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Between Technophilia, Cold War and Rationality:

A Social and Cultural History of Digital Art

A thesis presented

by

German Alfonso Nunez Adaid

to

The University of the Arts London

in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

in the subject of

Art History and Theory

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United Kingdom, London

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Abstract

Supervisor: Michael Asbury – Author: German Alfonso Nunez Canabal Adaid

Between Technophilia, Cold War and Rationality:
A Social and Cultural History of Digital Art

Evoking his early personal experiences, computer art pioneer Paul Brown wrote in the mid-1990s that to work with computers was akin to a ‘kiss of death’. According to him, as a result of sheer prejudice, the majority of people in the art world did not acknowledge such artworks as interesting, valid or important. Although recurrent in the literature concerned with such art, Brown’s claims must be confronted with the relative success of artistic practices interchangeably labelled as computer, new media, cybernetic, electronic or simply digital art. However, as attested by this proliferation of labels as well as by the development of numerous dedicated awards, degrees, galleries, museums, awards and publications, the success of such practices cannot be explained by artistic merit alone. Since many in the art world do not accept these artworks, as Brown and others suggest, how can we explain the works’ success in securing and developing their own space over the course of fifty years? This thesis investigates the emergence, development and institutionalisation of the field termed here as ‘art, science and technology’ (AST) between 1965 and the mid-1970s in Europe and North America. Also recognised by the aforementioned labels (among others), AST is an umbrella term that arguably designates the artistic practices interested in the adoption, theorisation and dissemination of post-war technologies and, particularly, information technology. Yet, despite this shared interest, here I argue that it is the particular institutional arrangement of AST that best distinguishes it from other artistic practices. A direct consequence of its rejection, AST’s emergence as a separate field is here explained via a revision of its initial social and cultural contexts. Arising from the technophile cultural climate of the long 1950s, and alongside the massive investments in technology made by Western governments in the same period, early AST developed not within traditional artistic spaces but within industries and universities. In the late 1960s, however, with the rise of economic, political and social uncertainties alongside escalating international conflicts, it became increasingly difficult to justify an art produced with the tools and support of the military–industrial complex. If on the one hand artists such as Brown understood these new artworks as central to art and its history, a normative development of a new technological era, on the other hand opponents located at the centre of contemporary art lambasted these new artworks for their supposedly scientific, commercial and aesthetic pretensions. Differently from previous attempts aimed at justifying the artistic worthiness of art produced with post-war technology, this thesis presents the history of such practices from the point of view of its own struggle – that is, its fight for survival. Ultimately, here I explain and describe how AST became detached from art while claiming its status. This is an effort not interested in the merits of these practices per se but, instead, concerned with AST’s development as an autonomous and prosperous field.
Eu dedico esse trabalho
a minha mãe, Sonia,
ao meu pai, German,
e a meu irmão Marcello.
Acknowledgements

First of all, I would like to thank Michael Asbury for his questioning and support, both as a friend and as a supervisor, over the course of this long work. Not many would have handled my unceremonious behaviour for as long as he did. Even though mine is an idiosyncratic work, Michael argued for me over and over again. Michael has managed the impossible: to be a leader in his field while being a humble and helpful scholar. I am certain that his generosity is unmatched in the arts.

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I would also like to note the contribution of Nicolau Centola, an incredibly talented artist and sharp scholar, who helped me realise the inconsistencies of artistic and political discourses. His dinners are filled with epic and enlightening moments. I would also like to thank the meninos of [+zero] for showing that art is not all about consumerism or glittering openings: this is play that should be serious and rewarding, not a job.

I also note contributions from Frieder Nake, Ernest Edmonds, Anna Bentkowska-Kafel, Simone Gristwood, Francesca Franco, Arno Görgen, Heiner Fangerau, Michael Hauskeller, Aquiles Pantaleão, Isobel Whitelegg, Carlos Tadeu Siepierski, Andrei Thomaz, Jonatas Poltronieri, Regis Frias and many others. Some I have known for years, others are more recent colleagues, yet all contributed to this work.

Last but not least, I thank Dayane, my partner and the mother of Júlio, the best and most loving son one could ask for. Dayane’s patience and support throughout my continual absence and seclusion made this work possible.

Thank you all.
Foreword

I like to think (and the sooner the better!) of a cybernetic meadow where mammals and computers live together in mutually programming harmony like pure water touching clear sky.

I like to think (right now, please!) of a cybernetic forest filled with pines and electronics where deer stroll peacefully past computers as if they were flowers with spinning blossoms.

I like to think (it has to be!) of a cybernetic ecology where we are free of our labors and joined back to nature, returned to our mammal brothers and sisters, and all watched over by machines of loving grace.

Richard Brautigan, *All Watched Over by Machines of Loving Grace* (1967)

I don’t care how God-damn smart these guys are: I’m bored.

It’s been raining like hell all day long and there’s nothing to do.

Richard Brautigan, *At the California Institute of Technology* (1967)
Introduction: The emergence of art, science and technology

On its website, one British university offers a BA course where the student is invited to ‘shape the future’, to ‘break down barriers and see things in a new way’, to be ‘ready for wherever this rapidly evolving industry will take you’ (Plymouth University, no date). Its graduates, it claims, rank among ‘the world’s best game designers, digital artists, web designers, coders and creative thinkers’ (Plymouth University, no date). Another university, which offers a similar BA, tells the prospective student that its ‘is an entirely new, innovative and sharply focused approach to the practices and issues surrounding contemporary digital art’ (University of Wales Saint David, no date). Here, we are told, one is also ‘ready to shape the digital landscape of the future’. Other similarly titled BAs, while not necessarily boasting about the future importance of digital technologies and digital industries, remind the reader that those have already ‘had a tremendous impact on all forms of communication in the 21st century’ (University of Kent, no date) and that they ‘occupy an increasingly important role in our lives, changing how we live, work, and play’ (Canterbury Christ Church University, no date).

Despite their obviously dull rhetoric, and apart from the emphasis on technology and its future and actual promises, something else connects these courses: they are all self-described as bridging two worlds, one artistic and the other industrial. Resembling a discourse perhaps mostly remembered in the arts as ‘bauhausian’ and echoing the calls professed by the ‘two cultures’ debate (Snow, 2000), on the one hand these courses are designed to help students to work with logic, industry and computing techniques and on the other hand they wish to provide students with freedom, creativity and, finally, artistic skill. The end result is a student who is either prepared to face both worlds at once, within a ‘new media’ (University of Wales Saint David, no date) or a ‘digital creative’ industry
(University of Greenwich, no date), or the artistic world itself. In these BAs you should be able to ‘improve your understanding of the principles of art and design, your aesthetic eye’ (University of Hull, no date); combine ‘creative and technical skills with cultural and new media theory’ (Plymouth University, no date); ‘learn about the application of digital technologies in a creative context’ (Kingston College, no date); and celebrate ‘the combination of creative and logical thinking’ (University of Wales Saint David, no date).

These BAs, all designated as digital art, are not alone. Another similarly designated course, this one a BSc and not a BA, tells us that ‘it integrates technical programming skills, theoretical and historical conceptions of art into a distinctively computational arts practice’ (Goldsmiths, no date). It too makes it clear that its ‘programme will develop you not just as a technical expert, but also as a creative thinker, allowing you to learn and explore through a combination of technology and imagination’ (Goldsmiths, no date). Despite being a bachelor of sciences and not art, this is also a course where the vocabulary of design, for example, is very much present. Other hybrids also lurk in the educational field. Let’s take another course, a joint BA/BSc degree, which titles itself not as ‘Digital Art’ but as ‘Imaging Art and Science’ (University of Westminster, no date). This course is based on the idea that we ‘live in a world saturated by images’ and ‘carry sophisticated technologies in our pockets’ that ‘capture private moments and share them publicly online’ (University of Westminster, no date). According to its observations, it tells us that we now ‘have access to a visual world previously unimaginable; medical imaging making visible the hidden; warfare conducted via imaging technologies; reality itself increasingly mediated, augmented, and even replaced by images’ (University of Westminster, no date). In a rather prophetic and alarming tone, it rhetorically asks its reader: ‘how do we discern that what we see is real, imagined, translated, visualised or manipulated?’ (University of Westminster, no date).

Obviously and unfortunately the text does not provide us with an answer to this apparently very pressing question. Hinting that the answer will be unveiled during its
three-year course, it nevertheless tells us, similarly to all previous degrees, that it ‘examines the visually rich and complex world of imaging from multiple perspectives of art, science and technology, in a dynamic, creative and interdisciplinary environment’ (University of Westminster, no date).

By further investigating the prospectuses of these degrees, it becomes clear that these are not classic fine art degrees in any sense – and I have the feeling that the majority of their graduates would much prefer the riches of the new industry anyway. Let’s take again, as an example, the Goldsmiths BSc, which seems at times more concerned with industry than the arts (and vice versa). Some of its basic subjects, intended primarily for first-year students, cover topics such as ‘Introduction to Programming’ (30 credits), ‘Mathematics for Problem Solving’ (15 credits), ‘Audio-Visual-Computing’ (15 credits), ‘Critical Studies in Computational Arts’ (30 credits) and so on (Goldsmiths, no date). The combination of commercial and artistic vocabulary is further intertwined over the subjects themselves. Whereas ‘Critical Studies in Computational Arts I […] aims to offer a space for exploring and examining the historical and critical context in which art is made, seen and understood’, another module, ‘Computational Arts Practice’, while still focused ‘on fine art practice’, finds its rationale within the idea that ‘software development, digital art and design and e-commerce have been noted for the predominance of independent thinkers, often self-employed’ (Goldsmiths, no date). The emphasis on artistic knowledge is made yet more puzzling in the ‘Skills and Careers’ section of the same BSc. There students are told they could work with film/TV special effects and post-production, as visual interface designers, as computer graphics designers, as video game developers, in music production, in multimedia systems analysis, in the media and entertainment industries, as mobile app developers, as web developers, as computer music/sound engineers, as interface designers or as database managers. It seems like a dream degree for any whizz kid immersed in the so-called digital world. Perhaps – with a certain dose of cynicism – it is indeed a dream. Nonetheless, as another degree
clearly posits, ‘an industry needs creative digital artists to cultivate rich combinations of hybrid skills, as well as a broader cross-disciplinary awareness’ (University of Wales Saint David, no date).

By promoting an imagined future via a technophile narrative – the necessity of multidisciplinary learning, with elements of both industry and art – these degrees contribute to a field that has been in existence for at least fifty years. Originating from an aspirant artistic practice that yet sits at the margins of the art world today, all these rather technical and commercially oriented degrees have in one way or another repeated the mantras of this field, and it, in return, has matured well beyond a humble, small and eccentric fragment of art. Supported by industrial giants such as Google and IBM; taught in renowned universities; discussed in specialised museums, festivals and awards, this field, in which I have participated for at least seven years as an insider, as a ‘digital art’ practitioner, is not, despite its best efforts, seen as artistic or, against the will of many of its participants, central to artistic debates.

This thesis, following my own intuition regarding what it means to be a digital artist, corroborates the apprehension of what one of the pioneers of the field, Paul Brown, labelled as the ‘kiss of death’ (Brown, 1996), or the incapacity, even ‘prejudice’, of the ‘mainstream art world’ against ‘any creative soul who experiments beyond the boundaries they prescribe’ (Brown, 1996) – in short, the incapacity of the art world to accept artworks that are dependent on computers. Despite diminishing over the past decade, it is this same incapacity and indifference that, in many ways, enthused this research. It was in my MA in digital art, undertaken right after a postgraduate diploma in fine art, where it seemed most accentuated. Despite sharing the same building, students of fine art and students of digital art simply did not see eye to eye: their interests, methods, concerns, references, career paths, exhibitions, mannerisms and, unsurprisingly, their artworks were very, very different. To me as a young scholar still in my mid-twenties, that division was astonishing: How could two groups that theoretically play the same
game, of art, be so distant from one another? How could the mutual suspicion exist if, in fact, these groups did not know each other at all? How could it be that they are both right, that both approaches, certainly, are art? In time it became clear that, despite some occasional intrusions on each other’s turf, the difference between mainstream contemporary art and this digital field runs deeper than mere incompatibility of vocabulary or artistic methods.

Hence, this thesis investigates the emergence and insularity of the artistic field designated here as ‘art, science and technology’ (AST), between its first public appearances in the 1960s and its institutionalisation in the 1970s, both in Europe and in the US. Also recognised today by labels such as digital art, art and technology, new media art, art and science, computational art, electronic art, cybernetic art and telematic art, AST is an umbrella term that arguably designates the artistic practices interested in the adoption, theorisation and dissemination of post-war technologies and, particularly, information technology. Yet, despite this interest in non-traditional methods and materials, here I argue that it is its institutional arrangement that best illustrates the boundaries between AST and other artistic practices.

The rationale for this assertion, focused on the networks of artistic production, instruction and dissemination, rather than styles or materials, is straightforward: the proliferation of labels that have attempted to unify the field over its fifty-year history are proxies of past failed attempts. If, on the one hand, the stylistic heterogeneity of these artworks renders any aesthetic criteria restrictive, on the other hand the quick and pervasive technological development of information technology decrees that most of the art produced today can be seen, at least partially, as digital, electronic or new media art. In other words, these two discerning methods, stylistic and medium-specific, are respectively too limited and general to offer any analytical value.

It is here, then, that the methodological worthiness of AST is most clear. Since it designates practices that circulate within a certain arena, its borders are the same as those
of the very institutions that promote AST. This definition, then, constructs a term that does not denote a movement or school of thought – that is, neither a defined style nor a medium-specific practice. As such, AST is the very specialised site, the world, where those artworks are discussed and seen. Ascending after the counter-cultural shift of the late part of the 1960s, from an optimistic technophile cultural climate towards a pessimistic technophobe one, this institutional split between AST and other artistic practices resulted internationally in an isolated, peripheral and highly specialised field that is, above all, highly autonomous in relation to contemporary art.

In order to explain this autonomy, I propose a method that steers away from the phenomenological, formalist or art historical methods, which have failed to explain the conditions and results of the partial success of AST, which has simultaneously been disregarded by contemporary art circles yet grown in size over the years. As this thesis is not interested in the merits of AST but, instead, is concerned with its emergence and development, I propose the adoption of a sociologically inspired method that is closer to my concerns. With that in mind, it is important to remember that my work does not contribute to debates regarding the qualities and particularities of AST. My method, concerned with individuals and institutions as well as AST’s discourses and internal politics, cannot discern what it is that makes good or bad art. Likewise, although the thesis itself is historical, it is neither a traditional art historical work, in the sense of placing these artworks within a canon, nor a traditional sociological work, concerned more with society at large than the artistic practice itself. This limit, which is a consequence of my efforts to attempt to explain the emergence of a group of people interested in the development of a new practice, should hence always be in the mind of my reader.

Having said that, it is it difficult to understand the value of the term ‘AST’ without applying it to case studies or examples. Whereas the first third of this thesis is dedicated to the discussion of my method, it is the other two thirds in which AST itself is
discussed. Yet, since a total history of anything is an impossible task, I dedicate my efforts to moments that best exemplify the tension between contemporary art and AST, as well as events that point to their separation and, consequentially, the eventual formation of specialised AST institutions. My emphasis on AST’s very beginnings is not, then, arbitrary. It is there that we find both the material and cultural context that made art with computers possible. Unfortunately, for the newly emerging practice, these conditions would, by the end of the 1960s, completely change. As we shall see, in a short space of time, between 1965 and 1971, with worsening economic conditions, the prospect of nuclear annihilation, the Vietnam War and the rise of the counter-culture and its varied social movements, many of AST’s pioneers would abandon the field. was is the people who stayed and persisted, despite growing resistance from the specialised art press and a technophobic cultural climate, who would inaugurate the first institutions. It is not a coincidence, then, that some of these, such as the journal Leonardo, are still central players in the development of AST.

At this point we should note that, although this thesis does not investigate recent developments, we are able to see the results of AST’s tumultuous early years in its current insularity. Despite the efforts of some brilliant artists – and perhaps against their own opinions – I expect to demonstrate how far AST is from contemporary art by not only showing the development of its institutional autonomy but also highlighting the particularities of its own discourse. Originating in its early days, a legitimatory component – common to any artistic product that attempts to justify its raison d’être, its worthiness as valid artistic expression – can currently be seen in a variety of sources, including in the university adverts and prospectuses seen above. Employed, for example, by degrees that are usually associated with industries rather than the arts, this discourse and its relation to matters not necessarily considered traditional artistic topics are, then, pivotal in explaining the field’s current state. Here the choice of the focus of this introduction is made clear. After all, there is an important reason to consider what adverts
for degrees have to say. While not all students may become artists, the institutions that instruct them are intimately connected to those of our subject, AST – and not only by their titles. It is via these degrees that, generally, AST’s newcomers are taught the habits, concepts and values of their future profession, either in AST or in industry.

