first example of a radically new history of modern culture – a view from the future when more people will recognize that the true cultural innovators of the last decades of the twentieth century were interface designers, computer game designers, music video directors and DJs - rather than painters, filmmakers or fiction writers whose fields remained relatively stable during this historical period.

What is New Media: Eight Propositions

Having discussed the particular perspective adopted by *New Media Reader* in relation to the broader cultural context we may want to place new media in – the notion of parallel developments in modern art and in computing - I now want to go through other possible

concepts of new media and its histories (including a few proposed by the present author elsewhere). Here are eight answers; without a doubt, more can be invented if desired.

1. New Media Versus Cyberculture

To begin with, we may distinguish between new media and cyberculture. In my view they represent two distinct fields of research. I would define cyberculture as the study of various social phenomena associated with Internet and other new forms of network communication. Examples of what falls under cyberculture studies are online communities, online multi-player gaming, the issue of online identity, the sociology and the ethnography of email usage, cell phone usage in various communities; the issues of gender and ethnicity in Internet usage; and so on. [2] Notice that the emphasis is on the *social* phenomena; cyberculture does not directly deals with new cultural objects enabled by network communication technologies. The study of these objects is the domain of new media. In addition, new media is concerned with cultural objects and paradigms enabled by all forms of computing and not just by networking. To summarize: cyberculture is focused on the social and on networking; new media is focused on the cultural and computing.

2. New Media as Computer Technology used as a Distribution Platform

What are these new cultural objects? Given that digital computing is now used in most areas of cultural production, from publishing and advertising to filmmaking and architecture, how can we single out the area of culture that specifically owes its existence to computing? In my *The Language of New Media* I begin the discussion of new media by invoking its definition which can be deduced from how the term is used in popular press: new media are the cultural objects which use digital computer technology for distribution and exhibition. [3] Thus, Internet, Web sites, computer multimedia, computer games, CD-ROMs and DVD, Virtual Reality, and computer-generated special effects all fall under new media. Other cultural objects which use computing for production and storage but not for final distribution - television programs, feature films, magazines, books, and other paper-based publications, etc. – are not new media.

The problems with this definition are three-fold. Firstly, it has to be revised every few years, as yet another part of culture comes to rely on computing technology for distribution (for instance, the shift from analog to digital television; the shift from film-based to digital projection of feature films in movie theatres; e-books, and so on). Secondly, we may suspect that eventually most forms of culture will use computer distribution, and therefore the term "new media" defined in this way will lose any specificity. Thirdly, this definition does not tell us anything about the possible effects of computer-based distribution on the aesthetics of what is being distributed. In other words, do Web sites, computer multimedia, computer games, CD-ROMs and Virtual Reality all have something in common because they are delivered to the user via a computer? Only if the answer is at least partial yes, it makes sense to think about new media as a useful theoretical category.

3. New Media as Digital Data Controlled by Software

The Language of New Media is based on the assumption that, in fact, all cultural objects that rely on digital representation and computer-based delivery do share a number of common qualities. In the book I articulate a number of principles of new media: numerical representation, modularity, automation, variability and transcoding. I do not assume that any computer-based cultural object will necessary be structured according to these principles today. Rather, these are tendencies of a culture undergoing computerization that gradually will manifest themselves more and more. For instance, the principle of variability states that a new media cultural object may exist in potentially infinite different states. Today the examples of variability are commercial Web sites programmed to customize Web pages for every user as she is accessing the site particular user, or DJs remixes of already existing recordings; tomorrow the principle of variability may also structure a digital film which will similarly exist in multiple versions.

I deduce these principles, or tendencies, from the basic fact of digital representation of media. New media is reduced to digital data that can be manipulated by software as any other data. This allows automating many media operations, to generate multiple versions of the same object, etc. For instance, once an image is represented as a matrix of numbers,

it can be manipulated or even generated automatically by running various algorithms, such as sharpen, blur, colorize, change contrast, etc.

