The Visual Language of Contemporary Digital Art and Its Collaborative Aspects on Science

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Abstract. Contemporary Digital Art in some aspects is very different from other types of art. This is due to the practice of art-science collaboration, as well as the specific visual language of this art form.

1 INTRODUCTION

Computer and Digital Art have been analysed globally since their inception at the end of the 1950s and 1960s. The fact that almost all of the pioneers were scientists, rather than professional artists, is unsurprising given the (un)availability of computers at the time, the complexity of the technologies involved and other similar aspects.

Several common features among the practitioners of this new form of art should be outlined.

- The first computer artists studied the technical and aesthetic issues characteristic of this new art form, and published their 'results' as peer-reviewed papers in the proceedings of scientific conferences. They had a different approach towards art, and it was often rooted in their former professional background. The opinion expressed by these authors on art phenomena was that of the public, rather than the artist or art historian.
- As scientists they were used to joint research and information sharing. This gradually laid the foundations for the beginning of cooperation between science and art in the context of Digital and later (New) Media Art.[2] The first computer artworks, due to their technical sophistication, were often the joint result of several authors working together.

This historical background gradually formed the practice of: (a) informal organisations of artists and scientists, residential programs and research centres; (b) exhibitions and periodicals dedicated to art, research and new technologies; (c) a new model of publicity – the art exhibition-festival-scientific conference, as well as new approach to creative process – art as visual research.

The ideological constraints imposed on art in the geopolitical space of the USSR hampered the development of Digital Art and was the main reason why so few works have been preserved. The prevalence of literary narrative in visual art shaped the taste and peculiarities of perception characteristic of the audience, including scientists and engineers – the first creators of these artworks. [1] Due to socio-political reasons the areas of professional specialisation in the Latvian SSR were very narrow, and there was a lack of information exchange between artists and scientists. The case studies provide an insight into collaborative practices of Latvian art-science during the Soviet period, as well as an analysis of the creative work of some contemporary Latvian digital and new media artists such as Raitis Šmits, Rasa Šmite, Jānis Garančs (E-LAB), Gints Gabrāns, Gundega Strautmane, Zane Bērziņa, and others.

Since digital technologies have come into use, the dynamic visualisations of various types of data flow has become the focus of attention in several branches of science, as well as in research and experiments related to art and architecture. Thus a new visual language appears in a mediated form. The data become visually accessible, but the meaning can be read and fully understood only if one possesses the required knowledge. This raises a number of questions about digital and new media artwork evaluation.

2 HISTORICAL ASPECTS

As early as the second half of the 19th century the appearance of a new technology – photography – in everyday life gradually changed the nature of visual art. At the beginning of the 20th century artists were influenced by the fundamental indeterminacy of observation brought about by changes in the scientific paradigm. Cubism was the first art movement to employ a visual language that was obviously different. Of course, it was a complex phenomenon that evolved as a result of numerous conditions, but the role played by scientific discoveries in the development of Cubism was beyond doubt. The Cubists' interest in an alternative representation of time and space in visual art was later taken up by Futurism, Cubo-Futurism, Constructivism and Suprematism. All this can be partly considered as the visual background of the first examples of computer art.

The Bauhaus school in Germany was the first 20th century art movement to declare that the combination of art, technology, functionality, aesthetics and research was one of its primary objectives. After the school was closed down in 1933 for political reasons its ideas and its representatives were "scattered" across Europe and the USA. László Moholy-Nagy, one of the leading teachers of the Bauhaus school, and, twenty years later, Nicolas Shöffer were two of the most notable "Digital and (New) Media Artists", who did not use the computer as we know it today only because this type of medium had not been invented yet. In the 1920s László Moholy-Nagy already used photo montage and complex electrical mechanisms in his work. The piece CYSP 1, created in 1961 by Nicolas Shöffer in cooperation with the PHILIPS Company, could be considered as the world's first cybernetic sculpture.

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[2] according to K. Kwastek author prefer to use the term '(New) Media Art' instead of 'New Media Art'. See: K. Kwastek. *Aesthetics of Interaction in Digital Art*. The MIT Press, Cambridge, MA, etc. (2013).