The optimistic discourse professed by these degrees, technically oriented while proclaiming the subject to be creative, even artistic, is shared by many current institutions of AST. Let us use as an example two of the oldest institutions concerned with the training of these new artists/industrialists/scientists: MIT Media Lab and Plymouth’s Planetary Collegium. Apart from the obvious but nevertheless pivotal fact that both are university-based research centres, it is noteworthy that these are both advertised as ‘transcultural, transdisciplinary’ (Planetary Collegium, no date) or as ‘antidisciplinary [and] beyond known boundaries and disciplines’ (MIT Media Lab, no date). Moreover, similarly to the BA and BSc degrees described above, both centres worry about the future by, ironically, celebrating it. Picturing a new, better and improved society invariably changed by new technology, they tell us that at ‘the Media Lab, the future is lived, not imagined. In a world where radical technology advances are taken for granted, Media Lab researchers design technologies for people to create a better future’ (MIT Media Lab, no date). Likewise, at one of the Planetary Collegium ‘nodes’, ‘while stretching to the full the constructive and expressive potential of electronic, telematic, and interactive digital media’, this research centre ‘pursue[s] developments in post-biological research, molecular engineering, neuroscience, and nanotechnology, while identifying artistic and spiritual strategies that optimise human capabilities, and seed new visions of a planetary society’ (M-Node, no date). Yet, despite their shared technophilia, these institutions sit at rather different points on the artistic and industrial spectrum and, in essence, reflect the different natures of their founders: Nicholas Negroponte and Roy Ascott. Negroponte, an architect and entrepreneur famous for his ‘One Laptop per Child’ project, favoured an institution not shy of corporate links and goal-oriented projects. However, usual for an
AST institution is that, at the same time that MIT Media Lab boasts patents, solutions, faculty awards and an annual operating budget of $50 million, it also considers among its achievements exhibitions in places such as MoMa, the Boston Institute of Contemporary Art, the Venice Biennale and ‘many commercial and non-profit galleries’ (MIT Media Lab, no date). The Planetarium Collegium and its nodes, while less excited about commercial or industrial links as such, follows Ascott’s academic tendency towards imaginative and speculative research, outputted nevertheless as traditional articles, books, journals and degrees. It is unsurprising, then, that Ascott is considered more as a pedagogue than an artist, mostly concerned with art as education for a future world, as exemplified by his Groundcourse work at Ealing Art College in 1961 and as a direct consequence of his teachers the Basic Design course of his teachers Hamilton and Pasmor (Mason, 2009, p. 250). With those differences in mind, we can think of the two institutions/founders as complementary and hence ‘both the Media Lab and Nicholas Negroponte would become leading emblems of the techno-social future’ (Turner, 2006, p. 181) while ‘Ascott’s visionary theory and practice aspire to enhance human consciousness and to unite minds around the world in a global telematic embrace that is greater than the sum of its parts’ (Shanken, 2003, p. 1). Irrevocably, they are supporters of a new society enhanced, controlled (MIT) and connected (Planetarium Collegium) by technology.

An optimistic emphasis on the future and its technologies, a combination of artistic and technoscientific discourses, and a focus on interdisciplinary learning: these were not only part of a new industry but also integral to the development of AST, as explored by this thesis. The brief examples discussed in this introduction are merely the most common and routine aspects of AST. Yet, while informing a new generation of digital, new media, electronic and computer artists, these degrees and institutions, in a very concrete sense, produce the future agents of our field. Regarding the state of the field itself, it is enlightening to follow the rationale of Bourdieu, for whom the field of art
is characterised by two principles (Johnson, 1993, p. 16; Tudor, 2005, p. 126): the ‘heteronomous’ and the ‘autonomous’. Together these form a structuring ‘double hierarchy’ where the former negatively subjects artists to the ‘ordinary laws prevailing in the field of power […] (e.g. sales, honours, appointments etc.)’ while the latter is a positive force in which artists seek to ‘achieve total autonomy with respect to the laws of the market […] (literary or artistic prestige)’ (Bourdieu, 1993b, p. 38). This potentially unholy combination between industrial/commercial concerns and artistic independency is then intrinsically manifested elsewhere: from specialised publications to AST’s own internal awards, and from dedicated degrees to AST’s inability to be rendered into the artistic canon. This dissonance with the hierarchal principles of the art field, as I demonstrate, is one of the aspects responsible for the failure of AST to be recognised as a prestigious, serious and central artistic practice. Initially nurtured within an industrial setting, by attaching itself to the development of computational technologies and by promoting an outmoded discourse favouring rationality and scientism, AST survived its early years and developed into a powerhouse in its own right while simultaneously being relegated to a peripheral artistic position – that is, a mere curiosity, important for industry but not so much for contemporary art.

This thesis is divided into three chapters and a conclusion. The first chapter examines the epistemological assumptions regarding the method employed here. In other words, I examine two concepts borrowed from sociology that are central to my text. Firstly, I begin by seeing art as the result of collective action – that is to say, rejecting any formalist or essentialist understanding of art. Secondly, I investigate the similitude between artistic worlds and social movements via the sociological literature, which sees both as collective social developments sharing many distinct features: frames, discourses, institutions and a quest for necessary resources. The second chapter traces the origins of AST, which initially developed from computer art and promoted a technocratic, rational formalist and pseudo-scientific view of both art production and perception. Moreover, in
the same chapter I investigate the material and discursive links that made possible this first wave of AST: its close relationship with the material world of the post-war and Cold War eras and its cybernetic dream of full control and predictability. Finally, in the third chapter I follow the consequences of AST’s first developments; specifically, its uneasy relationship with the artistic world and its response to the social protests of the late 1960s and early 1970s, which resulted in its own specialised institutions. My approach to most of these points is comparative. By selecting particular events, sometimes from different national contexts, I contrast many particular events central to the development of AST as we know it today.

It is important to note that I am not attempting to write a canonical history of AST. Likewise, I do not wish to map the production of a whole artistic practice over a period of more than fifty years; nor do I want to propose a unified aesthetic and theoretical discourse that unites what in reality is a very heterogeneous field. Instead, the aim here is to provide both a framework and a case study of how art worlds develop and mature into their own particular space while not necessarily being placed within the larger world of contemporary art. I conclude this thesis by painting a picture of an artistic field still evolving from the configurations of its earlier days: too detached from contemporary art and too preoccupied with its own futuristic visions.
Chapter 1: Method, scope and rationale

This first chapter has the intention of delimiting both the method and scope of this thesis. Beginning with an examination of some key authors who inform much of my rationale, I provide a brief and most certainly incomplete introduction into the core idea of art as a product of collective activity. This perspective, which is not necessarily in concordance with more essentialist or formalist ideas of art (i.e. it does not automatically assume the artistic output of a group of people is art, nor does it believe in some transcendental/universal quality of art) is derived mainly from the sociological work of authors interested in the production, dissemination, assessment and construction of that which we label as art, or, more broadly speaking, culture. The reason for such a method is the result of a series of questions both simple and naïve: What is it that makes the field of AST so particular? Why are the products of this group of people not seen, commented or known by people who are theoretically part of the same sphere, of art? Why are the participants in this world unknown to people outside it and why are they superstars for their own peers? Why do they label their works as art? In order to answer these questions from an art historical perspective, I would need, invariably, to construct a theory that justified AST as art within already established canons and debates. The result might resemble the existing works by very competent scholars but, like those works, it would be too focused on its own legitimation, too detached from the social world that art inhabits and, ultimately, would fail to address the question of why it is detached in the first place. Why should one investigate AST as a traditional artistic field if it is not one? The answer, this thesis argues, lies not with art and its canon but, instead, with people themselves: How do they organise groups? How do they justify their actions? How do they describe their work? How do they see themselves in relation to others?
At this point it is important to anticipate the confines of my research. Although non-Western AST artists appeared right after the first exhibitions of computer art, most of the newly created institutions were still centred in nations such as the US, Germany and the UK. While this narrative can be seen as Western-centric, we cannot forget that it was within those nations that the production of most AST was commented on and discussed. Journals such as Leonardo (France and the US), associations such as the Computer Arts Society (UK) and publications such as Studio International (US) held considerable sway over the early field. Despite some recent efforts dedicated to unearthing the production of artists and their groups outside these nations, some of which will be discussed further in this thesis, the central fact remains that AST’s early history has been established as a primarily Western phenomenon. Seen in better detail in my second chapter, this Western emphasis cannot, however, be seen as a prejudice or oversight of historians – at least for early AST. As argued latter in that chapter, it was within these nations that artists found the appropriate material conditions for an artistic practice centred in what was then high technology. Hence, we cannot forget that, up to the mid-1970s, digital computers were not only rare but also incredibly expensive; the specialist knowledge required to operate them was not, under any circumstances, easily found.

Yet, having said that, the same benefit of the doubt cannot be given to the incredible oversight regarding gender in these first few years. While many female artists were active participants in the first years, much of their contribution has been sidelined in the academic productions discussing the early days of AST. Although there has been a movement towards reasserting women’s history and contribution since, at least, 1993 (Malloy, 2003; Taylor, 2013c), damage seems to have already been done. Ironically this oversight may have happened a posteriori, later in the development of AST. According to Taylor (2013c), despite the androcentric character of computing and its industry in the late 1960s, given its rapid development, this industry was a place where talent was in high demand. For him what explained the disappearance of women from the history of
computer art was not the elusiveness of gender equality in computing but, instead, the very kind of artistic orthodoxy that also shunned computers in the first place; that is, ‘while women artists had to endure unwelcome masculine behaviours in the vanguard of computing, those experiences were often minor compared to the highly gendered impasses found in the artworld’ (Taylor, 2013c)\(^1\). All in all, then, my thesis reflects today’s readings of AST: A male-dominated Western-centric field that, despite some advances, still reverberates with previous oversights.

This chapter additionally discusses a different kind of problem, away from the questions of gender, nationality and the collective nature of art. It will explore the variety of, sometimes opposing, definitions of AST itself. Variously referred to as digital art, computer art, electronic art, new media art, technoscience art and so on, the productions of people pertaining to this small and detached art world have over the years acquired myriad different narratives, some concerning such art’s relationship with ‘traditional’ visual art; some more interested in its own particular developments. Although much has

\(^1\) Regarding the issue of gender in AST, one major project should be commented on here. Edited by Judy Malloy (2003), the book *Women, Art and Technology* has an extensive list of contributors and thoroughly discusses the subject of gender in AST. Yet, having said that, as Taylor (2013c) realises, this effort is still very much dedicated to more recent developments and not, as we may expect, at revising the field’s understanding of the contributions of women in early AST. A definitive work in this area is, then, still lacking. A great place to start may be Melanie Lenz’s (2014) article in the *V&A Online Journal*. There, using the museum’s own collection, she briefly but competently contextualises the production and importance of some female pioneers, discussing people such as Lillian Schwartz, Vera Molnar and Katherine Nash. We should also note that the V&A collection on computer art, which is perhaps the most important collection in the whole field, has been constructed with the help and donation of Patric Prince, one of the few historians who actively collected early AST works. It is interesting to me that not much has been written about her contribution. Despite the fact that this thesis does not attempt to remedy this gap in our knowledge of early AST, one female character features heavily in its pages: Jasia Reichardt. She will be a very present and recurrent character in the second and third chapters.
been clarified by previous scholarship, much is also missing. The particular problem of AST is not related to its legitimacy as an artistic practice. Following my initial premise, that art is the result of collective action – at least for active participants, institutions and theorists within the field – the question of the validity of AST is not any more a worthy question. For something to be called an artistic practice, it is only necessary that a group of people consensually think it to be so (and that another group funds this first one).

Hence, I will review some of the claims made by people attempting to coherently describe the artistic production of AST. Unsurprisingly, the people who agree over its merits, as art, are the same people who engage in the work of defining this practice according to the methods and theories seen in traditional art history. They look at patterns – aesthetic, theoretic and discursive ones – that may unite the work of a heterogeneous group of individuals, with the intention of locating a whole multitude of objects as belonging or not to any of the aforementioned labels. In this sense, this thesis represents a much humbler attempt to define AST: if your work is treated as such, as AST, then you are already part of the debate. If you publish within its journals, you belong to AST. If you show your artworks under its banners and at its festivals, you are an AST artist. If you have studied in one of its specialised courses, either as an undergrad or as a postgrad2, if you are interested in and use its tools, you may already be part of it. This simplistic yet powerful method has the advantage of looking at the field from a more unbiased perspective. It does not wish, then, to legitimise the production of these artists as art (although, as discussed later in this text, it may do so regardless). Neither does it want to group the works of individuals under a set of stylistic, aesthetic characteristics. To be part of AST, you must simply be part of its debate: engage with its concerns, support it via your very presence at its exhibitions, read about it etc. Having said that,

2 Just for fun, go to Google and type ‘BA’ or ‘MA’ and one of the following: ‘digital art’, ‘new media art’, ‘art and science’, ‘media art’ or ‘electronic art’.
AST is not a free-for-all world where anyone can partake as an active member. One thing is critical in order to contribute, both intellectually and artistically, to this world: to be engaged with the technologies developed after the Second World War. If you are familiar with either computing or technoscientific lingo, congratulations! You may well be able to join the group. This lack of artistic definition, of a stylistic definition of a group, allows us to see AST for what it is: a detached and autonomous artistic world, full of internal histories, inconsistencies, institutions and conventions like any other art world.

Finally, in this chapter I also prepare the ground for my idiosyncratic analyses. By presenting some of the key concepts employed throughout this thesis, many of them borrowed from the literature concerned with social movements and their tactics, I intend to allow both myself and the reader to concentrate on the details of AST’s history, from its humble beginnings to its emergence as a whole industry in itself. To do otherwise would be counter-productive. It would continually break the narrative, which is the most important aspect of this work. It is not (only) an art historical narrative but one concerned with the development of a group of people and a set of ideas that originated the strange world of AST that we know today.