More generally, extending what I proposed in my book, I could say that two basic ways in which computers models reality – through data structures and algorithms – can also be applied to media once it is represented digitally. In other words, given that new media is digital data controlled by particular "cultural" software, it makes sense to think of any new media object in terms of particular data structures and/or particular algorithms it embodies. [4] Here are the examples of data structures: an image can be thought of as a two-dimensional array (x. y), while a movie can be thought of as a three-dimensional array (x, y, t). Thinking about digital media in terms of algorithms, we discover that many of these algorithms can be applied to any media (such as copy, cut, paste, compress, find, match) while some still retain media specificity. For instance, one can easily search for a particular text string in a text but not for a particular object in an image. Conversely, one can composite a number of still or moving images together but not different texts. These differences have to do with different semiotic logics of different media in our culture: for example, we are ready to read practically any image or a composite of images as being meaningful, while for a text string to be meaningful we require that it obeys the laws of grammar. On the other hand, language has a priori discrete structure (a sentence consists of words which consist of morphemes, and so on) that makes it very easily to automate various operations on it (such as search, match, replace, index), while digital representation of images does not by itself allow for automation of semantic operations.

4. New Media as the Mix Between Existing Cultural Conventions and the Conventions of Software

As particular type of media is turned into digital data controlled by software, we may expect that eventually it will fully obey the principles of modularity, variability, and automation. However, in practice these processes may take a long time and they do not proceed in a linear fashion – rather, we witness "uneven development." For instance, today some media are already totally automated while in other cases this automation hardly exists – even though technologically it can be easily implemented.

Let us take as the example contemporary Hollywood film production. Logically we could have expected something like the following scenario. An individual viewer receives a customized version of the film that takes into account her/his previous viewing preferences, current preferences, and marketing profile. The film is completely assembled on the fly by AI software using pre-defined script schemas. The software also generates, again on the fly characters, dialog, and sets (this makes product placement particularly easy) that are taken from a massive "assets" database.

The reality today is quite different. Software is used in some areas of film production but not in others. While some visuals may be created using computer animation, cinema sill centers around the system of human stars whose salaries amount for a large percent of a film budget. Similarly, script writing (and countless re-writing) is also trusted to humans. In short, the computer is kept out of the key "creative" decisions and is delegated to the position of a technician.

If we look at another type of contemporary media - computer games – we will discover that they follow the principle of automation much more thoroughly. Game characters are modeled in 3D; they move and speak under software control. Software also decides what happens next in the game, generating new characters, spaces, and scenarios in response to user's behavior. It is not hard to understand why automation in computer games is much more advanced than in cinema. Computer games is one of the few cultural forms "native" to computers; they begun as singular computer programs (before turning into a complex multimedia productions which they are today) - rather than being an already established medium (such as cinema) which is now slowly undergoing computerization.

Given that the principles of modularity, automation, variability, and transcoding are tendencies that slow and unevenly manifest themselves, is there a more precise way to describe new media, as it exists today? *The Language of New Media* analyzes the language of contemporary new media (or, to put this differently, "early new media") as the mix (we can also use software metaphors of "morph" or "composite") between two different sets of cultural forces, or cultural conventions: on the one hand, the conventions of already mature cultural forms (such as a page, a rectangular frame, a mobile point of view) and, on the

other hand, the conventions of computer software and, in particular, of HCI, as they developed until now.

Let me illustrate this idea with two examples. In modern visual culture a representational image was something one gazed at, rather than interacted with. An image was also one continuous representational field, i.e., a single scene. In the 1980s GUI redefined an image as a figure-ground opposition between a non-interactive, passive ground (typically a desktop pattern) and active icons and hyperlinks (such as the icons of documents and applications appearing on the desktop). The treatment of representational images in new media represents a mix between these two very different conventions. An image retains its representational function while at the same time is treated as a set of hot spots ("image-map"). This is the standard convention in interactive multimedia, computer games and Web pages. So, while visually an image still appears as a single continuous field, in fact it is broken into a number of regions with hyperlinks connected to these regions, so clicking on a region opens a new page, or re-starts game narrative, etc.