As mentioned before, the beginnings of Computer Graphics and Computer Art had already determined initial aspects of art-science collaboration in this field. The common context, in a broad sense, of modernism art and science was the source from which scientists derived their ideas for the visual style of the first computer graphics, allowing the authors to treat these experiments as art. These works were exhibited for the general public in cooperation with art galleries and even museums of modern art. In the middle and second half of the 1960s, when Computer and Digital Art became more popular, relations between computer science, engineering and art reached a turning point, initiating a whole new process – artists began looking for possibilities to cooperate with scientific research centres. Informal organisations for artists and scientists were established, promoting the creation of collaborative projects and development of larger undertakings.

Informal organisations of artists and scientists, residential programs and research centres have to be mentioned as important meeting points of artists and scientists. In 1960 two independent groups *OuLiPo* (*Ouvroir de Littérature Potentielle*) and *G.R.A.V.* (*Groupe de recherche d'art visuel*) were founded in France. Most *OuLiPo* members were creative professionals who were also interested in information theory and collaborated with a group of mathematicians uniting under the name *Bourbaki* and ardently promoting mathematics. Members of the *G.R.A.V.*, on the other hand, dealt with issues pertaining to art research, specifically – the perception and processing of visual phenomena.

In 1961, in the former Socialist Federal Republic of Yugoslavia, a group of artists from Zagreb organised their first exhibition *Nove tendencije* (New Tendencies) in the gallery *Galerija suvremene umjetnosti*. The exposition consisted of a variety of new trends in art, among them kinetic installations and 'Programmed Art', created as visual research through the application of algorithms, among other things. Other exhibitions followed, and *Nove tendencije* gradually grew into an international art movement. As a result of these activities, a unique situation developed in the 1960s – during the Cold War Zagreb became a meeting place for artists, scientists and theorists from both the Eastern and Western Bloc – encompassing Europe, the USA and Japan.

Already in 1962 *Nove tendencije* emphasised the importance of art as visual research, but in 1968 and 1969 a new theme was proposed – 'Computers and Visual Research'. This was developed further in an international colloquium with the same title (1968) and in subsequent exhibitions, as well as in the magazine *BIT International*. The activities of *Nove tendencije* also included the organisation of exhibitions, followed by lectures, theoretical discussions and symposiums, as well as the publication of periodicals – catalogues and collections of articles. Most of the active computer scientists-computer artists and theorists of the time attended these events, exhibiting works of Computer Art and (or) presenting their papers. These events continued until 1973. *Nove tendencije* can be considered as the first significant example of cooperation between artists, theorists and scientists in the history of Computer Art.

The Centre for Advanced Visual Studies (CAVS) was founded in 1967 in the Massachusetts Institute of Technology, USA. Its initiator was György Kepes, a former colleague of Moholy-Nagy in the Chicago School of Design (now the IIT Institute of Design). The centre was intended as an artist fellowship program for funding large-scale joint projects in Technological and Environmental Art, and for supporting individual creative ideas. The CAVS existed until the end of 2009, and in 2010 it merged with the Visual Arts Program (VAP) and obtained a new name – the MIT Program in Art, Culture and Technology (ACT).

At the end of the 1960s the academic status of artists and art as a practice gradually changed. In the USA several artists showed an increasing interest in scientific disciplines, e.g. Donald C. Judd studied philosophy, Robert Morris – psychology and philosophy. Despite numerous orders from the military, the leading U.S. computer technology companies were open to cooperation with artists, hoping they would offer an unconventional perspective and new ideas that would contribute to the development of new technologies.

Informal associations intended for cooperation between artists and scientists were almost simultaneously established in several countries: Experiments in Art and Technology (E.A.T., USA, 1966), Computer Technique Group, (CTG, Japan, 1967), and Computer Arts Society (CAS, Great Britain, 1968).

Exhibitions and periodicals dedicated to art, research and new technologies form another part of the collaborative practice. Since the second half of the 1960s the tradition of joint exhibitions dedicated to art and computer technologies was gradually established. These events had several specific characteristics: the exposition included objects of art, design and technology which were often the result of collaboration between one or several artists, engineers, experts in computer technology and scientists. During the exhibition a symposium or a conference was often held, or it served as a space for the participants' discussions. A published volume sometimes accompanied the exhibition, which included papers written by the participants.