### 1.1 Episteme: Art as collective action

People today do not commonly refer to the art world as a world for no reason. Art, after all, is perceived to be an independent, somewhat self-contained and detached sphere of social practices. This idea of art presented as a partially independent sphere of social practice has been discussed, affirmed and debated before. This section reviews some of the authors who have greatly contributed to the term (art world) as well as the debate regarding art as a collective activity. Varying greatly in emphasis and methods, these authors do, however, share one main argument: that art is only made possible by the
interaction of individuals who act in favour of a set of practices called art. It is quite obvious that art’s consumption, creation, education and organisation all depend on collective, organised efforts. But that is not the whole story. What these authors see is that the same collective process determines not only the material organisation of art but also its value and, consequentially, art history itself. The resulting picture portrays a local instead of a universal phenomenon; a punctual instead of a timeless event; a fragmented world where the game of power between ideas, participants and institutions is constantly reconfiguring the very space inhabited by them. Furthermore, as our first author and subject remind us, these inhabitants are not randomly contributing to the thing that we call art. Not only do they act within relatively defined boundaries but they are also informed by something before their own experience. At least for Pierre Bourdieu, that was the case. In his Rules of Art (1996), a book that builds from his earlier works but especially from Distinction (1984), the French sociologist describes the emergence of what he calls the ‘literary field’ within the aesthetic project of Gustave Flaubert’s novel Sentimental Education (1869). I shall examine the main points concerning the independency of this field (and its own definition) as well as its relation to another characteristic typical of social practices like the arts: power and its legitimising properties. A ‘science’ of the literary field, Bourdieu defines elsewhere, could be defined as:

a form of analysis situs which establishes that each position – e.g. the one which corresponds to a genre such as the novel or, within this, to a sub-category such as the ‘society novel’ […] or the ‘popular’ novel – is subjectively defined by the system of distinctive properties by which it can be situated relative to other positions; that every position, even the dominant one, depends for its very existence, and for the determinations it imposes on its occupants, on the other positions constituting the field; and that the structure of the field, i.e. of the space of positions, is nothing other than the structure of the distribution of the capital of specific properties which governs success in the field and the winning of the external or specific profits (such as literary prestige) which are at stake in the field. (Bourdieu, 1993b, p. 30)
This literary field, for Bourdieu, is markedly political. More than merely a reunion of people involved in a collective project, this is a space of conflict, where interdependency is a fact. ‘High art’ is just high because there is something underneath it. Bourdieu’s conception of fields, therefore, assumes a fragmented existence: one presenting a hierarchy of value that is consequentially reflected in material gain for a specific genre. In this game\footnote{The ‘game’, a recurrent theme on Bourdieu’s oeuvre, can be seen as an ingrained, socially determining mode of being in which agents of cultural and intellectual fields partake. This game, however, is not without objectives; it is not 	extit{play}: ‘To enter a field (the philosophical field, the scientific field, etc.), to play the game, one must possess the habitus which predisposes one to enter that field, that game, and not another. One must also possess at least the minimum amount of knowledge, or skill, or “talent” in the most advantageous way possible. It means, in short, investing one’s (academic, cultural, symbolic) capital in such a way as to derive maximum benefit or profit from participation. Under normal circumstances, no one enters a game to lose’ (Johnson, 1993, p. 8).} legitimacy is crucial to the existence of a particular art genre (practice, form, field...). The game, played by agents within the field (the artist, the critic, the historian...), is inevitably surrounded by the question of ‘definitions’ (Bourdieu, 1996, p. 223). Similar to the action exercised by this very text, the capacity of naming or defining is undoubtedly related to power. Paraphrasing Bourdieu, the struggle is not about who is the writer, for example, but about what the writer is (1993b, p. 42). Art, or the artistic field, is not a completely separate world, though. While Bourdieu acknowledges the existence of art’s own internal structures, values and codes, he also reminds us of its own relation to local and timely contexts. When he conceptualises this field of cultural production, he is relating it to a larger, broader field of power. This field of power, for him, is ‘the space of relations of force between agents or between institutions having in common the possession of the capital necessary to occupy the dominant positions in different fields (notably economic or cultural)’ (Bourdieu, 1996, p. 215). While it does not necessarily take a lot of thought to understand this field of power as the various
dominant portions of society (e.g. the political elite, the intelligentsia, the academic elite),
each with its own internal structures and resources, Bourdieu actually makes a distinction
between these different forms of force exercised by the field of power:

A field of possible forces exercised on all bodies entering it, the field of power is
also a field of struggle, and may thus be compared to a game: the dispositions,
that is to say the ensemble of incorporated properties, including elegance, facility
of expression or even beauty, and capital in its diverse forms – economic,
cultural, social – constitute the trumps which will dictate both the manner of
playing and the success in the game – in short, the whole process of social ageing
which Flaubert calls ‘sentimental education’. (Bourdieu, 1996, p. 10)

Economic, political and cultural capital are all concepts that have been expanded and
popularised over time. Given its complexity, here I prefer to just refer to the results of
these forces as resources, whether material or otherwise (I shall talk more about these
later on). This relationship between Bourdieu’s literary field and the field of power, if one
could summarise it, is one of dominance and subjugation; its spoils are resources that, in
turn, can be translated into more power. Relating the emergence of the nineteenth-century
literary field to its economic and political context (an exclusively French one), we can see
the exchange between the field of power and the field of cultural production. At the heart
of this tension lies the idea or the concept that from that moment there was a shift in the
very economic order, resulting not only from the rise of the bourgeois but also from new
modes of economic and political power being created by the Second Empire’s industrial
expansion (Bourdieu, 1996, p. 48). This new economic reality, in conjunction with the
consequent change in the social order (the rise of the bourgeoisie), was about to change
not only the relation between artists and their financers but also the relation between art
and the dominant classes of the period. Bourdieu reminds us that, at the time, cultural
producers were

far from the learned societies and the clubs of aristocratic society of the
eighteenth century, or even the Restoration. The relationship between cultural
producers and the dominant class no longer retains what might have
characterized it in previous centuries, whether that means direct dependence on
financial backer (more common among painters, but also occurring in the case of writers), or even allegiance to a patron or an official protector of the arts. (Bourdieu, 1996, p. 49)

For Bourdieu, then, the new field of cultural production, following its newly acquired productive ‘independence’, needed to realign itself in order to survive. If the old methods of financing were being supplemented by different forms of artistic backing, mainly by means of new markets and industry (Bourdieu, 1996, p. 49), it was only natural that, while certain connections presented between the artist and their backers were severed, others were created. When Bourdieu talks about the subordination of one field (of cultural producers) in relation to another field (of power), he talks mainly (but not exclusively) about economic and material subordination. The autonomy described by Bourdieu (which is similar to that which exists today) may come at a price. However, it enables the emergence of a different sort of capital before only ascribed to other fields outside the scope of the arts: cultural capital. The logic of this system, of symbolic exchange, between the field of power and the field of cultural production, can be summed up in a sentence: artistry (as conceptualised by Flaubert and his contemporaries) is inversely proportional to its economic value. While artists ought to survive, they should not intend to sell their art (themselves) to others because it, like all good art, is both priceless and worthless at the same time⁴.

⁴ In his own words: ‘The symbolic revolution through which artists free themselves from bourgeois demand by refusing to recognize any master expect their art produces the effect of making the market disappear. In fact they could not triumph over the “bourgeois” in the struggle for control of the meaning and function of artistic activity without at the same time eliminating the bourgeois as a potential customer. At the moment when they argue, with Flaubert, that “a work of art […] is beyond appraisal, has no commercial value, cannot be paid for”, that it is without price, that is to say, foreign to the ordinary logic of the ordinary economy, they discover that it is effectively without commercial value, that it has no market. The ambiguity of Flaubert’s phrase, saying two things at once, leads to the uncovering of a sort of infernal mechanism,
As in the theology of fasting, the good artist (for Baudelaire, Flaubert and their circle) can and should only have remuneration ‘necessarily deferred – as opposed to the “bourgeois artist”, who is assured of an immediate clientele, or to mercenary producers of commercial literature’ (Bourdieu, 1996, p. 82). The paradoxical situation of the newly created modern artist is, hence, one of economic disposition. By effectively renouncing immediate economic gain, the artist, in this view, can concentrate solely on their work. And it is at this point, and only then, that art responds merely to its own rules and to the necessities that art and that artists are perceived as free. With its autonomy assured, the field of cultural production (or at least the good, legitimate part of it) would assume a symbolically powerful but yet destitute position within society. This ambiguous relationship between the self-proclaimed real artist and their backer, a relationship of symbolic and economic exchange, is (un)resolved via the rejection of one part over another for, as we know, everyone needs money to survive. Bourdieu’s interest in Flaubert is justified in the fact that this is the very same situation presented to each one of Flaubert’s characters, from early adulthood to maturity, who navigate through the social world of their time in search of recognition, money and success for themselves and their art. Hence,

the sentimental education of Frédéric [the main character of Sentimental Education] is the progressive learning about the incapability between two universes, between art and money, pure love and mercenary love; it is the story of structurally necessary accidents which determine social ageing by determining the telescoping of structurally irreconcilable possibles which were allowed to exist in an equivocal state by the double games of ‘double existence’: the successive meeting of independent causal series annihilate little by little all the ‘lateral possibles’. (Bourdieu, 1996, p. 20–21)

which is set up by artists and in which they find themselves caught: making a necessity of their virtue, they can always be suspected of making a virtue of necessity’ (Bourdieu, 1996, p. 81).
Bourdieu, although tracing the development of artistic autonomy in the French artistic world, does not necessarily focus his *Rules of Art* on the question of production itself – that is, on art ‘as the products of collective […] efforts rather than as individual creations’ (Zolberg, 1990, p. 80). That, as Zolberg tells us, ‘is most closely associated with the approach of Howard S. Becker’ (Zolberg, 1990, p. 80). Likewise, ‘not only does he see changes in the meaning of art, but Becker posits the coexistence of a number of different art worlds, whose actors engage in the process of creating art *de novo*, by including and excluding works from the category as they define it’. Becker’s most renowned work, *Art Worlds* (2008 [1982]), as the title itself suggests, is interested not as much in the emergence of an independent artistic field as it is in the consolidation and production of our contemporary art and its multiple forms (hence ‘art worlds’ in the plural). If we say that Bourdieu’s work concentrates on the consumption of art, as well as how it creates and legitimises distinctions within class society (and within fields themselves), Becker instead looks at the field of cultural production itself and more importantly production of culture (art) itself.

*Art Worlds* starts with a discussion of the definitions of art as a collective enterprise. At this stage Becker reinforces the idea of interdependency between many of the artistic field’s participants, consciously or otherwise, in relation to the definition of art itself. An artwork, whether a play, a painting or a concert, involves not only artists but also producers, workers, institutions and resources not necessarily seen as part of the artistic processes themselves. The first thing to come out of this rationale is the importance of conventions in an art world. This is no small matter, for convention is what unites all disparate participants in the art world. Without it there would be no way to

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5 An act that I believe is in itself analogous to Bourdieu’s game.
collaborate unless every relationship were thought out anew and fresh, and, as we know, that is not the case. For Becker not only does the artwork itself appear as it is because of these overlooked connections but also it is perceived as such because of these very same connections. The quality of materials available to the artist; the installations provided by the exhibitor; the methods by which the artist’s show is promoted; the demographic composition of the public; the educational institution that trained the artist – these are all obvious but powerful examples of how and why external factors influence the reception of a certain artwork or artistic career. To believe otherwise, that these external forces do not have any effect on the arts, apart from being naïve, is similar to the act of levelling all institutions, materials and participants. If all resources were identical and abundant and all artists were similar, why would there be any need for competition in the art world? When we say that Becker is an author on the subject of production, it is because he seeks an understanding of how an artwork is produced, considering factors from its physical

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As Becker posits: ‘People who cooperate to produce a work of art usually do not decide things afresh. Instead, they rely on earlier agreements now become customary, agreements that have become part of the conventional way of doing things in that particular art world. Artistic conventions cover all the decisions that must be made with respect to works produced, even though a particular convention may be revised for a given work. Conventions dictate the materials to be used, as when musicians agree to base their music on the note contained in a set of modes, or on the diatonic, pentatonic, or chromatics scales, with their associated harmonies. Conventions dictate the abstractions to be used to convey particular ideas or experiences, as when painters use the laws of perspective to convey illusion of three dimensions or photographers use black, white and shades of grey to convey the interplay of light and mass. Conventions dictate the form in which materials and abstractions will be combined, as in music’s sonata form or poetry’s sonnet. Conventions suggest the appropriate dimensions of a work, the proper length of a performance, the proper size and shape of a painting or sculpture. Conventions regulate the relations between artist and audience, specifying the rights and obligations of both’ (Becker, 2008, p. 29).
entity to its intellectual reception. While there could be an argument that unites Bourdieu’s concept of habitus and convention (as Becker thought), it is important to note that the latter is focused mainly on the practical differences between the disparate participants of the art world. This can be seen, for example, in the explicit effort of thinking about materials in the same way Bourdieu thinks about actions and discourses – that is to say, thinking about material culture as learned and experienced.

This approach, while not in complete resonance with Bourdieu’s more holistic and broader view of art and society, does illuminate some aspects of the groupings of people, acts and institutions that constitute the arts (or at least our contemporary understanding of them). We could say, perhaps simplistically, that Becker’s approach is concerned with the inner workings of the artistic field inasmuch as it is interested in how these workings relate to the production of both an artwork and its own self-perceived value. Becker does acknowledge, for example, art’s dependency on external resources. The difference here is that Becker does not necessarily equate these resources with an external field of power, apt for categorisation and ready to distribute resources. In fact for

7 That is, ‘When a particular convention can be taken for granted, when almost everyone involved almost always does things that way, the understandings that shape the convention can be embodied in permanent equipment. The existence of such permanent equipment (expensive, it goes without saying) makes it more likely that the conventional ways of doing things will continue, because any change will be expensive’ (Becker, 2008, pp. 56–57). It is interesting to note that Becker’s understanding of conventions, as a criteria that in essence minimise the costs involved in transactions, in our case between suppliers, experts, producers and consumers of art, seems quite similar to the idea of ‘path dependence’ as proposed by economics. Perhaps best exemplified by the work of Paul A. David in his ‘Clio and the Economics of QWERTY’ (1985), path dependency aims to explain why and how certain standards hold over time against a perceived market failure vis-à-vis better optimised but not established standards. Whereas this resemblance can be corroborated through further investigation, unfortunately, it cannot be seen within this thesis; but this is certainly an interesting topic needing further study.
Becker there is no need to talk of a larger field of power. At the same time that he does not negate external influences (Becker, 2008, pp. 38–39)\(^8\), distinction for him is achieved mainly via the artistic world’s own internal mechanisms. Shown in the dichotomy created between ‘mavericks’ and ‘integrated professionals’, ‘folk artists’ and ‘naïve artists’ (all themes of the eighth chapter of *Art Worlds*: ‘Integrated Professionals, Mavericks, Folk Artist and Naïve Artists’) and also between ‘art and craft’ (ninth chapter), these mechanisms differentiate one production from the other, mainly via one method: artistic theory itself\(^9\).

While focusing on the material aspects of art making, Becker also underlines the positions of power taken by some art world participants and products. These people entitled to speak on behalf of the art world are, in his theory, the main factor behind acts of categorisation. Not everyone can or will be allowed to discuss the merits of art. Anyone can have an opinion regarding a particular artistic practice and consider it as valuable and worthy of the name art. But, for it to be perceived as true (the categorisation), you would need more than just an opinion (Becker, 2008, p. 152). This disposition of some actors with a voice (a reputation) within the art world is what demarks Becker’s views regarding distinction. Without relying on a diffuse field of power, a field that is inevitably always changing, Becker constructs an argument that

\(^8\) His is a research concerned with the ‘mundane social organizational problems’ (Becker, 2008, p. 39).

\(^9\) In that we could say that Becker is also distancing himself from the more classical, Marxist social history of art proposed by T. J. Clark and not only from Bourdieu. Having said that, I should also point out that the connection between Marx and Bourdieu, at least for me, is far from conclusive. On the one hand, at least as far as the concept of ‘capital’ is concerned, one is in deep disagreement with another (Murray-Beasley, 2000, p. 101). On the other hand, as for ‘fields’, Bourdieu seems to follows Marx ‘in viewing scholarly work and cultural production in general as interventions in the social world rather than a form of disinterested reflection’ (Webb *et al.*, 2002, p. 20).
simplifies the explanation of the act of categorising art. Perhaps too art-centric, this view
acknowledges the important contribution of a class of people highly regarded in the art
world and entitled via (not a necessarily broad) consensus to speak. Such people embody
what Becker calls ‘aestheticians’. A pivotal figure in any art world, the aesthetician in
Becker’s view fulfils the role given to the field of power in Bourdieu’s theory.
Aestheticians, then, ‘provide that element of the battle for recognition of particular styles
and schools which consist of making the arguments which convince other participants in
an art world that the work deserves, logically, to be included within whatever categories
concern that world’ (Becker, 2008, p. 135).