This example illustrates how a HCI convention is "superimposed" (in this case, both metaphorically and literally, as a designer places hot spots over an existing image) over an older representational convention. Another way to think about this is to say that a technique normally used for control and data management is mixed with a technique of fictional representation and fictional narration. I will use another example to illustrate the opposite process: how a cultural convention normally used for fictional representation and narration is "superimposed" over software techniques of data management and presentation. The cultural convention in this example is the mobile camera model borrowed from cinema. In *The Language of New Media* I analyze how it became a generic interface used to access any type of data:

Originally developed as part of 3D computer graphics technology for such applications as computer-aided design, flight simulators and computer movie making, during the 1980's and 1990's the camera model became as much of an interface convention as scrollable windows or cut and paste operations. It became an accepted way for interacting with any data which is represented in three dimensions — which, in a computer culture, means literally anything and

everything: the results of a physical simulation, an architectural site, design of a new molecule, statistical data, the structure of a computer network and so on. As computer culture is gradually spatializing all representations and experiences, they become subjected to the camera's particular grammar of data access. Zoom, tilt, pan, and track: we now use these operations to interact with data spaces, models, objects and bodies. [5]

To sum up: new media today can be understood as the mix between older cultural conventions for data representation, access and manipulation and newer conventions of data representation, access, and manipulation. The "old" data are representations of visual reality and human experience, i.e., images, text-based and audio-visual narratives – what we normally understand by "culture." The "new" data is numerical data.

As a result of this mix, we get such strange hybrids as clickable "image- maps," navigable landscapes of financial data, QuickTime (which was defined as the format to represent any time-based data but which in practice is used exclusively for digital video), animated icons – a kind of micro-movies of computer culture – and so on.

As can be seen, this particular approach to new media assumes the existence of historically particular aesthetics that characterizes new media, or "early new media," today. (We may also call it the "aesthetics of early information culture.") This aesthetics results from the convergence of historically particular cultural forces: already existing cultural conventions and the conventions of HCI. Therefore, it could not have existed in the past and it unlikely to stay without changes for a long time. But we can also define new media in the opposite way: as specific aesthetic features which keep re-appearing at an early stage of deployment of every new modern media and telecommunication technologies.

5. New Media as the Aesthetics that Accompanies the Early Stage of Every New Modern Media and Communication Technology

Rather than reserving the term new media to refer to the cultural uses of current computer and computer-based network technologies, some authors have suggested that every modern media and telecommunication technology passes through its "new media stage." In other words, at some point photography, telephone, cinema, television each were "new

media." This perspective redirects our research efforts: rather than trying to identify what is unique about digital computers functioning as media creation, media distribution, and telecommunication devices, we may instead look for certain aesthetic techniques and ideological tropes which accompany every new modern media and telecommunication technology at the initial stage of its introduction and dissemination. Here are a few examples of such ideological tropes: new technology will allow for "better democracy; it will give us a better access to the "real" (by offering "more immediacy" and/or the possibility "to represent what before could not be represented"); it will contribute to "the erosion of moral values"; it will destroy the "natural relationship between humans and the world" by "eliminating the distance" between the observer and the observed.

And here are two examples of aesthetic strategies that seem to often accompany the appearance of new media and telecommunication technology (not surprisingly, these aesthetic strategies are directly related to ideological tropes I just mentioned). In the mid-1990s a number of filmmakers started to use inexpensive digital cameras (DV) to create films characterized by a documentary style (for instance, *Timecode*, *Celebration*, *Mifune*). Rather than treating live action as a raw material to be later re-arranged in post-production, these filmmakers place premier importance on the authenticity of the actors' performances. The smallness of DV equipment allows a filmmaker to literally be inside the action as it unfolds. In addition to adopting a more intimate filmic approach, a filmmaker can keep shooting for a whole duration of a 60 or 120 minute DV tape as opposed to the standard ten-minute film roll. This gives the filmmaker and the actors more freedom to improvise around a theme, rather than being shackled to the tightly scripted short shots of traditional filmmaking. (In fact, the length of *Time Code* exactly corresponds to the length of a standard DV tape.)

These aesthetic strategies for representing real which at first may appear to be unique to digital revolution in cinema and in fact not unique. DV-style filmmaking has a predecessor in an international filmmaking movement that begun in the late 1950s and unfolded throughout the 1960s. Called "direct cinema," "candid" cinema, "uncontrolled" cinema, "observational" cinema, or cinéma vérité ("cinema truth"), it also involved filmmakers using lighter and more mobile (in comparison to what was available before) equipment.