The Art and Technology Program was one of the first to provide an opportunity to see the results of the collaboration between artists and technology centres in a museum context. It was initiated in 1966 with the help of Maurice Tuchman – curator at the Los Angeles County Museum of Art (LACMA). The program established artists' residencies in over 30 companies and corporations. In 1970 an exhibition of objects created by artists involved in the program was organised at the LACMA, and a catalogue was published.

The late 1960s saw the development, growing popularity and first success of Computer Art. In 1968 and 1969 there were five exhibitions dedicated to new technologies: Cybernetic Serendipity (London, Great Britain); *Tendencije 4, Kompjutori i vizuelna istraživanja* (Zagreb, Yugoslavia); The Machine, as Seen at the End of the Mechanical Age (New York, USA); Some More Beginnings (New York, USA), and Event One (London, Great Britain).

In 1968, at the initiative of Frank Malina – scientist, engineer and artist – the journal *Leonardo* was established in Paris, which was, and still is, intended for exchanging ideas among artists, theorists and scientists in the form of peer-reviewed scientific publications. Nowadays the journal has grown from individual initiative into one of the most influential periodicals in the field of computer graphics and digital culture. "*Leonardo* illustrates how a journal with persisting agenda can build its own identity, and shape an art movement through its continuing presence and persistence." [2] It is indexed in the Thomson Reuters Arts & Humanities Citation Index.

When online publishing became possible in the mid-1990s, opinion was also exchanged in the form of democratic web-based discussion sites and mailing lists. The immediate publication of new research and the growing dynamics of discussion served as academic advantage of the web. In the next decade, new forms of communication appeared in the global network, such as online journals, blogs, online social networking services, microblogging in Twitter, etc.

A new model of publicity – art exhibition-festival-scientific conference is to be mentioned as a contemporary practice of art-science collaboration. At the end of the 1970s and during the 1980s a new form was gradually developed for exhibiting Digital and later – (New) Media Art: regularly held specialised exhibitions-festivals-conferences. These events were a continuation of previous exhibitions dedicated to art and technology. Nowadays this model of publicity has several new characteristics. The festival-conference format allows for a predefined length and regularity of exhibitions. A theme is chosen for each event, reflecting a new development in technology, its public urgency or a topical problem in the field. Digital and (New) Media Art embraces new computer technologies and media, expanding its thematic area. New hybrid forms and unusual technologies that often extend the boundaries of art are expected in these exhibitions. Artworks and conference articles are accepted through competition and blind peer review.

The most widely known new technology and media art festival in Europe is *Ars Electronica* (founded in 1979). Since 1987 the *Prix Ars Electronica* is awarded in each of the categories predefined by the organisers. The festival's theme and chosen categories, as well as the nominations reflect topical issues in Digital and (New) Media Art. In addition to organizing the festivals and exhibitions, in 1996 *Ars Electronica* established a centre comprised of a museum and media laboratory.

The cooperation between artists, scientists and engineers launched by the informal organization E.A.T. has been furthered since 1974 by means of annual exhibitions and conferences organised by the ACM SIGGRAPH. Since 1982 a juried SIGGRAPH Digital Art exhibition and extensive conference dedicated to computer graphics, design and art is held regularly, along with an exhibition of computer graphics (hardware and technologies). A peer-reviewed journal is published, which accepts only one-fifth of the submissions. Since 2010 it has been published in cooperation with the journal *Leonardo*. The satellite festival SIGGRAPH Asia has been held since 2008.

ZKM (*Zentrum für Kunst und Medientechnologie*), founded in 1989, includes a media art centre and research institutes, as well as a modern art museum. ZKM is a platform for inter-disciplinary experiments, research, creation and presentation of works. The purpose of the research centre is to bring together artists and scientists from different disciplines with the aim of developing untraditional ideas and creating innovative works, and to establish the ZKM archive, preserving the cultural heritage of 20th and 21st century Media Art.