As we can see, underneath the apparent similarity between both theories there is a
clear rift between Bourdieu’s artistic field and Becker’s art world. While Bourdieu uses
his study of the arts in order to understand society and its conflicts, Becker wishes to
study society and its practices in order to understand art (or rather art making in his case).
By emphasising the division of labour within the artistic field, its hierarchical processes
of internal distinction (mainly an aesthetic discussion via the work of the aesthetician)
and art’s internal disposition towards change, Becker seems to be engaged in a project of
understanding the principles that arguably instruct social behaviour and collective action
in relation to the art making. The action of his actors, always a matter of constantly
adapted personal choice rather than predispositions merely received from external forces
(Bourdieu’s field of power), is undoubtedly less deterministic than in Bourdieu’s view.
Becker’s view regarding relations of power is decidedly more inclusive, less restrained
and more fluid when thought of as a range of possibilities available for actors in the
world/field. In an interview in the epilogue of the twenty-fifth anniversary edition of *Art
Worlds*, Becker gives a compelling account and consequentially a critique (perhaps a
tentative explanation) of Bourdieu’s point of view in relation to his own background –
that is to say, the differences between the French and American sociological
establishments:
I have for years been telling people in France that to understand American sociology they must first understand that there are something like 20,000 sociologists in the United States and something like 2,000 departments of sociology […] This is at least ten times the number of people and departments as exist in France, probably more like twenty times. One consequence of this is that it is relatively easy to support a wide variety of sociological activities. No idea is too crazy or unacceptable to find a home somewhere. You name it and there is, somewhere, a department or a part of a department devoted to propagating that idea or point of view. You can always find some other people who think your idea, unacceptable as it is to ‘the leaders of the field’, whoever they are, is really good and ready to march under your flag. If you can find two or three hundred of them (not so easy, but certainly not impossible when there are 20,000 among whom to recruit) you can organize a section of the ASA [American Sociological Association]. If you can’t get that number, you can start your own organization (e.g., the International Visual Sociology Association), publish your own journal, elect your own president, and give your own prizes. It’s in that sort of setting that the idea of ‘world’ seems like a ‘natural’ way to think about organized activity. (Becker, 2008, pp. 377–378)

While Bourdieu describes his field in relation to the external forces that, for him, decidedly constrain the options available for both producers and consumers of culture alike, Becker shows how flimsy this overreaching view can be, especially within the present context. If a quasi-totalitarian field of power restrains these participants, how then can today’s art be the heterogeneous beast we see today? This is perhaps Bourdieu’s main flaw. Change within the art world, for Bourdieu (in The Rules of Art), is a rather pre-defined game resting solely in the field of power influence. Bourdieu may capture the feeling behind the changes within Flaubert’s time but at the same time he does not acknowledge the changes within his field of power itself, which is always a unified and totalitarian concept. Hence, for him, to understand art is a matter of first understanding its relation to the larger field of power (Bourdieu, 1996, p. 214) instead of understanding the

10 This deterministic view, although not as over-reaching as it may sound, since there is never an explicit argument for transcendence in Bourdieu’s ideas, is nevertheless a constant struggle and source of internal self-criticism in the sociology of culture and art as a whole (Zolberg, 1990, pp. 11–15; Wolff, 1993, Chapter 2; Chaney, 1994, pp. 40–47; Born, 2010).
changes presented within art and its own conception (for him a product of the interference of his field of power). I wonder, then, how Bourdieu would react to the more contemporary debate regarding the rise of the so-called omnivorous consumer of culture instead of the fixed, restricted consumer of Flaubert’s time. Distinction and power itself, history shows, also change over time.\(^{11}\)

This problematic of change within an art world, for us, is an essential question. After all, the emergence of AST and its world is the very problem of this thesis. It is important to define how different authors have observed the phenomenon of change within art worlds. We know that, for example, AST has changed deeply since its beginnings. We also know that its many labels are disputed. The question then is: If there is change in this particular art world, what may have caused it? Could it be larger struggles in society, as Bourdieu proposes in his field of power? Or could the internal dispositions proper to the art world and its material/institutional culture be main culprits? Unfortunately we cannot answer these questions at this point, for that is the objective of the research. What we can do, however, is to piece the various explanations for change in and the constitution of art worlds into a brief context (which is the focus of this chapter). Only then will we be able to recognise and ponder the influences of these various explanations in relation to our subject (the emergence and development of AST).

Becker’s contribution to this endeavour is central. The adoption of either the concept of field or the concept of world is, consequentially, not a random choice. Becker himself in the above-mentioned interview denies that his research is a ‘light’ version of Bourdieu’s grand theory of fields (Becker, 2008, p. 372). In this work I do not have the intention or

\(^{11}\) On the relationship between Becker and Bourdieu, Inglis posits that, although both authors share concerns, Becker, ‘given that his style of sociology derives from the symbolic interactionist school with its emphasis on how people “label” each other and what effects those labels can have, […] focuses more on the “gatekeeping” functions of institutions, persons and practices in the art world – art schools, galleries, museums, showings, art critics, magazine and newspaper reviews’ (Inglis, 2005b, p. 27).
pretension of constructing an expansive theory that relates artistic development to large conflicts in society (as Bourdieu does). I do recognise the interference of external power, mainly manifested via resources distribution, but I do not, in any instance, wish to extrapolate these observations into the understanding of social struggles and geopolitical aspirations. That is not the job of this thesis. From this point of view it is fair to say that this thesis examines both the AST world, recognised as the set of institutions, agents and values that designate AST’s constituencies, and the AST field, thought of primarily as the site of intellectual struggles and power relationships – struggles and relationships that are constantly demonstrated throughout this thesis. Another way of conceptualising this distinction is to think of the material and the mundane (to borrow Becker’s adjective) in contrast to the political. Having said that, when we use ‘field’ or ‘world’ other than to describe AST, we are expressing one aspect (the mundane, the micro) over the other (the political, the macro).

Surely Bourdieu and Becker were not the only ones to conceptualise an idea of art within a sociological perspective, one that stresses not only the objects but also the institutions and conventions of art. In a relatively brief but influential text for The Journal of Philosophy (‘The Artworld’, 1964), Arthur C. Danto describes what he calls the art world. Danto’s art world, however, despite being superficially similar to Bourdieu’s concept, contains many differences that both writers highlighted in subsequent texts. Starting from the commentary of both Socrates and Shakespeare (via the character of Hamlet) in relation to art’s similitude to a mirror facing nature – the idea that art’s properties reside within its capacity to mirror reality – Danto traces a path in which this idea of art (as mimesis of the world) is supplemented by the idea of art as a reality in itself, self-contained within the art object and, invariably, containing an essence (in Bourdieu’s depreciative label) in the object itself. This project, stemming from an apparent desire for order within the heterogeneous artistic practices developed specially after the Second World War, differs from Bourdieu’s not only in its origins but also in its
scale. Let’s clarify the respective arguments. Danto, aiming for an overreaching connection between disparate artistic practices, finds in the institutions of art (its organisations, discourses, ideologies…) a common ground in which all art resides. Therefore, for him, the most important step in the recognition of an art world was the replacement of a Socratic ‘Imitation Theory of Art’ (IT) (Danto, 1964, p. 572) – in which art’s value (or lack of, for Socrates) resides in its capacity to recreate and therefore illuminate reality (Danto, 1964, p. 572) – with a ‘Reality Theory of Art’ (RT) (Danto, 1964, p. 574) – in which we perceive the art object not as representation or imitation but as an entity in itself. It is this ideological change, brought forward by aesthetic developments in the arts, that, for Danto, characterises our current art world. When Danto stresses the importance of the change, however, he is not looking at the change only but also at how it persists. It is, then, by recognising that these distinct principles (IT and RT) were transmitted (and consequentially transmuted) through time that Danto finds his art world: ‘To see something as art requires something the eye cannot decry – an atmosphere of artistic theory, a knowledge of the history of art: an artworld’ (Danto, 1964, p. 580).

For Bourdieu, Danto’s perception of an art world, while not completely mistaken, is certainly faulty and incomplete. In the final part of *The Rules of Art*, Bourdieu attempts to understand the origins of the idea of a ‘pure aesthetics’ (Bourdieu, 1996, p. 285) presented in, for example, the modernist thought of formalist and phenomenological theories. As we saw with Danto, as the IT came to supplement the RT in the intellectual quest for understanding that which we call art, we, the participants of the art world, could no longer recognise art as a mimesis of nature. Instead, from this paradigmatic change, we (in this view) come to see the art object as an independent, self-contained and indivisible entity with a reality of its own. This materialised body, in turn, has to have a quality (the ‘essence’ in Bourdieu’s term) inherent in it in order to be appreciated as such an indivisible entity. Otherwise, how could one explain that object A is different from object B if they are perceived to be identical? This emphasis on the object of art and its
reception, one can conclude, is what differentiates Bourdieu and Danto. This is not to say that Bourdieu ignores the fact that certain objects are perceived as art. While Bourdieu does acknowledge the existence of this selective reception, in contrast to Danto, he also realises that the reception itself is a temporal subject, subject to its own particular context. Danto may recognise the institution of art but, as Bourdieu argues, he fails to understand the emergence of the art world with/within society and its context, and its relationship to that context. Danto, inclined to view ‘greatness’ in art as independent from an

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12 He then posits that ‘to escape this aporia [the essentialist one], is it sufficient to assert, with Arthur Danto, that the basis of the difference between works of art and ordinary objects is none other than an institution, to wit, the “artworld” which confers on them the status of candidates for aesthetic appreciation? This is a terse assertion, and if a sociologist may be permitted such a judgment, rather “sociological”; born once again out of a singular experience which is too quickly universalized, it only designates the fact of the institution (in the active sense) of the work of art. It overlooks the historical and sociological analysis of the genesis and structure of the institution (the artistic field) which is capable of accomplishing such an act of institution, that is, of imposing recognition of the work of art as such’ (Bourdieu, 1996, p. 287). Danto’s review of The Rules of Art, published over thirty years after his ‘The Artworld’, reaffirms his belief in the intrinsic value of artistic objects. Nearly lamenting his own point of view, he says that: ‘It is not clear that Sartre’s question of what makes Flaubert Flaubert has been answered, inasmuch as a field will account for everyone, great or good or competent, who exists in it at any given time. There is an implied criticism that this sort of social-scientific analysis might “somehow have the effect of ‘levelling’ artistic values by ‘rehabilitating’ second-rate authors.” The Musée d’Orsay opened to cries of indignation for seeming to give the same degree of prominence to the lesser contemporaries of great artists as to those artists themselves. To this Bourdieu offers a compelling response: “Everything inclines us to think that, on the contrary, one loses the essence of what makes for individuality and even the greatness of the survivors when one ignores the universe of contemporaries with whom and against whom they construct themselves.” Yes and no. It is certainly true that we get a definite perspective on Courbet’s masterpiece, The Studio, when we see it in the context the Musée d’Orsay provides. But I incline to view that its greatness is somehow independent of that understanding, and that the work’s power is present in it however much or little we may happen to know about the field that made Courbet and that Courbet in turn transformed. There are autonomous experiences with art that do not entail that art itself is autonomous’ (Danto, 1996).
understanding of the relations of power presented at and within the object in question, while acknowledging the institution of art, also dismisses the larger, broader context in which the art institution (and the artist itself) emerged. Hence, for him, things (art) have an intrinsic, universal and timeless value (‘greatness’). The autonomy proposed by Danto, that the objects considered art contain autonomous properties within themselves, is certainly different from the autonomy proposed by Bourdieu, which rests on the advent of an idea of autonomy of the art object (the ‘pure gaze’; the pure aestheticism) in relation to its position in the nineteenth-century social power struggle (mainly a class struggle).

It is important to note that Becker also discusses Danto’s contribution in his *Art Worlds* but, like Bourdieu, he recognises Danto as being an actor involved rather internally in the arts. That is to say, Danto, for both Becker and Bourdieu, is an aesthetician, a gatekeeper, namely that obscure creature which defines via discourse the very definition of art. Surely artists, historians and the institutions of art themselves also contribute to the debate. Flaubert was an artist himself and in the Bourdieusian narrative he does contribute to changing perceptions. Both Becker and Bourdieu, despite believing otherwise, also contribute to the debate. The difference here, between Danto and the others, is the lack of a specific aesthetic theory to support their claims. For Becker, it is by being in the position of a ‘critic’ (something which Danto certainly was) that the aesthetician becomes the biggest contributor of certain aesthetics perceived as correct. Danto, for example, may recognise the institutions of art (and its varied participants) as a major influence in the development of the arts but, as an aesthetician, he also delves into the debate surrounding merit, and that, *a priori,* is what characterises the position of an aesthetician. It comes as no surprise then that Becker discusses Danto’s theory in his ‘Aesthetics, Aestheticians and Critics’ chapter. By discussing the position and function of
this critic (Danto), Becker develops his argument in relation to art’s own internal developments. Informed by conventions and status, these internal disputes (a political aspect natural to a subjective belief system such as art) are what we may call the artistic theoretical struggle (Becker, 2008, p. 135). Being a consequence of art’s discriminating feature, artistic theory (aesthetics) is perhaps the main vehicle via which positions are taken, judgements are made and merits are bestowed: it is art’s main intellectual battleground. Artistic theory, however, is not the everything-goes some might imagine. Instead, is a reasonably clear game with some distinct features that, it could be argued, account for a world in itself. Even if its particular consequences for art in general are not easily defined, theory and its practitioners hold a great deal of importance in the creation, development and survival of art worlds. Therefore, common to both Bourdieu and Becker is an engagement in reviewing Danto’s argument concerning the perceived importance of Warhol’s work. Danto’s example, I believe, remembered so many times in this kind of sociological questioning of the arts, is important for two reasons. Firstly, it constructs a framework whereby one comes to understand Warhol’s work (and all that is subsequent) as a consequence of its relationship with the institutions and conventions of art. For both Bourdieu and Becker this was interesting in itself: that there was a man, outside their sociological discipline, who developed an argument relatively close to theirs. Becker, for example, says, without giving names, that ‘ironically enough, a number of philosophers have produced a theory that, if it is not sociological, is sufficiently based on sociological considerations to let us see what such a theory might look like’ (Becker, 2008, p. 145). Secondly, it can be argued, both Becker and Bourdieu

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13 Bourdieu discusses a similar situation – within the independent literary world – in the capacity of art to persist (1996, p. 270) and in the constitution of its internal struggles (1996, p. 252).

14 ‘Never mind that the Brillo box may not be good, much less great art. The impressive thing is that it is art at all. But if it is, why are not the indiscernible Brillo boxes that are in the stockroom?’ (Danto, 1964, p. 581).
are interested in Danto’s importance in the American artistic establishment itself. This might sound cynical, but I believe there is strong evidence for this, for Danto certainly was not just any critic.

Danto was indeed a force within the art world studied by Bourdieu and Becker. He was an embodiment of the aesthete, respected and more importantly heard, and both our writers knew of his importance in the game of defining art. Danto’s status within the art world, coupled with his understanding of institutional conventions, is a good example of artistic theory being made live, without intermediaries or second-hand historical sources. Because it used very similar observations to those made by both Becker and Bourdieu, Danto’s artistic theory (the institutional one) proved too much of a temptation for both those sociologists, since they are also part of the game. It seems that both found a perfectly neat example of how to misunderstand art as a collective activity in the figure of Danto. While Bourdieu attacks Danto for being unperceptive of the role of society and its context in artistic comprehension (as we have previously seen), Becker’s complaint is centred over Danto’s ambition and insistence on classifying art as distinct from non-art:

By shifting the locus of the definitional problem from something inherent in the object to a relation between the object and an entity called an art world, the institutional theory provided a new justification of the activities of contemporary artists, and an answer to the philosophically distressing questions levelled at their work, which asked for a demonstration of skill or beauty, thought or emotion, in the works regarded as excellent […] The institutional theory allows art world participants to define that special talent in a new way, as (for instance) the ability to invent imaginative new concepts, and thus gives legitimacy to the artist’s special role and rewards. Our analysis of the institutional theory adds some nuances to the description of art worlds. We see that art world officials have the power to legitimate works of art, but that power is often disputed. As a result, the aesthetician’s desire for definitive criteria by which to distinguish art from non-art, criteria congruent with the actions of art world officials, cannot be satisfied. (Becker, 2008, pp. 163–164)

It is interesting to note the beginning of Becker’s argument here, where he claims that Danto and others shift ‘the locus of the definitional problem from something inherent in
the object to a relation between the object and an entity called an art world’. As we saw, Danto did not shift his focus entirely. He still believed in something inherent in the object. Becker, in his own logic, is right to stress that the so-called institutional theory had the ambition of differentiating art from non-art; after all, that was Danto’s function, his position, his right as a critic/aesthete. Becker, however, differs from Bourdieu in that he misses a point here. If there is an argument to be made against Danto’s theory and its limitations, it is Bourdieu who conveys the definitive one. Danto’s art world is indeed disconnected from its context. By not recognising his own act as a legitimising one, despite understanding the importance of art’s conventions in society’s reception, Danto ends up contributing to the very belief system he himself describes. The correct interpretation and applicability of this thought, in Becker’s view, is that the sociologically informed theory of the arts, while being able to distinguish internal struggles and developments characteristic of the art world, cannot and does not have the intention of settling the definition of art. A similar point could be said about this text. It does not contribute to an aesthetic definition of AST. Instead, it wishes to answer the question of how the AST world, with its participants and products, came to be what it is today. My intention, shared by both Bourdieu and Becker, is one of curiosity and not necessity. Coming back to our example, the matter of the fact is that Danto’s art world, differently from Becker’s, was a creation from within the artistic culture, with no intention of understanding how Warhol was accepted and instead offering a rationale on why he should be acknowledged. While Danto built his sociologically informed theory in order to classify art as distinct from non-art, Becker wishes to explain the production of art or whatever object people may call art, focusing instead on the internal mechanisms that produce such a definition.