Like today's DV realists," the 1960s "direct cinema" proponents avoided tight staging and scripting, preferring to let events unfold naturally. Both then and now, the filmmakers used new filmmaking technology to revolt against the existing cinema conventions that were perceived as being too artificial. Both then and now, the key word of this revolt was the same: "immediacy."

My second example of similar aesthetic strategies re-appearing more than deals with the development of moving image technology throughout the nineteenth century, and the development of digital technologies to display moving images on a computer desktop during the 1990s. In the first part of the 1990s, as computers' speed kept gradually increasing, the CD-ROM designers have been able to go from a slide show format to the superimposition of small moving elements over static backgrounds and finally to full-frame moving images. This evolution repeats the nineteenth century progression: from sequences of still images (magic lantern slides presentations) to moving characters over static backgrounds (for instance, in Reynaud's Praxinoscope Theater) to full motion (the Lumières's cinematograph). Moreover, the introduction of QuickTime by Apple in 1991 can be compared to the introduction of the Kinetoscope in 1892: both were used to present short loops, both featured the images approximately two by three inches in size, both called for private viewing rather than collective exhibition. Culturally, the two technologies also functioned similarly: as the latest technological "marvel." If in the early 1890s the public patronized Kinetoscope parlors where peep-hole machines presented them with the latest invention — tiny moving photographs arranged in short loops; exactly a hundred years later, computer users were equally fascinated with tiny QuickTime Movies that turned a computer in a film projector, however imperfect. Finally, the Lumières's first film screenings of 1895 which shocked their audiences with huge moving images found their parallel in 1995 CD-ROM titles where the moving image finally fills the entire computer screen (for instance, in *Jonny Mnemonic* computer game, based on the film by the same title). Thus, exactly a hundred years after cinema was officially "born," it was reinvented on a computer screen.

Interesting as they are, these two examples also illustrate the limitations of thinking about new media in terms of historically recurrent aesthetic strategies and ideological tropes.

While ideological tropes indeed seem re-appearing rather regularly, many aesthetic strategies may only reappear two or three times. Moreover, some strategies and/or tropes can be already found in the first part of the nineteenth century while others only make their first appearance much more recently. [6] In order for this approach to be truly useful it would be insufficient to simply name the strategies and tropes and to record the moments of their appearance; instead, we would have to develop a much more comprehensive analysis which would correlate the history of technology with social, political and economic histories of the modern period.

So far, my definitions of new media focused on technology; the next three definitions will consider new media as material re-articulation, or encoding, of purely cultural tendencies – in short, as ideas rather than technologies.

6. New Media as Faster Execution of Algorithms Previously Executed Manually or Through Other Technologies

A modern digital computer is a programmable machine. This simply means that the same computer can execute different algorithms. An algorithm is a sequence of steps that need to be followed to accomplish a task. Digital computers allow to execute most algorithms very quickly, however in principle an algorithm, since it is just a sequence of simple steps, can be also executed by a human, although much more slowly. For instance, a human can sort files in a particular order, or count the number of words in a text, or cut a part of an image and paste it in a different place.

This realization gives us a new way to think about both digital computing, in general, and new media, in particular, as a massive speed-up of various manual techniques that all have already existed. Consider, for instance, computer's ability to represent objects in linear perspective and to animate such representations. When you move your character through the world in a first-person shooter computer game (such as *Quake*), or when you move your viewpoint around a 3D architectural model, a computer re-calculates perspectival views for all the objects in the frame many times every second (in the case of current desktop hardware, frame rates of 80 frames of second are not uncommon). But we should remember

that the algorithm itself was codified during the Renaissance in Italy, and that, before digital computers came along (that is, for about five hundred years) it was executed by human draftsmen. Similarly, behind many other new media techniques there is an algorithm that, before computing, was executed manually. (Of course, since art has always involved some technology – even as simple as a stylus for making marks on stone – what I mean by "manually" is that a human had to systematically go through every step of an algorithm himself, even if he was assisted by some image making tools.) Consider, for instance, another very popular new media technique: making a composite from different photographs. Soon after photography was invented, such nineteenth century photographers as Henry Peach Robinson and Oscar G. Rejlander were already creating smooth "combination prints" by putting together multiple photographs.