3 DEVELOPMENT TENDENCIES IN LATVIA (CA. 1960–1990)

Due to a number of factors characteristic of the Soviet political space and the Latvian SSR – professional isolation and military secrecy made it impossible for artists to master computer technologies or collaborate with computer scientists and engineers who had the necessary equipment and technology. Similar reasons prevented engineers and computer scientists from producing Digital Art. However, the information regarding scientific and technical progress that was not a part of the so-called 'closed themes' was available in various forms, such as series of books and journals on popular science, as well as public lectures.

The principles of cybernetic modelling became popular in the Western world in the 1950s when they were applied to the exchange of information in machines (computers) and its synergy. The exhibition Cybernetic Serendipity held in 1968 in London was a culmination of the aesthetic practice of Western Cybernetics. At the same time, the Latvian artist in exile Sigurds Vīdzirkste exhibited several paintings entitled 'Cybernetic Canvases'. In the 1970s in the Federative Republic of Germany, another artist in exile Juris Soikans developed his model of Cybernetic Aesthetics, which he conceived as both a theoretical and practical project. The form of an artwork, as defined by Soikans – a snapshot of the programmed process [3] – is topical in contemporary Digital and (New) Media Art where an image develops as a dynamic system.

In the early 1960s the Design Department (then known as the Department of Industrial Art) was created in the Art Academy of Latvia and evening courses in 'Artistic Design' were organised. This formed the basis for collaboration between industrial technology and art (people working in industrial design could enhance their qualification by taking evening courses). Political criteria were not clearly established in this newly formed area, and this allowed for more independent and experimental approaches. Gradually the efforts of the academic staff to introduce students to contemporary Western art movements (such information was much more restricted in the Fine Arts departments) partly led to the fact that examples of Kinetic, even Conceptual and Environmental Art made by professional artists (who positioned their work as design, rather than visual art) appeared as early as 1970s. [4]

In the 1970s and 1980s several joint exhibitions were organised in Riga, all sharing the same concept – the artworks were created by groups of artists, while engineers ensured their technical realisation. The content of these exhibitions is somewhat comparable to the aforementioned art and technology exhibitions held elsewhere in the world. In this context the exhibition *Daba. Vide. Cilvēks* (Nature. Environment. Man) held in 1984 as part of the Art Days event is particularly significant. Its participants included painters, sculptors, graphic artists and designers (then known as applied decorative art and industrial art designers), whose works displayed a wide thematic and technological range. This can be regarded as an important step towards overcoming a rigid classification of art forms, which gradually paved the way for the radical changes that took place in the next decade.

4 CONTEMPORARY LATVIAN DIGITAL AND (NEW) MEDIA ART SINCE THE MID-1990s

In 1996, at the initiative of several emerging artists – Raitis Šmits, Rasa Šmite, Jānis Garančs, and Alise Tīfentāle, E-LAB – Electronic Art and Media Laboratory (*Elektroniskās mākslas un mediju laboratorija*) was founded with the aim of creating a new and aesthetically different form of art. Its most significant

projects were the online audiovisual artworks of the 1990s, the Internet radio station *net.radio Ozone* (1997), the mailing list and Internet radio network *Xchange* (1997), and since 1997 – the development of the bilingual journal Acoustic Space (*Akustiskā telpa*). The creation of Acoustic Space Lab (*Akustiskās telpas laboratorija*) in 2001, a network-based platform for collaborative experimentation, resulted in a series of translocal co-projects that explored the acoustic dimension of networked media space.

By developing Net Art, E-LAB defined a new form of artistic self-expression – Internet communication as the experience and exploration of new cyberspace, enhanced with sound and images that allowed it to be viewed as art. The first audio experiments created by E-LAB were not only revolutionary in the context of Latvian art. At the time they were also at the forefront of global (New) Media Art. This was an unprecedented situation in the Latvian art scene – for the first time since the belated emergence of professional art in Latvia in the mid-19th century, local artists were creative pioneers of a new phenomenon in art.