15 Although this inadvertently may contribute to a definition.
Since Becker, Bourdieu and Danto there has been a significant growth in the art world theory within sociological establishments. I say growth because sociology itself, similarly to the arts, has an incredibly strong political element, or struggle. In fact, this struggle has been translated in a series of works and research into the internal political aspects of various cultural fields of production. This thesis is not interested in reviewing the status of a whole intellectual field; however, relevant work to highlight is that of Shyon Baumann, a relatively young researcher and the author of *Hollywood Highbrow: From Entertainment to Art* (2007). My choice to study him is based on two points regarding his work. Firstly Baumann, like this thesis, has revisited Becker’s and Bourdieu’s respective conceptions of ‘world’ and ‘field’. Baumann sees them as being compatible, despite their differences. In fact, Baumann recognises these differences as being a ‘matter of degree rather than type’ (2007b, p. 180). I will explore this idea later on. The second reason lies in the fact that Baumann, also similarly to this text, is interested in the applicability of these ideas by understanding them in relation to a certain temporal and spatial context. His subject, namely the acceptance of certain Hollywood films as art, is indeed a very defined one. In fact it is much more defined than this broader study of everything that is called digital, electronic, computer, technoscience or new media art. Nevertheless, his focused attention informs much of the thought presented here. *Hollywood Highbrow*, as the author suggests, advocates ‘the creation of an understanding of the medium of film as a legitimate and serious artistic medium, and of a body of film works as being legitimate and serious works of art’ (Baumann, 2007b, p. 1).

It could be said that, while both Bourdieu and Becker are interested in the constitution of an artistic field and an artistic world (respectively), Baumann is rather interested in the legitimising processes of these art fields and worlds – that is, how do they become accepted as legitimate constituents of the label ‘art’? According to this method, Baumann does not develop a new understanding of the idea of an art world and instead builds upon the thought of Bourdieu, Becker and others. That certainly makes sense, as Baumann
himself attaches his work to Becker’s legacy (2007b, p. 4). Perhaps he is right in bypassing many of the discussions regarding the boundaries of the art world. To enrol once again in the minutiae and nuances of definition of such a world would be self-defeating for, as Baumann’s work shows, every art world and its local context do something to make a single definition of ‘art world’ insufficient. Importantly, Becker too talks about this problem, of defining boundaries for the art world, and his conclusion is similar to Baumann’s (Becker, 2008, p. 35).

However, what most differentiates Baumann in relation to Becker’s or Bourdieu’s method is the propensity to align his research (legitimacy in the arts) to another branch of social study more broadly concerned with the history and development of social movements. Baumann’s epistemological preference is discussed in a succinct yet clear text written for the journal Poetics (Baumann, 2007a). In this text he argues that ‘there is an analogy between social movement success and recognition as art, so that the major concepts that explain the paths of social movements also apply to art worlds: political opportunity structures, resource mobilization, and framing processes’ (Baumann, 2007a, p. 47). Both Hollywood Highbrow and this text are in fact filled with these kinds of analogies, which mostly refer to third parties’ research into the legitimation of a variety of art forms. Baumann’s general premise is as follows:

Discrete areas of cultural production attain legitimacy as art, high or popular, during periods of high cultural opportunity through mobilizing material or institutional resources and through the exercise of a discourse that frames the cultural production as legitimate art according to one or more pre-existing ideologies. The main benefit for the sociology of art is a theoretical advancement beyond the current state of tenuously linked casework studies of artistic legitimation toward an understanding of a process that is common across art worlds. (Baumann, 2007a, p. 60)

In many ways, Hollywood Highbrow can be seen as a rather positivistic study. Baumann’s use of raw data (i.e., concerning the consumption of art, concerning the social make-up of museum publics, concerning the time distribution of articles devoted to
seeing cinema as art etc.) is not a common method of investigation applied to the arts and is based on by his own career, department and academic formation. His methods are taken from contemporary (American) sociology and, as such, the attempt to quantify social relations is part of him and his game. In Baumann’s defence I would say, again, that his method first and foremost is not concerned with particular aesthetic forms or universal claims regarding those forms (in contrast to many AST participants, as will be seen later in this thesis). He does not attempt to formalise perception, nor does he wish to link a specific artistic practice to its consensus within a particular art world. He is very aware that consensus itself is far from being a complete and unrestrained agreement (Baumann, 2007a, p. 61). Ours is a more undecided, fragmented world than that described by Bourdieu. Given the increasingly transnational nature of art, there seems to be no single and/or totalitarian field of power partitioning resources as Bourdieu describes it. The heterogeneous cultural production championed by contemporary art is testimony to this fragmentation, which may serve many different agendas and wills.

Baumann’s premise, for example, talks about ‘periods of high cultural opportunity’ – that is, cultural and political opportunities for the art world to develop. What would these opportunities be and how does Baumann find them within the infinite possibilities of society? How does Baumann, with his positivistic tendency, find arguments to support this claim and term? His rationale is quite simple, actually. In order for Hollywood films to be perceived as art, there must be a public acknowledging them as such. Baumann and others (Baumann, 2007b, pp. 21, 52) realise that, differently from in Europe, it was only around the 1960s that films came be seen as art in America. That is not to say there were no attempts whatsoever before that date to create films as art in America. Quite the opposite; but, despite the efforts of some, it was only after the Second World War that the American audience started to resemble their peers across the Atlantic. This resemblance/distinction in attitude towards films can be attributed to industrial set-up, educational development and the political environment within the US. The early
development of the industry and its differences across European and North American territories were the first factors behind the disparity in perception. To begin with, early American cinema, usually developed around the idea of very affordable nickelodeons, was mainly a blue-collar entertainment with high attendance and was usually seen as corrupt by higher classes and American intellectuals (Baumann, 2007b, p. 24). This picture stands in strong contrast with the early European cinema described by Baumann and the work he references. As opposed to the American urban working class, which was largely formed of European immigrants favoured by strong economic growth and therefore with disposable income, the European working class was heavily affected by the First World War and did not possess the same surplus to enable them to enjoy cinema like their American cousins. As a result, the film industry in the major European film-producing countries was built around already existent artistic institutions. Baumann goes on to argue, citing the historian Benjamin Hampton, that


rather than creating inexpensive makeshift theatres from stores and restaurants, European films became a part of a variety theatre and music-hall programs, with prices similar to those other forms of entertainment. Consequently, there were far fewer outlets for exhibition, which in general was more expensive for populations with less disposable income. (Baumann, 2007b, p. 25)

Being present in a more elitist setting certainly helped the perception of film as art in the European context. Figures quoted by Baumann highlight the disparity of the early film industry: by 1929, 7 per cent of the French population frequented cinemas whereas in the US 75 per cent of the population did (Baumann, 2007b, p. 28). Another combination of qualitative evidence and sociological statistical data can be found in Baumann’s analysis of the reasons why most American cultural establishments accepted film as art only after the Second World War. The reason for this, argues Baumann, resides in the educational development achieved by the US following the end of the war. To show its dramatic increase, Baumann plots two very simple charts following firstly the total enrolment in institutions of higher education and secondly the percentage of 18- to
24-year-olds enrolled in such institutions (Baumann, 2007b, pp. 33–34). For him ‘the film history literature is rife with assertions that the audience for film in the 1960s was qualitatively different from previous decades’ (Baumann, 2007b, p. 33). Once sure of this development, Baumann’s questions turn to its logical consequence or, in other words, how this change in qualitative terms resulted in differences between the US and Europe in terms of perceptions of film as art. He offers three explanations presented in the literature, and we should very briefly develop those here. Firstly, ‘as DiMaggio (1992) and Levine (1988) have noted, associations with the status of audience members have in many cases contributed to the rise and fall in prestige of various art forms’ (Baumann, 2007b, p. 34). The second mechanism described by Baumann lies not in the increasingly high status of cinema audiences but instead in rising levels of education, especially higher education. According to his sources there is a ‘claim that a taste for the high arts is facilitated by the educational system that teaches individuals how to approach and to understand high art [...] the proper audience, then, first had to be constituted before film could succeed as Art’ (2007b, pp. 34–35)16. The third mechanism described by Baumann, instead of focusing solely on the public, is rather centred upon the idea that it was artists, critics, theorists, historians and ‘any other intellectuals who were members of the film world’ (Baumann, 2007b, p. 36) themselves who first articulated an understanding of film as art.

While not ‘mutually exclusive’ (Baumann, 2007b, p. 36), the second and third points of view may both be responsible for the change of status of Hollywood films. The first is also related to the second in a symbiotic manner in which the two are responsible for each other. People got richer because they studied more; people studied more because they got richer. Baumann may not have achieved a clear arbitration between these views, but one could say that this was not his intention. All changes were of historical importance in one way or another. The most important contribution, it could be argued, was the mere

16 A point also extensively developed by Bourdieu (1986).
confirmation of contextual importance in the development of an artistic form (cinema being his case study). Baumann’s method of investigation is indeed very helpful. *Hollywood Highbrow* in fact excels at describing this change in perception via factors placed outside the art world in question\(^\text{17}\).

His intention in discussing this subject of contextual, larger changes in society that affect the perception of cultural production stems from his larger project concerning legitimising processes. For Baumann, understanding the development of an artistic form involves recognising developments not only within the artistic world in question but also within society in general. These influences, albeit variable in nature and definition, could be simply defined (as Baumann himself does) as *exogenous* and *endogenous* in relation to the art world. That the boundaries of an art world may vary according to previous definitions and emphasis does not change the fact that events happen either outside or within such a circle of collective activity – either outside or within art. The most obvious examples of these exogenous events can be found in big political events as well as major technological advancements: the rise of Nazi Germany; the Soviet revolution; North American McCarthyism; the Brazilian and much of Latin America’s repressive dictatorships; the terrible atomic fate of Japan; the rise of the moving picture; computational technology… these are not anecdotal examples but hard events that, in one way or another, had consequences for the arts but did not originate from the arts themselves. Likewise, by tracing the development and birth of artistic institutions dedicated to film’s appreciation as an art, Baumann finds his endogenous factors. This battleground, over definition and status, not only theoretical and ideological but also

\(^{17}\) For a much more complete description and debate of the merits and limits of exogenous factors (both material and cultural) as explanatory and formative in social movements, see Meyer and Staggenborg (1996), Edwards and McCarthy (2004), Kriesi (2004), Meyer and Minkoff (2004) and Williams (2004).
economical, can be regarded as the place where art (and its worthiness) is politically constructed. The creation of film festivals, film clubs, academic departments dedicated to film, specialised museums and galleries... these events can, according to Baumann’s argument, all be described as derived from within the artistic establishment, emerging from the collective action taken by some (never all) participants active in the art world and politically engaged in the dissemination of an idea of film as art. Perhaps the most enduring and visible feature of this practice can be found in the creation of an argument, a rationale, an explanation or, simply, a justification that explains the positions taken by art world participants and their ‘support’ for film as art. Baumann usually defines this act of rational justification as ‘framing’. Although he has explicitly developed this subject elsewhere (2007a, pp. 57–58), its main features are still a recurrent subject in his book. Usually associated with the work of social psychologist Erving Goffman (1986), and more recently with David Snow (2004), framing’s worthiness has been called into question as a result of its proliferation in various academic fields and given the fact that it has not been properly defined (Snow, 2004, p. 380; Baumann, 2007a, p. 57). Despite this I believe, following Baumann in his own rationale, this is an idea that relates cultural production and collective action to contextual change and ideology like few others do. Given the complexity and historicity of the subject, let us yet again briefly clarify this theme. In its most basic form, the framing process can be understood as a representation of focused attention in relation to a perceived problem, opportunity or grievance

18 That is to say, ‘in contrast to the traditional view of social movements as carriers of extant, preconfigured ideas and beliefs, the framing perspective views movements as signifying agents engaged in the production and maintenance of meaning for protagonists, antagonists, and bystanders […] The verb “framing” is used to conceptualize this signifying work, which is one of the activities that social movement adherents and their leaders do on a regular basis.’ That is, ‘they frame, or assign meaning to and interpret relevant events and conditions in ways that are intended to mobilize potential adherents and constituents, to garner bystander support, and to demobilize antagonists’ (Snow and Benford, 1988, p. 198). The resultant
Differently from the idea of contextual or internal change in relation to the social movement (or, in our case, AST itself), framing processes are concerned with the micro-relationships present in any art world: letters, speeches, manifestos, conversations, arguments etc. For this research the consequences are clear: Why, for example, would one believe in, support, create or finance AST’s projects? Baumann’s book, despite being unknown in the art world, offers a novel perspective on the changes common to all fields of cultural production. Similarly, the whole sociological enterprise dedicated to the subject of collective action, while not usually applied to the arts, can be enriched by a case study like this one. This text will continue by applying and criticising the concepts developed mainly by these three authors (Bourdieu, Becker and Baumann). For now it suffices to say that, despite this very brief epistemological introduction, we are armed with the tools to tackle our own subject: AST.

products of this framing activity within the social movement arena are referred to as collective action frames – that is, ‘Collective action frames, like picture frames, focus attention by punctuating or specifying what in our sensual field is relevant and what is irrelevant, what is “in frame” and what is “out of frame,” in relation to the object of orientation. But frames also function, perhaps even more importantly, as articulation mechanisms in the sense of tying together the various punctuated elements of the scene so that one set of meanings rather than another is conveyed, or, in the language of narrativity, one story rather than another is told’ (Snow, 2004, p. 384). The huge literature being produced in relation to the framing perspective, unfortunately, cannot be reviewed here. For more on the general nature of the theory, please see Snow et al. (1986), Benford (1993a, 1993b, 2013), Benford and Snow (2000, 2005) and the collection edited by Johnston and Noakes (2005). In relation to the debate or discussion regarding the differences between frame and ideology, see Snow (2004), Snow and Benford (2005) and Westby (2005). On a general note, I also recommend the quite large work edited by Snow, Soule and Kriesi (2004).
1.2 Scope: Too many labels

In *Art Worlds*, Becker (2008) discusses the viability of and the context for the development of new art worlds. New art worlds, he posits, ‘grow up around something that has not been characteristic practice for artists before’ (2008, p. 311). One example that might fit the bill, he says, is the ‘invention and diffusion of a technology’, which may produce new ‘art products possible’ (Becker, 2008). This new technological breakthrough, probably ‘originated for nonartistic products’, would then, very much like ‘photography and motion pictures’ (Becker, 2008), be used by artists beyond its original intentions. Although today both photography and motion pictures are art worlds in their own right, Becker notes the ambiguities inherent in this development. In short, are they new art worlds or ‘only new segments of old ones’ (Becker, 2008)? As an amateur musician he ponders the advancement of electronic devices, ‘from oscillators to synthesizers’ (Becker, 2008), and this development’s capacity to generate a new art world. Although the tools are new, ‘much electronic music is created by people trained in music, who use machines as an adjunct to live human performance, is heard by audiences raised on more or less conventional concert music, and is judged by critics who use the same standards they apply to other serious, composed music’ (Becker, 2008). For these reasons, he concludes, no new art world could have risen from the machines only since, in essence, electronic music is just a genre of music. But here there is a catch. Some of the people who made sound with electronics are different from what we might conventionally think of as musicians. Not traditionally trained and perhaps coming from places such as ‘computer electronics or mathematics’ (Becker, 2008), they ‘beg[a]n to make music with the machines alone, dispensing with the human figure’ (Becker, 2008, p. 312). Moreover, not being trained as traditional musicians, since first and foremost they were engineers, mathematicians or physicists, their music was also different and contained ‘random noise or machine-generated pure tones […] for instance’ (Becker,
2008). This cultural output, different from that being produced by musicians using electronic devices, ‘makes the development of a new art world more likely’ (Becker, 2008). Since this new product brought ‘together people who [had] never cooperated before to produce art based on and using conventions previously unknown or not exploited’ (Becker, 2008, p. 310), it could develop into something other than traditional music. It is then no coincidence that we have electronic music, a genre of traditional music, based on the same conventions utilised by traditional musicians, and electroacoustic music, a world in its own right, complete with internal conventions, institutions and discourses.

Before we proceed, then, it is important to ask: Is AST a genre? Is it a style or theory that unifies a wide range of artworks? Is it a specific method of artistic practice? The answer to these questions is, in short, no. Derived from its institutions, mobilising discourse and material context, and not from stylistic considerations, the specificity of AST as a label is demonstrated throughout this thesis by a series of case studies that trace the origins of this world back to its post-war and then Cold War context. This context, both intellectual and material, is what makes AST an effective tool for understanding the birth of this emergent field. To take the opposite path, to attempt to discover aesthetic, stylistic or theoretical patterns that make AST distinct, is futile since, up to now, there has not being a single label that has managed to encapsulate its whole production cohesively. That is not surprising since, as we shall also see, the production of what people may refer to computer, digital, new media, virtual or even electronic art encompass a too large and heterogeneous practice to be considered as a single artistic style, movement or conceptual

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19 Tellingly (though unfortunately, since we do not have the space to further explore this subject), this world shares much in common with AST: from a historiography concerned with its concrete art lineage, by way of musique concrete (Camilleri and Smalley, 1998), even to shared awards, such as the ones given out by Ars Electronica, in Linz, Austria.
proposition, much in the same way that there is not a single electroacoustic music but, instead, a series of conventions and institutions that bind those practices together. What unites the artworks, artists, writers, theoreticians, critics, journals, BAs, festivals and biennales of AST is, to put it simply, its involvement with technoscientific developments of the post-Second World War era and the belief, despite larger art world rejection, that this was a worthy project. This perhaps simplistic criterion, while not wholly perfect, as there are intersections between AST and contemporary art, as in between music and electroacoustic music, is nevertheless the most appropriate way to study the world and the field of AST: in other words, that which is shown, discussed and promoted by AST.