While this approach to thinking about new media takes us away from thinking about it purely in technological terms, it has a number of problems of its own. Substantially speeding up the execution of an algorithm by implementing this algorithm in software does not just leave things as they are. The basic point of dialectics is that a substantial change in quantity (i.e., in speed of execution in this case) leads to the emergence of qualitatively new phenomena. The example of automation of linear perspective is a case in point. Dramatically speeding up the execution of a perspectival algorithm makes possible previously non-existent representational technique: smooth movement through a perspectival space. In other words, we get not only quickly produced perspectival drawings but also computer-generated movies and interactive computer graphics.

The technological shifts in the history of "combination prints" also illustrate the cultural dialectics of transformation of quantity into quality. In the nineteenth century, painstakingly crafted "combination prints" represented an exception rather than the norm. In the twentieth century, new photographic technologies made possible photomontage that quickly became one of the basic representational techniques of modern visual culture. And finally, the arrival of digital photography via software like Photoshop, scanners, and digital cameras in the late 1980s and 1990s not only made photomontage much more omnipresent than before but it also fundamentally altered its visual characteristics. In place of graphic and hard-edge compositions pioneered by Moholy-Nagy and Rodchenko we now have

smooth multi-image composites which use transparency, blur, colorization and other easily available digital manipulations and which often incorporate typography that is subjected to exactly the same manipulations (thus in Post-Photoshop visual culture the type becomes a subset of a photo-based image). To see this dramatic change, it is enough to compare a typical music video from 1985 and a typical music video from 1995: within ten years, visual aesthetics of photomontage have undergone a fundamental change.

Finally, thinking about new media as speeding up of algorithms which previously were executed by hand foregrounds the use of computers for fast algorithm execution, but ignores its two other essential uses: real-time network communication and real-time control. The abilities to interact with or control remotely located data in real-time, to communicate with other human beings in real-time, and control various technologies (sensors, motors, other computers) in real time constitute the very foundation of our information society – phone communications, Internet, financial networking, industrial control, the use of micro-controllers in numerous modern machines and devices, and so on. They also make possible many forms of new media art and culture: interactive net art, interactive computer installations, interactive multimedia, computer games, real-time music synthesis.

While non-real time media generation and manipulation via digital computers can be thought of as speeding up of previously existing artistic techniques, *real-time* networking and control seem to constitute qualitatively new phenomena. When we use Photoshop to quickly combine photographs together, or when we compose a text using a Microsoft Word, we simply do much faster what before we were doing either completely manually or assisted by some technologies (such as a typewriter). However, in the cases when a computer interprets or synthesizes human speech in real time, monitors sensors and modifies programs based on their input in real-time, or controls other devices, again in real-time, this is something which simply could not be done before. So, while it is important to remember that, on one level, a modern digital computer is just a faster calculator, we should not ignore its other identity: that of a cybernetic control device. To put this in different way, while new media theory should pay tributes to Alan Turing, it should not forget about its other conceptual father – Norbert Weiner.

7. New Media as the Encoding of Modernist Avant-Garde; New Media as Meta-media

The approach to new media just discussed does not foreground any particular cultural period as the source of algorithms that are eventually encoded in computer software. In my article "Avant-garde as Software" I have proposed that, in fact, a particular historical period is more relevant to new media than any other– that of the 1920s (more precisely, the years between 1915 and 1928). [7] During this period the avant-garde artists and designers have invented a whole new set of visual and spatial languages and communication techniques that we still use today.

According to my hypothesis, with new media, 1920s communication techniques acquire a new status. Thus, new media does represent a new stage of the avant-garde. The techniques invented by the 1920s Left artists became embedded in the commands and interface metaphors of computer software. In short, the avant-garde vision became materialized in a computer. All the strategies developed to awaken audiences from a dream-existence of bourgeois society (constructivist design, New Typography, avant-garde cinematography and film editing, photomontage, etc.) now define the basic routine of a post-industrial society: the interaction with a computer. For example, the avant-garde strategy of collage reemerged as a "cut and paste" command, the most basic operation one can perform on any computer data. In another example, the dynamic windows, pull-down menus, and HTML tables all allow a computer user to simultaneously work with practically unrestricted amount of information despite the limited surface of the computer screen. This strategy can be traced to Lissitzky's use of movable frames in his 1926 exhibition design for the International Art Exhibition in Dresden.