In 1996 the first international festival dedicated to new media culture Art + Communications (*Māksla + Komunikācijas*) was held in Riga. The festival program also included an international conference and the official opening of E-LAB. This new form of art exhibition-festival-scientific conference can be considered as part of the earlier development of Computer and Digital Art, particularly – the experience of European Digital Art festivals (*Ars Electronica*, *Transmediale*, etc.), now also adopted in Latvia. Today the festival Art + Communications is internationally recognized in the world's digital community. Over the years artists participating in the festival have addressed such issues as Save As (2013), Art of Resilience (2012), Techno-Ecologies (2011), Transbiotics (2010), Energy (2009), Spectropia (2008), Spectral Ecology (2007), Waves (2006), and Media Architecture (2003).

Since the creation of E-LAB and later – RIXC (E-LAB was renamed RIXC, Centre for New Media Culture in 2000), seminars and lectures on (New) Media Art and culture have been organised. Rasa Šmite and Raitis Šmits work as lecturers at Riga Stradiņš University and the Art Academy of Latvia. In 2006 the Art Research Laboratory (*MPLab*) was established, and a year later a New Media Art study program was created in cooperation with the University of Liepāja and RIXC. This program offers an education model of art as research – a model that is close to the principles applied in the art and technology, education and research centres described earlier (e.g. MIT Program in Art, Culture and Technology). As Jan Kaila[3] shares his expierence on this topic: "But to return to the main question: How are artists and their practice affected by theorizing, contextualizing and writing? [..] Does it improve their eye for the artistic game? [..] It is this grey area which comprises the greatest benefit that artistic research confers to artist, his or her colleagues and audience..." [5]

E-LAB and RIXC have introduced a number of new artistic practices in Latvia. Working in a group of like-minded individuals allows each artist to reach his or her personal goals, while also assisting in the creation of a joint project. These new media artists do not conceal their names. However, the community, the group and the creative process often take precedence. RIXC has greatly contributed to the development of (New) Media Art in Latvia. The aforementioned authors from E-LAB, as well as Gints Gabrāns, Voldemārs Johansons, Zane Bērziņa, Gundega Strautmane and others – applied various research methods and interdisciplinary cooperation in their projects.

In 2007 Gints Gabrāns' project Paramirrors was displayed in the Latvian pavilion of the 52nd International Art Exhibition of *La Biennale di Venezia*. It was carried out in cooperation with Elmārs Blūms from the Institute of Physics, University of Latvia, Ilze Aulika, Vismants Zauls, Mārtiņš Rutkis, Institute of Solid State Physics, University of Latvia and Jānis Spīgulis, Institute of Atomic Physics and Spectroscopy, University of Latvia. [6]

Jānis Garančs (1973), a co-founder of the creative team E-LAB, is a new media artist who creates his technically sophisticated and medium specific artworks using computer technologies. The author is interested in research on interactive virtual reality. His projects of the last decade (ca. 2002–2012) reveal the artist's interest in Immersive Media Art. His works impress with a highly contemporary artistic language. However, it is difficult to subject them to formal analysis. In many cases the author's concept and the fleeting nature of the users experience has to be accepted, since the means of expression or a framework in which to speak of the quality of the performance are difficult or even impossible to articulate. Unlike artworks that can be compared and viewed many times (like a traditional painting, sculpture, etc.) the observer has to rely on memories about the impressions that each project created. One can call it a perpetual "work in progress" [7]

Textile artist Gundega Strautmane (1978) worked with Valdis Krebs (Latvia, USA), an employee of the System Modeling Laboratory in the Institute of Mathematics and Computer Science, University of Latvia. They used the Braille system in order to transform various data visualisations made by Valdis Krebs into tactile compositions. Here the use of technology and artist-scientist collaboration resulted in a complex visual object with traditional aesthetic values, which, moreover, is created for an extended audience – partially sighted people. Zane Bērziņa (1971), also a textile artist, has gone from unique textile designs to research[4] and new media applications in textile, and interdisciplinary cooperation. Such a progression illustrates the nature of modern art, which is no longer restricted to its traditional forms, and research can be readily integrated in the creative process.

5 THE IMPACT OF SCIENCE ON THE VISUAL LANGUAGE OF DIGITAL ART

Digital and computer art is characterised by (a) the use of data as a specific means of expression of visual language and (b) understanding of a work of art as a programmable, dynamic visual system. The possibility to change the medium of presentation allows for several different versions of the same work of art.