Moreover, as Becker elucidates:

We cannot clearly separate new art world from those which have changed substantially by virtue of an artistic revolution, nor can we easily decide when an art word has died, as opposed to being changed or taken over by new people. We need not make these distinctions definitively, since our interest is in the growth and decay of forms of collective action rather than in the development of logical typologies […] To understand the birth of new art worlds, then, we need to understand, not the genesis of [artistic] innovations, but rather the process of mobilizing people to join in a cooperative activity on a regular basis. (Becker, 2008, pp. 310–311)

Follow the money, they say. AST students, festivals, publications and the like, as I shall demonstrate, do not need or find it necessary to rely on the art world’s blessing. AST has, after all, developed a whole network of collaborators and supporters for itself and it does not need the resources used by the art world and, perhaps more importantly, its market.20

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20 Although AST’s relationship, or lack of, with the art market is an important topic, I do not wish to engage with it at the moment. The reason for this is twofold. Firstly, its size is tiny. Although there have been some isolated successes, on the large scale of things, it is barely noticeable (Reyburn, 2014). Some of the reasons for this are explored in the third chapter, within Section 3.3.1 (“Conventions”), although these are not developed with the market in mind. The second, and certainly most crucial, aspect of my decision to keep the market outside my discussions is that AST does not need it. It mainly survives via industrial, commercial,
Supported by industry, commerce and academia, it has, from humble beginnings, developed into a large area of collaboration. The mobilisation of these people behind the idea of AST is hence key to its own development. The diffusion of its ideals and the certainty of its worthiness, over time, have produced the highly complex activity that we now label as AST. Having said that, it is important to stress that resources are not only material, financial objects. Institutions such as museums, universities, salons, awards, galleries and so on provide an invaluable source of symbolic capital, via a cultural authority often synonymous with the names of such institutions. That the V&A has developed an extensive collection of early computer art is no trivial fact. Museums in this case, by ‘their ability – indeed their mission – to collect, preserve, restore, display and promote art gives them an enormous amount of control over the value, visibility and survival of cultural productions’ (Baumann, 2007a, pp. 55–56). Likewise, universities, while proving physical spaces and, on many occasions, a salary for artists (especially true in AST), may also intangibly support AST via their curricula\textsuperscript{21}. In this way, ‘universities can preserve and disseminate knowledge of cultural content while simultaneously bestowing legitimacy on that content by its very inclusion’ (Baumann, 2007a, p. 56)\textsuperscript{22}. Yet, one final intangible resource is primary in AST’s quest for legitimacy: that which is academic and governmental links. These will be shown throughout this research. Here, again, AST is in dissonance with contemporary art since, in many ways, it does not possess a high-status crowd to support it. Instead, as exemplified by the push made by Google towards AST via its highly financed DevArt program, AST is supported by multiple, distinct identities full of resources but lacking symbolic capital. Admittedly, however, its relationship with the traditional market is an aspect that must be investigated further, but this is not done here. Likewise, its relationship with the symbolic capital of its donors and supporters, industry and the like is seen indirectly, mainly via the art world’s negative reaction to it; see Section 3.1.1 (‘Experimentalism: Cybernetic Serendipity and E.A.T.’) for more on this.

\textsuperscript{21} For a review of the literature on resources applied to the sociology of art, via a perspective that aligns it with the research into social movements, see Baumann (2007a).

\textsuperscript{22} Remember the BAs, BScs and research centres of our introduction?
produced by its theorists, aestheticians, philosophers and historians. If we did not choose AST as a lens through which to discuss artistic developments intersected with technoscientific knowledge, what would be the alternative? Some of these alternatives, then, are the subject of this section. These are resources of AST, in that they attempt to coherently and ideologically frame the production of AST within various artistic perspectives. What is important to highlight at this point, over the proposed labels discussed next, is that those, and invariably all, definitions of art require a certain degree of consensus – that is, a (loose) agreement between AST members. While not entirely consensual to all participants, and hence the multiplicity of definitions, these attempts are nevertheless important in that they not only justify AST as art but also try to organise and define the field or at least some parts of it. If consensus were universal, there would be no need for critics, philosophers and artists to discuss aesthetic arguments. If artistic consensus were general and universal, art would not change over time, nor it would vary according to context and place. Perhaps a more fitting question would look at this problem from a different angle. For something to be legitimate it must be made legitimate by someone. Legitimacy of new art does not happen a priori but, instead, is exercised by such textual attempts.

In order to briefly demonstrate the problem with such labels, as well as the interplay between theoreticians competing for the right to name the objects of AST, let’s consider the label that describes the degrees and the art practice seen in the introduction to this work: digital art. The name itself, used repeatedly over the past twenty years or so, does not denote anything special. ‘Digital’ may popularly be thought as an adjective derived from computational developments, from Turing, but it hardly describes the products produced only with the technoscientific developments of the post-Second World War world. Likewise, ‘technological’, as in art and technology, hardly specifies anything different from previous artistic productions since all art, in essence, is applied technology. Hence, as Poltronieri (2010) highlights, it would be preferable to use the label
computational instead of the popularly found definitions of ‘technological’ and ‘digital’ once we have understood that ‘technological art’ is translated simply as an artistic praxis in which a series of applied techniques are deployed. Since all forms of manifestation through art involve the use of some technique the term ‘technological art’ results in something redundant. All art is technological by itself [...] With respect to digital art, Lopes tells us that computational art is not the same thing as digital art. Above all, computer art is not the same as digital art. Moreover, computer art is a new art form and digital art is not [...] Electronic computers available today use binary code, represented by zeros and ones, as a form of symbolic exchange. However, the binary format is not the only digital code available. To name a few, the alphabet is another digital code, as are the numerals and signs of traffic. None of them are binary but they are all digital as they are constituted of discrete and discontinuous elements – as letters and numbers are. (Poltronieri, 2010, pp. 17–18, my translation)

As we know, the label ‘digital art’ – despite being incomplete and failing to account for perhaps the most important and novel aspects of this production of computational objects – is nevertheless very much present. Perhaps an exercise of pure marketing by some, the digital has become one of those catchwords that everyone uses but nobody gives much thought to. Similarly to ‘sustainability’, ‘creative’ or ‘dynamism’, ‘digital’ has become a prima donna in a lot of cultural discourse. The talk of a digital culture is, for example, another topic that could be debated in these same terms. Another one of these wide, almost meaningless terms that have been attached to AST production is ‘new media’. In order to talk about this one, I will review some of the ideas of a famed media theorist, Lev Manovich, and his book The Language of New Media (2002). Like others throughout this section, his work is interested mainly in distinction – that is, in separating his new media from old media. It is not a work dedicated exclusively to the arts and, therefore, it does not speak about artistic objects per se but rather about that which he classifies as new media. Throughout this book he presents a systematic reading of his new media, built almost like a pedagogical, straightforward book about the qualities that make new media new. In his own words:

This book aims to contribute to the emerging field of new media studies (other names which have been already used to describe it are ‘digital studies’ and
Manovich then starts with a reading of Dziga Vertov’s silent film *Man with a Movie Camera* (1927) as a perfect example of the qualities he deems exclusive to this new media. Vertov’s work, for Manovich, embodies and predates the challenges and possibilities created by new media. This film also serves as an example of the qualities and works continuously discussed throughout Manovich’s book and as a reminder of the similitude between film and new media. The qualities observed by him to exemplify new media are labelled ‘numerical representation’, ‘modularity’, ‘automation’, ‘variability’ and ‘transcoding’. I shall briefly review them in order to understand Manovich’s rationale, which, inevitably, led him to place new media closer to film than to other media. *Numerical representation*, to begin with, is presented as the basis for the creation of new media. Therefore, ‘all new media objects, whether they are created from scratch on computers or converted from analog media sources, are composed of digital code; they are numerical representations’ (Manovich, 2002, p. 49). This simple observation, that new media can be mathematically represented, is indeed correct but, as it is, can we say is it sufficient to make a distinction between new and old media? The answer is no because, as we saw before with Poltronieri, there are many other things that can be represented numerically (or, more simply, digitally). Manovich is well aware of this and so he continues to outline his view. *Modularity*, as he conceives it, refers to the capacity of new media to be presented discretely – that is to say, divided into units that in a way that resembles the behaviour of fractals. Like language itself, which is composed of interchangeable units, Manovich’s new media, given its capacity for being digitally represented, can be manipulated. The construction of new media objects, then, is done by a method of building modules into new media objects and those, in turn, are in reality collections of discrete numerical units that are also new media objects. ‘Media elements,
be it images, sounds, shapes, or behaviours, are represented as collections of discrete samples (pixels, polygons, voxels, characters, scripts). These elements are assembled into larger-scale objects but they continue to maintain their separate identity. The objects themselves can be combined into even larger objects – again, without losing their independence’ (Manovich, 2002, p. 51). These two qualities, numerical representation and modularity are responsible, in Manovich’s theory, for the other three qualities that, combined, characterise new media. *Automation* and *variability* are both related to that which we usually associate with new media and consequentially computers: programs and programmability. Because new media objects can be numerically represented and constructed by a modular process that we can automate, manipulate and change, *transcoding*, as a consequence, refers to the capacity of computing practices and conventions to alter our very understanding of things represented by the numerical code. The images given to us by computers, for example, while being a representation of a certain image that occurs in reality, also affect our perception of this very same image:

In new media lingo, to ‘transcode’ something is to translate it into another format. The computerization of culture gradually accomplishes similar transcoding in relation to all cultural categories and concepts. That is, cultural categories and concepts are substituted, on the level of meaning and/or the language, by new ones which derive from the computer’s ontology, epistemology and pragmatics. New media thus acts as a forerunner of this more general process of cultural re-conceptualization. (Manovich, 2002, p. 64)

It is not uncommon for us to think of our minds as computers. Neurologists, for example, use terms such as ‘short memory’, ‘deep memory’ and ‘unconscious process’ (similar to ‘deep’ programming languages) to describe brain functions. Likewise designers, among whom I must include myself, usually describe colours as particular Pantone hues or, yet, as RGB or CYMK numbers (used by monitors and printers respectively). Transcoding, then, is indeed a powerful analogy to describe the effects of new media in our lives. The problem with Manovich’s systematic reading is, then, what to make of all of this. If there is such a strict set of conditions for something to be
described as new media, and if all these qualities are as clear cut as he suggests, why do people like him still engage in this debate? The confusion seems to be, for him and others, a matter of defining the new. And the new, as we will see, is derived mostly from somewhere else; only the combination of all these ‘qualities’ is what makes new media new.

New media according to Manovich is a by-product of two independent but eventually intertwined creations: the moving picture and the analytical machine. The combination of elements, above anything else, is what characterised the new media in contrast with the old media (Manovich, 2002, p. 21). Again, as we saw with Poltronieri, numerical representation and modularity are also qualities of language itself. It is only by uniting them with cinematic qualities that we have new media, according to Manovich. He provides some insightful examples. Perhaps the best one concerns how we operate and communicate with these analytical machines later called computers. The screen, in its rectangular two-dimensional format, is still pretty much the most common way to interact with computers. That is to say, computers and the industry that sprang from them still rely on a century-old format that was mainly developed by cinema. This reliance on convention is what Manovich calls into question (despite the fact that this convention in particular could also have been adopted from painting itself) and that, according to him, is what makes new media appear so close to film and therefore to film’s theory.

This view, which posits film and computational technology as closely related, is interesting when considered in light of the popular label ‘digital art’: an artistic practice that, in turn, should rely on new media objects as conceptualised by Manovich. While Manovich is interested in positioning his new media objects within the umbrella of film and media studies, another popular book, simply named Digital Art (2003), written by Christiane Paul, Adjunct Curator of New Media Arts at the Whitney Museum in New York takes a more holistic view of those terms and technology. Understandable as it is, given that the book was conceptualised as a survey (Paul, 2003, p. 8) of practices, it is
still interesting to note the variation of interpretation of technology itself and how difficult is to define these very heterogeneous practices.

Paul’s history of digital art (her adopted label), developed briefly in her introduction, follows a regular, well-known path. It is a history that acknowledges and rationalises the interdependency between digital art and its material culture, on one hand, and between digital artworks and art history on the other. While constructing these links, Paul, similarly to other authors, attempts to unite this new practice with the vanguards of twentieth-century art while simultaneously making it singular, given its particular material culture. In this view Paul, for ‘obvious reasons’, posits the history of digital art as ‘being shaped as much by the history of science and technology as by art-historical influences’ (2003, p. 8). In her brief introduction she reminds the reader of the institutional links between the complex scenario surrounding early developments in the field and the interplay between computers, military complexes and academic complexes. These developments, for her and to some degree for the argument put forward in this thesis, are what characterised the early production of digital art. It is interesting to note her recognition of *Cybernetics: Or, Control and Communication in the Animal and the Machine*, Norbert Wiener’s 1948 seminal work, which was a major force in the development of the field of the same name. For now we should note that, as opposed to Manovich, Paul’s history of digital art is firmly positioned in the context of the developments in the artistic field of the first half of the twentieth century. This narrative provides the reader with the assumption that Digital Art did not develop in an art-historical vacuum either, but has strong connections to previous art movements, among them Dada, Fluxus and conceptual art. The importance of the movements for digital art resides in their emphasis on formal instructions and in their focus on concept, event, and audience participation, as opposed to unified material objects. (Paul, 2003, p. 11)

The construction of an argument adjoining both the history of computational art and art history is, as we will see throughout this text, a common feature of digital art
discourse. And, as we know, is also a defining characteristic of legitimatory discourses. Since it attempts to posit digital art as a consequence or development of previous artistic movements (in a very modernist fashion), Paul in reality is attaching a production that she believes is worthy (digital art) to previous highly regarded productions. By positioning her digital art within a larger art historical continuum, she is, in effect, attempting to transfer the symbolic capital of established styles such as ‘Dada, Fluxus and conceptual art’ to digital art. It is important to stress here that Paul is not in any way unusual in doing it so; neither she is insincere or manipulative. She is, after all, an art historian, and all historical texts on AST follow the same process, of attaching its history to larger art historical debates. In fact, all art history, criticism and theory do the same. Perhaps with a negative or positive contrast, highlighting both the continuities and the disruptions, this is the nature of the positioning game. That is what explains, categorises and justifies a new product as art. Hence, Paul’s positioning undoubtedly follows this most basic step and is also undoubtedly a strong element in the discourse that aims to legitimise the practice regarded as digital art. One element (very similar to Manovich’s remarks about the particular qualities of new media) that draws attention to this discourse and its process can be seen in the perceived relationship between Dada and logarithmic art. According to Paul, ‘The element of a controlled randomness that emerges in Dada, OULIPO, and the works of Duchamp and Cage points to one of the basic principles and most common paradigms of the digital medium: the concept of random access as a basis for processing and assembling information’ (Paul, 2003, p. 15). It is ironic that both Manovich and Paul perceive ‘random access’ as being paradigmatic to the computer only. Here we find one of the fallacies of this legitimising discourse. With a bit of thought, we can imagine the same situation presented in a book. Nothing after all impedes one accessing a certain page of the book randomly and non-linearly. Paul does not quote Manovich on this topic, but that is not surprising. This is a thought that is repeated by many writers and in a way has become an obsession for all: to search for what makes computational art an exclusive
practice and, at the same time, to place this seemingly new practice as art. This modernist impulse, in a formalist and Greenberg-like fashion, finds the real subject of the artwork in its very medium: its specificity. Instead of the flatness of the painting’s surface, for example, we have the controlled randomness of computers as the subject of concern. Paul’s method of classification then highlights more than the structure of her book only and also gives away the frame (or at least one of them) in which some people think about these cultural practices. If Manovich defines new media in terms of the questions raised by the moving picture and the computational apparatuses, Paul, on the other hand, defines the development of digital art as concerned with the arts and their preoccupations with medium specificity. Both authors, in fact, are searching for something unique and particular within these products. While Manovich is concerned with the specificity of the medium itself, Paul is searching for and promoting this uniqueness in digital art. Hence, for her, the ‘medium’s distinguishing features certainly constitute a distinct form of aesthetics: it is interactive, participatory, dynamic, and customizable, to name just a few’ (Paul, 2003, p. 67). Although admitting the difficulty in pinpointing exactly what she means is specific to the digital, since ‘the employment of digital technologies’ can be ‘multiple’ and ‘hybrid’, she stress that her work emphasises the ‘formal languages specific to them’ (Paul, 2003). I cannot recall finding a reference to Greenberg in her book, but she has almost mirrored that classificatory system remembered as modernist:

What had to be exhibited was not only that which was unique and irreducible in art in general, but also that which was unique and irreducible in each particular art […] It quickly emerged that the unique and proper area of competence of each art coincided with all that was unique in the nature of its medium. (Greenberg, 2003, pp. 774–775)

Paul’s emphasis on medium specificity seems to betray another problem and again one concerned with distinction and classification. Given the complexity of works made of not one but many forms and apparatuses, and the lack of a theory that defines the specificity of digital art as a whole, Paul resorts to what she dubs ‘themes’ (Paul, 2003, p.
139) that are employed by digital artists. Similar to the divisions used in big art shows, these themes are actually the headings within Paul’s last chapter, which is arguably what makes her work seen as a survey of digital art’s practice. Of all these themes perhaps the most enduring and popular can be found in the theme of the body (other such themes include the questioning of randomness and control). By linking with questions raised by cybernetics, Paul finds a connection between the histories of art and of the production of digital art, via the debate surrounding the body (Paul, 2003, p. 139). This theme – the body – and its technologically informed reinterpretation, the ‘cyborg dream’, has indeed trespassed not only on the artistic field in question but also on the larger popular culture (and is the subject of Section 3.4). Being present in the form of film, literature and art, the debate over machines (computers) and the concept links between them and the body is undeniably a recurrent theme. The relationship between humans and machines and its consequent debate, I believe, has become more than a localised and temporal phenomenon: it is reflected in the positivistic impulses shown by sociology, for example; in the attention human modelling is given within academia; in the methods presented by the automatic algorithmic market; in prosthetic limbs, which resemble the imaginings of human–machine fictions of some decades ago; in the popular imagination; and so on. Since I will review some of these transhuman impulses in AST later on in this thesis, for now it suffices to stress the importance of this theme in Paul’s digital art and our AST.

With this centrality in mind, we should not be surprised that some commentators consider this theme to be a central characteristic of the products of AST. One of the most active characters in the debate concerning both creating a discourse that rationalises AST and celebrating human–machine analogies can be found in the figure of Roy Ascott, founder of the Planetary Collegium (see the Introduction). A professor, writer and artist of the computational, Ascott has in a way become a guru – sometimes literary – of the field. He has been one of the leading figures since the late 1960s, and is also a prolific thinker on the subject. Ascott and his ideas, it could be argued, are the closest to
consensus the field may offer. His discourse, in one way or another, has such a reach that Carl Popper, for example, quotes him as being ‘the outstanding artist in the field of telematics’ (in Shanken, 2003, p. 1). Telematics is a blend of telecommunication and computational technology and is perhaps the most well-known concept develop by Ascott. According to Ascott, telematics can be defined as:

a term used to designate computer-mediated communications networking involving telephone, cable, and satellite links between geographically dispersed individuals and institutions that are interfaced to data-processing systems, remote sensing devices, and capacious data storage banks. It involves the technology of interaction among human beings and between the human mind and artificial systems of intelligence and perception. The individual user of networks is always potentially involved in a global net, and the world is always potentially in a state of interaction with the individual. (Ascott, 2003, p. 232)

The main reference used in this thesis is a collection of Ascott’s writings edited by Edward A. Shanken and titled Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness (2003). A student of Richard Hamilton, Ascott was very much interested in cybernetics in his early days and, like most people before and after him, what most interested him was not the technology itself but the possibilities raised by it in regard to the human body and mind:

The technologies of presence are preparing us for connectivity with artificial life, the creation of a cyborg culture. If we are leaving the old, classical, earthly body for another, it is not in order to dematerialize but to inhabit a new corpo-reality, which is almost totally artificial, bionic, prosthetic. Just as the artist is concerned no longer with the creation of content but with the construction of a context (the goal is a hypercontext), so, too, the brain seeks its hypercontext in the hyperbody. This is to talk about the post-biological body as interface. (Ascott, pp. 266–267)

23 In fact, as early as 1968 he contributed to the journal Leonardo’s second issue (Ascott, 1968). Leonardo is a central AST publication and has latterly been a nurturing institution for the same world; it will be discussed in detail in Chapter 3.
Telematic Embrace, as the title itself suggests, is an ode of love regarding the possibilities of technology. For Ascott the computational revolution is much more than an increase of productivity, a decrease of physical distances or a new medium available for artists. For him and for many involved with this subject, the computer heralds a new time and a new human. These new possibilities in fact are his most beloved subject, and his views even (perhaps tritely) verge on futurology. He is undoubtedly a romantic over the computer, and that is why he is seen by some as a utopian (Shanken, 2003). A pause is necessary to clarify his perceived utopianism. Of course, one could argue in his favour, for example, by affirming that his rationale is correct, that new media will free human beings from their corporeal limitations, via telematics, and therefore expand our consciousness beyond our physical bodies; that the ‘post-biological body’, as described by him above, is indeed a possibility. People can believe (and they do) that with it we would achieve feats unknown in human or natural history. The logical extrapolation from telematics, if Ascott’s predictions are correct, would represent a new state of being. Facilitated by computing technology, the new human would be master of its essence and would, similarly to the act of programming, reshape itself at its own will. If we say Ascott is a utopian it is because we do not concur and do not believe this feat to be possible. Ascott is a romantic and not a rationalist because, as our technical knowledge informs us, we are very, very far away from his transhumanistic dreams. Likewise, Ascott is a utopian and not a realist because, even after some fifty years of continuous development of technology, we are nowhere near his telematic existence (or at least the most radical, non-biological versions of it). If we say he is naïve, it is because nothing in the world confirms his convictions. Paraplegics still cannot walk, people still get sick and we are still very much bounded by our national, local and biological identities. Moreover, even if all these realities could be altered, would the political arrangements of humans change?

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24 For more on transhumanism and AST, see Section 3.4.1.
Wouldn’t these changes just further intensify the differences between the have and have-nots? This question of utopianism is actually discussed (and dismissed) by Shanken in his introduction to the aforementioned book (Shanken, 2003). Using methods similar to Paul’s, of linking Ascott’s production with the larger concerns of art, Shanken returns to the artistic debate and negates the perceived utopianism:

Whereas conceptual art deemphasizes the materiality of art objects to interrogate the semiotic basis of visual meaning, telematic art asks how the semiotic structure of computer networking offers alternative forms of authorship, meaning, and consciousness in the electronic ether of cyberspace. If telematic art is interpreted as an extension of conceptual art, then a significant aspect of a telematic artwork will be embodied in its own idea. Opposition to what has been termed the ‘techno-utopian rhetoric’ of telematic art may be responsible, in part, for the occlusion of this point […] While such critical challenges are important, this so-called rhetoric may, in and of itself, be considered a significant aspect of the art form. In other words, the conceptual idea of Ascott’s telematic art – that electronic telecommunications technologies may contribute to the creation of a networked consciousness that is greater than the sum of its parts – is an integral part of his work and the history of the genre. (Shanken, 2003, p. 86)

For us the importance of this discourse does not reside in its overreaching consequences but rather in the manner in which the argument is played out. Combining and reinterpreting, in fact even predating, transhumanism (crudely speaking: the idea that humans will surpass the necessity of their physical bodies via technology), Ascott actually manages to create a gripping and optimistic view of the future. Although naïve, this view has attracted much support and, in effect, separates those with the vocabulary and expertise of telematics from those belonging to the old art. For Ascott, art will not survive without a deeper involvement with his telematics and its new telematic world order (Ascott, 2003, p. 258).

25 This popularity, for example, can be seen in the proliferation of Ascott’s Planetary Collegium ‘nodes’ around the globe.
When I say the reading of cultural production may vary according to context and ideological point of view, this is not merely an assumption. The next example, Julian Stallabrass’ *Internet Art: The Online Clash of Culture and Commerce* (2003), can be seen as a classic example of counter-balancing the more fictional approaches proposed by Ascott. Stallabrass is a professor at the Courtauld Institute of Art, and his *Internet Art* has an obviously different tone from his other most famous work: *High Art Lite: The Rise and Fall of Young British Art* (2006). In *Internet Art*, Stallabrass explores not the whole world of AST but a subsection of it: namely that which is exclusively done through and for the Internet. This, I believe, is a wise choice since Stallabrass neither seems interested in all developments of Internet art nor seems to care about those which do not fit his criteria. Usually a harsh critic of consumerism in the arts, Stallabrass’ views are no different here, as *Internet Art* tackles questions very dear to the arts such as the object, ownership and production. He sees the productions of certain AST artists not guides for the future, as Ascott (2003, p. 11) does, but pretty much the opposite. *Internet Art* posits its cultural products as contemporary events of today. To do that it searches for the contextual scenario, the local politics and the economics in which his artists are present. So political in fact is his emphasis that, resembling Aracy Amaral (2006a, 2006b), a celebrated Brazilian theorist concerned with the social aspects of art, he talks about ‘the emergence of art on the Net [that] hands back to artists a prize and an obligation favour of artistic license and cottage-industry production values: an explicit social role’ (Stallabrass, 2003, p. 10). It is important to note that Stallabrass refers to a small and (literally) interconnected group of artists that, in a very similar behaviour to other social

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26 Stallabrass’s participation is in itself noteworthy. He is not, like most of the sources mentioned in this text, an insider of AST. In fact the opposite is true. He has always been a very important figure within traditional contemporary art and his book was produced while he held a fellowship at Tate Britain.

27 To talk about products in relation to Stallabrass’ Internet art is quite problematic since, for him, Internet art sits diametrically opposite the art world’s market and culture.
movements, have organised themselves and created their own channels of discussion and
exhibition. These were not, like Ascott’s students and group, brought together by an
ideology of transhumanism via computational technology; instead Stallabrass presents a
sarcastic, anti-establishment and confrontational grouping – a collective, albeit loose,
group interested in today’s questions and not in some future scenario.

Yet, when we say Stallabrass understands Internet art as political, we are not
saying he does not regard it as art. On the contrary: his Internet Art, like many of the
other works reviewed here, flirts with the idea of positioning its subject within a larger
historical lineage. Although highlighting the similarities between Internet artists’
discourse and the discourse of the early twentieth-century avant-garde – that is, ‘its anti-
art character, its continual probing of the borders of art, and of art’s separation from the
rest of life, its challenge to art institutions, genuine group activity, manifestos and
collective programmes, and most of all an idea of forward movement (as opposed to one
novelty merely succeeding another)’ (Stallabrass, 2003, p. 35), he finds in conceptual art
the real potential link between Internet art and previous artistic developments28. For him,
conceptual art’s ‘break from the aesthetic of the isolated art object and the move towards
an art of discursive process […] could be completed online, where the provisional, ever-
changing character of material is taken for granted’ (Stallabrass, 2003, p. 26). Moreover,
also similarly to our previous examples, Stallabrass too sees a distinguishable
characteristic in Internet art. Although affirming that Internet art is not a medium, and

28 Modernistic ideals were also especially present in the discourse of early computer artists (see
Chapter 2). However, in time, that also would give way to a rereading according to conceptual art (see
Chapter 3). Stallabrass identifies three reasons for avant-gardism in the early Internet art: ‘First, there was the
need to carve out a recognizably distinct area of interest for this novel art. Second, since modernism and the
avant-garde were one more lively models, the issue of autonomy had to be addressed. Third, it was a way of
hitting out against disabling and over recursive strands of postmodern theory that had been used to shelter an
increasingly conservative art world’ (Stallabrass, 2003, p. 39).
hence cannot be thought of under the banner of a single medium or form (Stallabrass, 2003, p. 24), Stallabrass posits two qualities particular to it. Firstly, ‘the most fundamental’ is its relationship to ‘data’ (Stallabrass, 2003, p. 26). Borrowing from Manovich’s conception of old media, Stallabrass states that, whereas ‘artists made unique objects in particular media in which the interface and content were inseparable[, …] in new media the content of the work and the interface are separated [and hence] a work of new media can be understood as the construction of an interface to a database’ (Stallabrass, 2003, pp. 26–27). This preoccupation with data, or information, identified by him as a conceptualist, argues for Internet art as a new kind of conceptual art. With this Stallabrass is both positioning his Internet art within the spectre of conceptual art and promoting it as an alternative to conceptual artists: ‘Online, Conceptual art potentially reinvents itself’ (Stallabrass, 2003, p. 33). His second distinguishing feature of Internet art is found in its interactivity. Here, differently from the popular view of interactivity as empowering, engaging and democratising artistic audience, he finds artists discussing interactivity in a negative and suspicious way (Stallabrass, 2003, p. 61). Writing in 2003, an aeon away from us in 2016, he perceives the Internet as scanty in depth, with interactivity and true engagement a yet-to-be-achieved phenomenon. Perhaps even worse, he and his examples perceive the Internet not as a space of utopian dreams but one ‘lacking democratic values’, with an ‘increasing dominance of business ethos’ seeing interactivity and its uses as just another tool ‘that leads to the all important 0/1 choice, to buy or not to buy’ (Stallabrass, 2003, p. 67). Interactivity potential, for him, is found not in the tricks of machine interaction but in possible networks, ‘fostering transnational politics’ (Stallabrass, 2003, p. 83), giving Internet artists the ‘possibility of making their works act as political and social agents without the mediation of state institutions, commercial dealers and the print or broadcast media’ (Stallabrass, 2003, p. 104). Stallabrass, however, at the end of his work, ponders the definition of Internet art and, like this work, acknowledges the impossibility of reaching such a definition. Despite
recognising some particularities – its use of data and interactivity (as a catalyst of social engagement) – he concurs on the view that, although many links have been attempted between Internet art and art, usually adopting a formalism that emphasises the medium specificity of it, these projects have failed: ‘It is just this synthesis of content, media and transmission that makes definitions so difficult’ (Stallabrass, 2003, p. 139). Unsurprisingly for us, Stallabrass identifies these many possible arguments for an undefined (perhaps even indefinable) practice – arguments regarding the existence, the quality, the peculiarity and the validity of Internet art (or any other product of AST) – as resulting in something else entirely: ‘The outcome of that conversation has been a developing field of art, which, as we have seen, has been conceptually challenging and politically radical, but also emergence of a distinctive theoretical discourse’ (Stallabrass, 2003, p. 143).

1.3 Method: A comparative history of AST?

It could be said that the authors we saw in the previous section all offer different takes on the production of an AST narrative, highlighting both its specificity and qualities. Their narratives are not in total concordance and one could say, rightly, that neither should they be. Despite painting different pictures from one another, these visions could and actually do exist in parallel. What they do represent, however, is the very battle over definition present in any given field of artistic production. By positioning AST as $X$ instead of $Y$, each individual supports a particular point of view sustained by their own views of the world and institutions of art. As I have said before, my job here is not to choose between available discourses. What I am trying to show is that, despite their different takes on the same phenomenon, they all share a similar method. In order to achieve their objectives of sorting out the mess created by the artists, they create a canon of worthy subjects and artworks; they historically link these artworks to previous artistic developments and they
also create a discourse, based on these previous steps, to distinguish what they perceive as correct or worthy of attention. These efforts, similarly to Danto’s institutional ones (discussed in Section 1.1), are all involved in classification. Even Stallabrass, the most critically attuned theorist, despite recognising the impossibility of such a definition, also engages in an exercise of extracting Internet art from the larger AST (or new media as he sees it). They cannot give a picture of the whole field but only small sections of it. Others, such as Ascott, argue for the future potential, a telematic one, in order to influence the development of these productions. Others, such as Paul, focus on the various ‘themes’ present in what Paul labels as digital art.