The encoding of the 1920s avant-garde techniques in software does not mean that new media simply qualitatively extends the techniques which already existed. Just as it is the case with the phenomenon of real-time computation that I discussed above, tracing new media heritage in the 1920s avant-garde reveals a qualitative change as well. The modernist avant-garde was concerned with "filtering" visible reality in new ways. The artists are concerned with representing the outside world, with "seeing" it in as many different ways as possible. Of course, some artists already begin to react to the emerging media

environment by making collages and photomontages consisting of newspaper clippings, existing photographs, pieces of posters, and so on; yet these practices of manipulating existing media were not yet central. But a number of decades later they have come to the foreground of cultural production. To put this differently, after a century and a half of media culture, already existing media records (or "media assets," to use the Hollywood term) become the new raw material for software-based cultural production and artistic practice. Many decades of analog media production resulted in a huge media archive, and it is the contents of this archive – television programs, films, audio recordings, etc. – which became the raw data to be processed, re-articulated, mined, and re-packaged through digital software – rather than raw reality. In my article I formulate this as follows:

New Media indeed represents the new avant-garde, and its innovations are at least as radical as the formal innovations of the 1920s. But if we are to look for these innovations in the realm of forms, this traditional area of cultural evolution, we will not find them there. For the new avant-garde is radically different from the old:

The *"old media avant-garde"* of the 1920s came up with new forms, new ways to represent reality and new ways to see the world. The *"new media avant-garde"* is about new ways of accessing and manipulating information. Its techniques are hypermedia, databases, search engines, data mining, image processing, visualization, and simulation.

The new avant-garde is no longer concerned with seeing or representing the world in new ways but rather with accessing and using in new ways previously accumulated media. In this respect new media is post-media or *"meta-media"*, as it uses old media as its primary material

My concept of "meta-media" is related to a more familiar notion of "post-modernism" – the recognition that by the 1980s the culture became more concerned with reworking already existing content, idioms, and style rather than creating genially new ones. What I would like to stress (and what I think the original theorists of post-modernism in the 1980s have not stressed enough) is the key role played by the material factors in the shift towards post-modernist aesthetics: the accumulation of huge media assets and the arrival of new

electronic and digital tools which made it very easy to access and re-work these assets. This is another example of quantity changing into quality in media history: the gradual accumulation of media records and the gradual automation of media management and manipulation techniques eventually recoded modernist aesthetics into a very different post-modern aesthetics.

8. New Media as Parallel Articulation of Similar Ideas in Post WWII Art and Modern Computing

Along with the 1920s, we can think of other cultural periods that generated ideas and sensibilities particularly relevant to new media. In the 1980s a number of writers looked at the connections between Baroque and post-modern sensibilities; given the close linked between post-modernism and new media I just briefly discussed, it would be logical if the parallels between Baroque and new media can also be established. [8] It can be also argued that in many ways new media returns us to a pre-modernist cultural logic of the eighteenth century: consider for instance, the parallel between eighteenth century communities of readers who were also all writers and participants in Internet newsgroups and mailing lists who are also both readers and writers.

In the twentieth century, along with the 1920s, which for me to represent the cultural peak of this century (because during this period more radically new aesthetic techniques were prototyped than in any other period of similar duration), the second culturally peak –1960s – also seem to contain many of new media genes. A number of writers such as Söke Dinkla have argued that interactive computer art (1980s -) further develops ideas already contained in the new art of the 1960s (happenings, performances, installation): active participation of the audience, an artwork as a temporal process rather than as a fixed object, an artwork as an open system. [9] This connection makes even more sense when we remember that some of the most influential figures in new media art (Jeffrey Shaw, Roy Ascott) have started their art careers in the 1960s and only later moved to computing and networking technologies. For instance, in the end of the 1960s Jeffrey Shaw was working on inflatable structures for film projections and performances which were big enough to

contain a small audience inside – something which he later came back to in many of his VR installations, and even more directly in EVE project. [10]

There is another aesthetic project of the 1960s that also can be linked to new media not only conceptually but also historically, since the artists who pursued this project with computers (such as Manfred Mohr) knew of minimalist artists who during the same decade pursued the same project "manually" (most notably, Sol LeWitt). [11] This project can be called "combinatorics." [12] It involves creating images and/or objects by systematically varying a single parameter or by systematically creating all possible combinations of a small number of elements. [13] "Combinatorics" in computer art and minimalist art of the 1960s led to the creation of remarkably similar images and spatial structures; it illustrates well that the algorithms, this essential part of new media, do not depend on technology but can be executed by humans.