Data as a means of expression of visual language. The possibility of obtaining data and visualising information that

[3] Jan Kaila is a Professor of Artistic Research in Dept. of Postgraduate Studies at the Finnish Academy of Fine Arts.

[4] She developed her PhD thesis as a practice-based artistic research. See: Z. Berzina. *Skin Stories: Charting and Mapping the Skin. Research using analogies of human skin tissue in relation to my textile practice. (Dissertation).* University of the Arts, London (2004).

would otherwise remain invisible is fascinating. In the early days of computer art the emotional impact of the work was determined by this new, previously unavailable means of representing data. Nowadays in numerous projects contemporary artists study and draw attention to various global problems, reflecting their message by means of information (data) visualisation and information flow.

As a result of technological progress it is possible to process increasingly large volumes of data and follow the flow of data in real time more effectively. The data become visually accessible, but the meaning can be read and understood only if one possesses the required knowledge. This raises a number of questions. What is it that we see? What do we mean by it? How does it affect our perception and emotions? Is the artist himself/herself aware of what he/she wants to say and what he/she does say? What criteria should be used to evaluate this type of work? What is the difference between real space and data space?[5] For example, the series *Asinsgaisma* (Blood Light, 2011) created by the Latvian new media artist Gints Gabrāns can be considered as a visual model in which all of the above questions are posed.

A work of art as a programmable, dynamic visual system. The two parts of digitally created art – the algorithm or binary code 'read' by the computer (not a person) and the visual part made visible for the viewer – form a whole. The programmability of the work of art determines the importance of its idea, neutralises the need for artistic craftsmanship and automates its creation. Depending on the author's intention, the process can be adjusted as needed. When working with a computer the synthesis of various art forms takes place organically, because it is possible to simultaneously transform the data stored in one file into both visual and auditory information. [8]

From an aesthetic point of view it is possible to treat a multimedia document – a standard unit of communication in the World Wide Web – as a new type of art object. It has a starting date, it can be supplemented, altered and edited, and it does not have (or more precisely, might not have) a fixed ending date. Its content is selected upon the request of a particular user (in this case – the audience). In terms of Digital Art aesthetics, interactivity can be understood as the replacement of the representative discourse of a work with a virtual, navigable model. The work's format (size) and proportions (height-to-width ratio) are not set, and a virtual world can be created on the screen. The ergonomic structuring of this new navigable space has to be carried out by an artist in cooperation with a viewer.

The visual content of the artwork can be edited and periodically updated at the artist's discretion. The possibility to separately store the various stages of a work, as well as the fact that it can be created in a number of 'layers' ('objects'), which can be disabled and then added (re-connected) to the final version, allow for infinite continuation and endless variation. This kind of creative process can acquire aesthetic value in and of itself. In addition, the possibility to change the medium in which the work is reproduced provides an opportunity to create several different versions of the same work.

It is possible to discern the characteristics of the visual language of an image – a multi-media file created as a dynamic system (if this file is intended to be readable and directly viewable). However, like in some practices of contemporary art, it is impossible to define its aesthetic value and artistic contribution in the traditional sense. Visual aspects do not play a unique role anymore. Moreover, their variability and dynamics should be taken into account. One must recognise that this hybrid work cannot be broken down into its individual components: the whole is more than the sum of its parts. [9]

6 AESTHETICS AND VISUAL LANGUAGE OF COMPUTER-GENERATED AND COMPUTER ASSISTED ART

From the perspective of technical aesthetics it is possible to distinguish two groups of Computer and Digital Art. The first one is 'computer-generated' art. The second includes works created using computer graphics software and which are referred to as 'computer assisted' art. In these works, the computer serves as an instrument for realising the author's various artistic ideas. Here one cannot speak of principles characteristic of a unified aesthetic and visual language. In contrast, a particular subgroup of computer assisted art – namely, 'Popular Digital Art'[6] – consists of a large body of works with predefined aesthetic guidelines, visual language and iconography.

Aesthetics of computer-generated art. It is possible to distinguish several technically aesthetic characteristics determined by the use of the author's original algorithms.