Four Decades of New Media

Along with the ones I already mentioned, more connections between 1960s cultural imagination and new media exist. *New Media Reader* contains a number of important texts by the radical artists and writers from the 1960s which have conceptual affinity to the logic of computing technology: Allan Kaprow, William Borrows; Oulipo movement (whose members pursued combinatorics project in relation to literature), Nam June Paik and others. "The Complex, the Changing, and the Intermediate" part of the reader presents the most comprehensive, to date, set of cultural texts from the 1960s whose ideas particularly resonate with the developments in computing in the same period.

Although modern computing has many conceptual fathers and mothers, from Leibnitz to Ada Lovelace, and its prehistory spans many centuries, I would argue that the paradigm that still defines our understanding and usage of computing was defined in the 1960s. During the 1960s the principles of modern interactive graphical user interface (GUI) where given clear articulation (although the practical implementation and refined of these ideas took place later, in the 1970s at Xerox Parc). The articles by Licklider, Sutherland, Nelson, and Engelbart from the 1960s included in the reader are the essential documents of our

time; one day the historians of culture would rate them on the same scale of importance as texts by Marx, Freud, and Saussure. (Other key developments that also took place in the 1960s – early 1970s were Internet, Unix, and object- oriented programming. A number of other essential ideas of modern computing such as networking itself, the use of computers for real-time control, and the graphical interactive display were articulated earlier, in the second part of the 1940s and the first part of the 1950s.) [14]

The first section of the reader takes us to the end of the 1970s; by this time the key principles of modern computing and GUI were already practically implemented and refined by the developers at Xerox Parc but they were not yet commercially available to consumers. The second section "Media Manipulation, Media Design" covers the late 1970s and the 1980s. During this period Macintosh (released in 1984) popularized GUI; it also shipped with a simple drawing and painting programs which emphasized the new role of a computer as a creative tool; finally, it was the first inexpensive computer which came with a bit-mapped display. Atari computers made computer-based sound manipulation affordable; computer games achieved a new level of popularity; cinema started to use computers for special effects (Tron released by Disney in 1982 contained seventeen minutes of 3-D computer generated scenes); towards the very end of the decade, Photoshop, which can be called the key software application of post-modernism, was finally released. All these developments of the 1980s created new set of roles for a modern digital computer: a manipulator of existing media (Photoshop); a media synthesizer (film special effects, sound software), and a new medium (or rather, a set of new mediums) in its own right (computer games). *New Media Reader* collects essential articles by computer scientists from the 1980s that articulate ideas behind these new roles of a computer (Bolt, Shneiderman, Laurel, and others).

As computing left the strict realm of big business, the military, the government, and the university and entered society at large, cultural theorists begin to think about its effects, and it is appropriate that *New Media Reader* also reprints key theoretical statements from the 1980s (Turkle, Haraway). I should note here that European cultural theorists reacted to computerization earlier than the Americans: both Lyotard's *The Post-Modern Condition*

(1979) and Baudrillard's *Simulacra and Simulations* (1981) contain detailed discussions of computing, something which their 1980s American admirers did not seem to notice.

The last section of the reader "Revolution, Resistance, and the Web's Arrival" continues to weave texts by computer scientists, social researchers, cultural theorists, and critics from the end of the 1980s onward; it also takes us into the early 1990s when the rise of the Web redefined computing one again. If the 1980s gradually made visible the new role of a computer as a media manipulator and an interface to media – the developments which eventually were codified around 1990 in the term "new media" – in the 1990s another role of a digital computer (which was already present since the late 1940s) came to the foreground: that of a foundation for real-time multi-media networking, available not just for selected researchers and the Military (as it was for decades) but for millions of people.