1. An algorithm is an expression of the sharpness of one's mind (thought, idea) rather than the agility of one's hands, and it includes a description of possible options, rather than the material realisation of a work. It can be described as computer-generated art because the author realises his creative potential when he writes an algorithm, whereas the computer transforms (generates) it into a work of art.

2. Each completed version of an algorithmic artwork is only an instance (in object-oriented programming – an object, as opposed to the class to which it belongs). An algorithm can be regarded as a work of art. [10]

3. It is the computer, rather than the artist, that translates the text of the algorithm into a visual language. With technological development the technical capabilities of a computer have also advanced. Its potential lies in generative ideas capable of self-generating improvisation within a class of objects. "The art in a work of digital art is to be found in the infinite class of works a program may generate, and not in individual pieces that only *represent* the class." [11]

A program code for executing algorithms is developed by working on original programs in Algorithmic and Software Art, as well as creating interactive digital installations in the virtual online environment, and elsewhere. The collective or individual development of open source software often becomes part of the work when creating this type of art. Communicating, sharing information and cooperating can be regarded as new components of art.

In summary, computer-generated art generally employs a computer-specific visual language. Technical aesthetics plays an

[5] This question is posed by Katja Kwastek in her *Aesthetics of Interaction in Digital Art*. The MIT Press, Cambridge, MA, etc. (2013).

[6] The author introduces the term 'Popular Digital Art' to cover the aesthetic guidelines and the homogeneous visual language characteristic of this Digital Art form.

important role in the development of original algorithms and programs, but in many cases computer-generated art owes its originality to both of these factors: meaning, the algorithm or program and their visual or multimedia realisation in a broad sense. The author contends that what is most important is the way in which the artist has conceptually defined his or her work. This depends on the individual choice of each author.

The second group includes works that are created using computer graphics software. However today one has to admit that even Algorithmic and Generative art can be 'computer assisted' to some extent, and the confluence between these two groups can happen due to the particular user manuals of open source programming resources. They openly declare: "With generative art the necessary skill doesn't have to be learned; it's already encapsulated within the tools". [12]

Aesthetic guidelines and visual language of Popular Digital Art. It became a mass phenomenon in the late 1990s due in large part to the rapid development of 2D and 3D graphic software. Its aesthetic guidelines were already laid down before technical and technological progress facilitated the development of these artistic practices. The war and ongoing struggle between 'good' ("us") and 'evil' ("the enemy") were already well-established themes in films ('Blockbusters' and the 'Sci-Fi' genre) and computer games. Another characteristic of Popular Digital Art is a mix of references to, and use of, different mythologies and characters from fantasy literature and works of science fiction, as well as the use of aesthetics borrowed from the war and horror film industry. This is often combined with objects from the author's own private mythology.

Owing to such features and peculiarities of Digital Art as modularity, automation and variability and following the communicative ideas of virtual spaces, the artistic process of a creative community and the work of an individual artist sometimes become difficult to distinguish. *Cgsociety.com, Deviantart.com, Cgimage.lv*, *Epilogue.net, Gfxartist.com, 3dtotal.com, fantasticportfolios.com* and other similar websites are online platforms for creative communities practising multi-functional Popular Digital Art and sharing user-generated artworks. Unlike other art websites, there it is possible to encounter such sections as 'Work in Progress', 'Tutorials', 'Resources', and 'Stock Images'. The artistic result is still important, but the interaction between the individual and the creative community adds a new dimension to the creative process. [13] The aesthetic conceptions of the community on the navigation of 3D objects in space, the structure of characters, as well as other criteria – composition, choice of colour, and even the impact on the audience, are offered in the form of advice and can be taken into account or disregarded.

7 DANGER OF 'COMPUTER AND DIGITAL ART GHETTO'[7]

Within the framework of this research a set of problems is identified. Lack of originality is characteristic of some works in this medium.

- The same mathematical models, principles and relationships are used to create Algorithmic Art, as well as the tools of graphic software. In the future this may lead us to re-evaluate existing works and put a greater emphasis on analysing them in relation to the state of computer technology at the time, or to employ different standards for assessing art created in different periods.
- There can be various combinations of the formal and emotional contribution of the author and the 'easy solutions' provided by computer programs. It is difficult to determine the originality of these works due to the increasing variety of software packages and different versions thereof.
- The guidelines regarding the form and content of Popular Digital Art have been defined prior to its development, thus creating the possibility of a predetermined ghettoisation of the visual language and aesthetics of this art.
- The cumbersome mass of works and similar visual information on the websites of creative communities of Popular Digital Art complicate their assessment, forcing us to address the quantitative aspect of the 'ghetto' of this art.

8 ARTWORK AS VISUAL RESEARCH

In both Latvian and foreign examples of contemporary Digital and (New) Media Art, one encounters increasingly unusual methods for creating visual (2D and 3D), audible and even tactile elements of composition and rendering the artistic process more interactive. The range of materials and technologies has considerably expanded; an increasing number of new auxiliary devices are used to create artworks. The explanation of the process significantly contributes to the comprehension of the meaning of an artwork. In order to adequately perceive and understand such an art object, the viewer is often expected to have a fuller grasp of the textual explanation, as well as to participate in the creation of the artistic content.

The visual research is meant as a fresh and novel type of creative process, rather than independent scientific research conducted by an artist who does not have an academic degree in the relevant scientific field. For the digital and new media artist, creating a work of art or carrying out the artistic process in accordance with his or her idea takes precedence. The creative motivation of an artist and that of a scientist may vary. One must also take into account that (pre-existent) professional knowledge might determine the way the public, the artist and the scientist each perceive the visually expressed content of Digital or (New) Media Art.

This has led to the emergence of a new type of artist (or designer - architect) - theoretician - researcher - producer, who conceives his or her work as a project-process, carrying out a theoretical study on the subject, applying various technologies and involving a team of field experts and assistants in its realisation. As Robert Atkins wrote: "This role includes research, production, writing, graphic design and construction, designing interfaces, engaging the right people, and finding industrial collaborators." [14] The best of these examples are fascinating as new forms of art, not only as a process of technological research and its visual or multimedia interpretation.

[7] The author has chosen a collective name – 'the ghetto of Computer and Digital Art' to address a set of problems that cause the lack of originality characteristic of some works in this medium. The term applies to cases in which the author considers – in a traditional manner – the originality of his work or an original, unique idea as an essential component thereof.

9 CONCLUSIONS

The author analysed the way in which developments in the natural sciences at the beginning of the 20th century, along with other factors, have affected the development of several trends of modernism art that later were important for the first computer artists. They used these ideas to develop works, which have the elements of modernism, scientific visual language and information visualisation.

An original model was developed to narrate (a) the history of the cooperation between artists' associations, individual artists, representatives of different fields of science, engineers, technologists, scientific research institutions and commercial enterprises, and (b) how this cooperation in art and research projects facilitated the development of contemporary Digital and (New) Media Art phenomena.

Such phenomena in Latvia have been analysed in conjunction with the technologies, collaborative practices and regularities in science and art. E-LAB and RIXC introduced several new tendencies in the Latvian art scene by adopting the global experience and, since 1996, organising the new media culture festival Art + Communications. What is more, they published a journal/collection of conference articles entitled Acoustic Space. The above-mentioned activities, as well as the establishment of the Art Research Laboratory (*MPLab*) and the introduction of research as a component of the artistic process, expanded the creative range of art in Latvia.

An overview of the diverse expressions of Computer and Digital Art has provided sufficient grounds to conclude that there is a need to talk about the technologically determined specificities and characteristics of the visual language and aesthetics of this art. In the context of Latvian art we can speak about the impact of Cybernetics and aesthetic theories influenced by Cybernetics on the heritage of 'in exile' art. It has been concluded that the form of an artwork, as defined by Juris Soikans – a snapshot of the programmed process – is topical in contemporary Digital and (New) Media Art where the image develops as a dynamic system.

During the course of this research the author concluded that the general features characteristic of Computer and Digital Art are as follows: (a) data have become a specific means of expression of visual language and (b) the work of art has became a programmable multimedia file that develops as a dynamic system. However, like in some practices of contemporary art, it is difficult to define the aesthetic value and artistic contribution of the work in a traditional sense. Visual aspects no longer play a central role, and their dynamic nature should be taken into account.

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