In the 1960s we can find strong conceptual connections between computing and radical art of the period, but with the sole exception of Ted Nelson (the conceptual father of hypertext) no computer scientist was directly applying radical political ideas of the times to computer design. In fact, these ideas had a strong effect of the field, but it was delayed until the 1970s when Alan Kay and his colleagues at Xerox Parc pursued the vision of personal computer workstation that would empower an individual rather than a big organization. In the late 1980s and early 1990s, however, we seem to witness a different kind of parallel between social changes and computer design. Although causally unrelated, conceptually it makes sense that the end of cold War and the design of the Web took place at exactly the same time. The first development ended the separation of the world into separate parts closed to each other, making it a single global system; the second development connected world's computers into a single networking. The early Web (i.e., before it came to be dominated by big commercial portals towards the end of the 1990s) also practically implemented a radically horizontal, non-hierarchical model of human existence in which no idea, no ideology and no value system can dominate the rest – thus providing a perfect metaphor to a new post-Cold War sensibility.

The emergence of new media studies as a field testifies to our recognition of the key cultural role played by digital computers and computer-enabled networking in our global

society. For a field in its infancy, we are very lucky to now have such a comprehensive record of its origins as the one provided by *New Media Reader*; I believe that its readers would continue to think about both the ideas in its individual texts and the endless connections which can be found between different texts for many years to come.

References:

[1] More subtle but equally convincing is the relationship between *Panopticism* by Michel Foucault which comes from his book *Discipline and Punish* (1975) and *Personal Dynamic Media* by Alan Kay and Adele Goldberg (1997). In 1960s and 1970s the prevalent model of computer use was time sharing. It was Panopticon-like in so far as it involved a single centralized computer with terminals connected to it and thus was conceptually similar to an individual prisoner's cell connected by lines of site to the central tower in Panopticon. At the end of the 1960s, computer scientist Alan Kay pioneered a radically different idea of a personalized computer workstation, a small and mobile device that he called Dynabook. This idea came to be realized only in 1984 with the introduction of Macintosh. (It is not accidental that the famous Apple commercial - directed by Ridley Scott who two years earlier made *Blade Runner* - explicitly invokes the images of Orwellian-like society of imprisonment and control, with Macintosh bringing liberation to the users imprisoned by an older computing paradigm.)

[2] For a good example of cyberculture paradigm, see online *Resource Center for Cyberculture Studies*www.otal.umd.edu/%7Erccs/).

[3] Lev Manovich, *The Language of New Media* (Cambridge, Mass.: The MIT Press, 2001).

[4] I don't mean here the actual data structures and algorithms which may be used by particular software – rather, I am thinking of them in more abstract way: what is the structure of a cultural objects and what kind of operations it enables for the user.

[5] Manovich, *The Language of New Media*, 80.

[6] I believe that the same problems apply to Erkki Huhtamo's very interesting theory of media archeology which is close to the approach presented here and which advocates the study of tropes which accompany the history of modern media technology, both the ones which were realized and the ones which were only imagined.

[7] Lev Manovich, "Avant-Garde as Software," in *Ostranenie*, edited by Stephen Kovats (Frankfurt and New York: Campus Verlag, 1999). Available online at www.manovich.net. (The subsequent quotes are from the online text.)

[8] See Norman Klein's book *From Vatican to Las Vegas: A History of Special Effects* that is discussing in detail the connections between the treatment of space in Baroque and in cyberculture. Norman Klein, *From Vatican to Las Vegas: A History of Special Effects* (New Press, 2004.)

[9] See, for instance, Söke Dinkla, "From Participation to Interaction: Towards the Origins of Interactive Art," in *Clicking In: Hots Links to a Digital Culture*, edited by Lynn Hershman Leeson (Seattle: Bay Press, 1996).

[10] Jeffrew Shaw, ed., *Jeffrey Shaw-A User's Manual* (DAP, 1997).

[11] For Manfred Mohr, see http://www.emohr.com/.

[12] Frank Dietrich has used the term "combinatorics" to talk about a particular direction in the early computer art of the 1960s. See Frank Dietrich, "Visual Intelligence: The First Decade of Computer Art," (Computer Graphics, 1985).

[13] It is interesting that Sol LeWitt was able to produce works "by hand" which often consisted of more systematic variations of the same elements than similar works done by other artists who used computers. In other words, we can say that Sol LeWitt was better in executing certain minimalist algorithms than the computers of the time.

[14] See Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America*, reprint edition (The MIT Press, 1997).