As pieces of critical analyses, following their own hermeneutical rationale, I believe all of them to be valid. They may be contradictory, but what they are doing is to reflect the heterogeneity of production in the first place; the artists, like the theorists, also have different points of view regarding their practice. This is indeed a problem and not only for this text. How can one recount the whole history of something if there is no way of discerning what you want to speak about? How does one describe something as legitimate if not all voices are heard? And what makes something legitimate anyway? The answers may not be what one expects. First of all we are comfortable in saying the neutrality of Becker and Bourdieu is in fact nothing but the opposite of neutral. They indeed do not wish to classify artistic practice explicitly, as Ascott, Danto, Manovich, Paul and Stallabrass do. That, however, does not change the fact that, as they observe the arts, they do in fact change our perception of them (as long as one is aware of them, of course). To observe is to interact and they, like everyone else, are caught in this circle. As they try to describe the functioning of the artistic legitimising process, they will invariably affect it. Theirs is also a particular view on the subject and, consequently, as long as people recognise the patterns of legitimisation as they do, they will also affect the way people perceive and discuss art: that may not be their intention (nor is it mine), but it may indeed affect the perception of the field. Danto’s institutional critique, perhaps better
represented by Stallabrass and his insights into the institutional constraints of Internet art, is an example of the institutional reading of the arts. Inadvertently, this thesis may also fall into this circle. Since I do not intend to stylistically or aesthetically classify AST, by using the very term and as a result of its own method of inquiry (which is concerned with how a whole new network of people developed an art in parallel to art itself), I may well be creating another (imperfect) definition. This problem invariably takes us to the question of what we should look at. As this thesis is interested in the emergence of AST as a separate world, it is imperative then to concentrate our efforts on some particular areas of the field: its discourse, resources and institutions. Hence, I am aware that, by the very act of discussing one of the many possible stories presented in the field, I could also define it. This process is bias in itself but it is not naïve in its emphasis, as have not chosen my case studies at random. They are events and institutions that are central to the mythology of AST. Since these subjects hold a canonical value for the field, in fact, members of AST themselves have already selected them for us. Consequentially, I will not talk about obscure AST artists or undisclosed contexts and events. What I will doing, however, is to review, via a sociologically inspired perspective, the events that are considered central in the development of whatever term you may prefer: digital, computer, new media, art and technology and so on. I analyse and contrast these events, characters, artworks, institutions and discourses not with the intention of delineating a particular stylistic or formalist conception of the vast production of AST but rather to demonstrate how AST got from A to B, from then to now, from early computer art and art & technology attempts to AST.

At this point a paradoxical problem emerges: Is this thesis then proposing a history, a historiography, a sociology, a critique or, simply, a study of the material culture of the period and practice in question? Firstly, the study of emerging artistic practices

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29 As seen in Becker’s premise (2008, p. 310), discussed in Section 1.1.
developed here is constructed on the basis of perceived facts existing both in the past and present tenses. Let’s take, for example, a central element of AST development, the microprocessor and the transistor revolution, portents of a new type of apparatus, the computational one. These apparatuses are still, relatively speaking, recent creations, being only popularised over the past twenty years or so and still reverberating through society as a whole. Respectively, in relation to the aim of this thesis – to understand an artistic practice via a developmental history as it is institutionalised – entails not only an apprehension of previous moments but also an acknowledgement of the present state of this very practice. If history, as it is commonly understood, attempts to represent the past via a particular narrative (Foucault, 2002a, p. 7; Caire-Jabinet, 2003, p. 11; Prost, 2008, p. 235), then we could indeed say that this is a historical research. The problem, however, becomes more latent when we think about when history finishes (if indeed it does) and when we reach the present (Gombrich, 2008, p. 599; Braudel, 2011, p. 98). Where should we stop and say, ‘this is not history of art but rather contemporary art (history?)’?

That is perhaps the main problem regarding art history in the context of new and relatively young practices that are not completely positioned within institutional, aesthetic, ideological or technical umbrellas; even though the practices that constitute AST are at least fifty years old and have passed through very established historical periods (post-war, the Cold War and the history of computing), AST’s history is very much up for grabs, depending on your epistemological, material and/or aesthetic concerns. While the traditional forms of art history, from Gombrich to Argan, are preoccupied with defined and consensual styles and periods (the Renaissance, Baroque, Romanticism, Modernism etc.), given the novelty of our subject, we cannot afford such stylistic generalisations, for these are histories concerned with canons and with established and validated forms of art. That is not to say that the thing we call AST has not moved in this same direction, towards consensual and institutionalised conceptions of itself, but rather that its canon is still in its infancy and, as its biography shows, it is still
very much a work in progress. My emphasis on AST’s institutions and on very few characters, for example, demonstrates an anxiety in relation to what is in effect a very ephemeral canon. Would it be more appropriate to regard this research as historiographical, being as it is more concerned with how the very history of AST is being constructed, instead of mythologising art history itself (Mansfield, 2002b, p. 1; Caire-Jabinet, 2003, p. 16)? Perhaps. But again, and quite reasonably, we are involved in yet another paradox. How can one analyse the predicaments and arguments for a certain history without being involved in a new, revisited history? This question will have to remain unanswered for now.

Plausibly one might ask how it can be possible to explain a practice so new and vast if not by looking at its documents (the *oeuvre*) and its characters (the artists) only, as many art histories do? I do not, in any form, negate the value and insights that result from this kind of effort. Neither do I negate the very presence and importance, in art history, of these references or units of discourse. The fact is that, as Foucault (2002a, p. 26) has argued, despite its apparent simplicity, the very definition of *oeuvre*, for example, is not an easy one. Moreover, by concentrating my efforts on the society and culture to which these units of discourse (Foucault, 2002a, p. 120) belong, I hope for an unbiased (aesthetically speaking) survey of artistic practice: one that heavily acknowledges local contexts, pre-existing ideologies and the material culture in which AST is found. This emphasis on context, I believe, is central to the sociological, material and institutional preoccupations of this thesis. In contrast to a stylistically preoccupied history, this is broader; it is a history that, even though it may fall victim to the kinds of paradoxes described above, aims to remove itself from the art theory (as in proposing a theory of artistic practice) and critical theory (as in proposing a critique of artistic products) canons. AST, as a detached and heterogeneous artistic world, again, cannot be fully explained by phenomenological, stylistic or philosophical insights.
Perhaps the problem concerning the history of AST can be summarised between two approaches, a stylistic one and a formalist one. Stylistic approaches, as exemplified by Stallabrass, recognise an incapacity to define what the medium of AST is and, instead, focus their efforts on developing a theory that unites discrete elements within AST – his Internet art. Likewise, although Paul attempts to work within the constraints of a digital art – that is to say, art developed with computers – she also develops a collection of themes that are used as guides within a discrepant art world. Formalist approaches, on the other hand, as exemplified by Manovich’s new media, attempt to discern a set of characteristics that are unique and proper to AST. Since he is satisfied with his distinction between new media and old media, he does not attempt to discuss styles within AST artworks – to do so would require negation of the intrinsic value of new media and, at the same time, would destroy its specificity as a medium. Since all these attempts fail to comprehend the separateness of AST, as well as its peculiarity not as a medium or method but as a distinct artistic practice, this thesis cannot follow either of these constructions, formalist or stylistic. My method at once avoids the problem of styles and medium specificity by locating the emergence of a new art not in its objects but rather at the development of its discourses and institutions; it is, literally, a story of how people got together to do AST and how and why they did so. The theoretical components central to my analyses (institutions, political opportunities, technological changes, framing processes, contexts etc.) are drawn from a large but cohesive field of knowledge, a field that deals with social movements and their political dynamism. It is important to note, however, that mine is not a classic sociological method either, one that in some views completely disregards individuals and discourse in favour of large, social statistical samples (Prost, 2008, pp. 174–176). Additionally, it can be argued, in relation to my previous analyses of Bourdieu, that there is a tendency in some of these sociological studies to disregard the effects of time in favour of a stable mechanism that, somehow in this kind of narrative, persist in its entirety over time. Even though mine is a
sociologically inspired analysis of an artistic practice, I cannot and will not concur with any pretence to universality. This overarching universality, with some very brief examples (Prost, 2008, pp. 183–184), does not hold in the face of evidence.

Notwithstanding these observations on atemporal and/or universal approaches, I do not mean to forecast the demise of insights by more positivistic authors. Could we, for instance, hold Baumann’s (2007b) study regarding the legitimation of Hollywood films to be a historical work? Is it possible that, despite not discussing the \textit{oeuvre} of Hollywood cinema itself as an art history would, his is an art historical work? It all depends on who you ask. Baumann himself would probably not subscribe to this label. After all, in contrast to an art historian, he is not preoccupied with a historical narrative, the particularities of its \textit{oeuvre} (films) and its authors; nor does he value artistic merit, aesthetic theories and/or biographies. So how can we see his work as a historical inquiry?

There are two paths to follow in this analogy. Firstly, Baumann’s work, even though not intended to be a historical study, deals with a timeframe that is inherently historical. He may not be constructing a narrative of films and their creators but he is constructing a narrative of cinema, as a collective activity, and its development towards recognition. This is conceivably not the kind of enquiry people would ascribe to art history but it is history nevertheless. Following the ambitions of the Annales (and later the New History) school of thought, exemplified by the efforts of Fernand Braudel (2011, pp. 100–101), the study of society in general is blurred by its time; in other words, both fields of knowledge (sociology and history) are, in essence, talking about the same subject and are not, imperatively, mutually exclusive. Foucault, for example, who criticised the quest for a total history that is naturally multidisciplinary (2002a, pp. 10–14), was also very aware of the artificiality of divisions in these academic disciplines (2002a, p. 12). We could also quote historian Antonie Prost, for whom ‘the sociological affirmation is always, equally, historical because it focuses on the inseparable realities of very determined contexts;
therefore it is only valid at the respective space and time of these contexts’ (2008, p. 183, my translation).

The second and perhaps most important fact to be aware of in the analogy between sociology and history regards the comparative method itself. This, I believe, is where historiographical method meets sociological method (Prost, 2008, p. 172).

Sociology, a study of that which is general (otherwise it would not be a ‘social science’, which, invariably, studies that which is general to societies and not particularities), needs to examine social facts in $X$ in order to compare them with others in $Y$. In this way, how does it differ from the comparative art historical method, which, in most part, deals with particularities of individuals and compares them with particularities of other individuals? What are the peculiarities if not ‘facts’ constructed in relation to something else? This method, resembling the medical one, of indirect experimentation, in which ‘it is necessary to determine whether the absence of a fact is followed by the absence of another or, inversely, whether the presence of a determined fact is always followed by the absence of other’ (Prost, 2008, p. 174, my translation), is nothing but an experimental method \textit{a posteriori} that invariably forces the researcher into looking at similar constructed facts exterior to the first sample. Hence the need for a \textit{comparative social and cultural art history} that, differently from the emphasis given by the sociologist, is interested not only in the general (the social) but also in the particular (the individual). Such an approach organises and reaffirms the understanding of both the art historical and the sociological methods employed by this thesis. Differently from the approaches of the authors described in my biographical review, this comparative art history relates both to the social and to the individual. This thesis is not a collection of artworks sorted by stylistic considerations or technological, medium-specific components. Instead, by focusing on the social and cultural contexts presented in various spaces, which are invariably subject to change over time, this thesis hopes to present a rather dynamic history and certainly not an immovable one – in other words, neither a simple collection
nor an idle anthology of AST. Finally, it is important to stress that this method, as sketched here, is not finished. A whole new study will invariably be needed in order to supplement some of the deficiencies of this thesis. I have not, for example, started to compare and analyse the works of historians concerned with a social history of art, as exemplified by T. J. Clark. Marxism may appear to be incompatible with an understanding of collective action but, being very honest, who knows? That is certainly a judgement that cannot be accomplished here. The method here should be seen as a first step and not, as one might expect, a complete and conclusive effort\(^\text{30}\).

\(^{30}\) For a long and ongoing debate between the merits and demerits of sociology of art, social art history, art history and artistic criticism, see Zolberg (1990) and Wolff (1993).
Chapter 2: The initial setting of AST: Computer art

No artistic world develops in a historical vacuum, nor is it unconnected to its context, be it political, cultural or material. AST and its first appearance, as computer art, are no exception. It is only by understanding the connections of these early practitioners to the world at large that we can comprehend the rationale behind much of the action – and reaction – caused by those new cultural products positioned within the label ‘computer art’.

There are indeed two elements, exogenous to the art world in question, that oriented and allowed both the production and the reception of those practitioners and, in turn, the people who would follow them in the next few years. These interconnected events are, namely, the Cold War (in which the West, and particularly the US, was focused on the containment and isolation of the USSR via an economic and scientific lead, resulting in the creation of the military–industrial complex) and the development of a rational formalist discourse (which arose amid rapid technological change; concerned belief in a process of total formalisation of human activity; and provided a framework for national policies vis-à-vis geopolitical strategies). Together these two events allowed early computer art development in a very specific manner: they provided the material, institutional and discourse opportunities in which the new art form would develop. These opportunities, allied with changes happening within the artistic field itself, informed and nurtured the early AST field and, as we shall see in this and the next chapter, are still felt today. The payoff from this enquiry is, therefore, paramount to our endeavour, as it will provide a framework in which we can read the subsequent years of computer art practice and, later, AST itself.
Firstly, and perhaps most importantly, we need to comprehend that computer art initially developed not only within academic and industrial settings but also, more generally, within the context of the Cold War. We should not underplay the importance of mutual annihilation and a technological race between two superpowers. From national policy to geopolitical struggle, from technological development to military application, from philosophy of science to street protests, all social facts of life were touched by the spectre of a dualistic world struggle between the US and the USSR. Albeit an indirect influence on the pioneering work of early computer artists, such is the importance of this conflict for our subject that it can be confidently asserted that the development of the computing industry, pivotal to computer art for obvious material reasons, was a direct consequence of both the Second World War and its resulting geopolitical struggle (Edwards, 1996; Ceruzzi, 2003; Kline, 2006; O’Mara, 2006; Longo, 2008; Alberts, 2010; Haigh, 2010; Laprise, 2011; Cortada, 2014).

Moreover, not only did the conflict reorient the geopolitical landscape of the pre-war status quo but it also affected the way economies and states as a whole were managed. US policy, as part of the Cold War effort, consequentially had shifted towards industries that helped the Cold War effort. Assuming a (ironic) statist and centralised disposition, the US diverted its investments to industries and universities rather than to the military itself, creating the now infamous military–industrial complex, an amalgam of private industries, government departments and universities working in tandem. This new funding system not only resulted in the leviathans of computing technology, such as IBM, but also made possible the development of myriad other industries (Haigh, 2010). IBM, for example, with vast previous experience in ‘office machines’ and huge state support, dominated the computing market. Likewise American Telephone and Telegraph (AT&T), with a vast monopoly over the telephone systems in the US and hence sheltered from competition, profited from closer government ties, allowing the development of a unique corporate culture and excellent research capability (Kane, 2010). This only exacerbated
the gap between the US industries, universities and economy and those of its European allies. One effect of this gap (and the attempted bridging of it), especially in the years following the war, and of reparations efforts after the Second World War (the Marshall Plan), is referred to as the ‘Americanisation’ of the US’s European and Asian allies (Berghahn, 1986; Kipping and Bjarnar, 1998; Zeitlin and Herrigel, 2000; Kipping, Kudo and Schröter, 2003; Longo, 2008; Alberts, 2010). Unsurprisingly, as early as 1965 Europe still had a very asymmetrical relationship with North American industry and science in general (Nau, 1975). This newfound affluence in the US also affected the people within those privileged industries, such as computing. With profits soaring, a labour relationship marked by a deep fear of Soviet influence and of consequential unionisation (better exemplified by McCarthyism), together with greater interventionism by nation states (Ikenberry, 1992), made resurgent the idea of early twentieth-century welfare capitalism, especially in industries attached to the history of ‘office machines’ – that is, analogue computers, already precursors of the practice of welfare capitalism in the early twentieth century. This preoccupation with employees, in turn, made the vast research compounds of tech firms in the US possible, by creating both huge new suburban neighbourhoods and careers (similar to those of early computer artists) that could easily move from academic to industrial positions and vice versa (Kaiser, 2004): a characteristic shared by both computer and AST artists alike. Moreover, the agglomeration of researchers from different areas into the same physical space, a rather open and liberal internal culture that promoted interdisciplinary work, and a blurring between workspace and life in general would, in some specific cases such as Bell Labs, create the necessary conditions for the development of partnerships and highly speculative work such as that of the early practitioners of computer art31.

31 It is important to note that these three developments did not allow computer art only. The whole AST field in fact is a product of these social, economic and political developments. If the reader is reluctant
Although better armaments help, that alone cannot explain why governments elsewhere, not only in the US, were keen in investing huge sums in technological and scientific research. In other words, why did technocrats and politicians everywhere bet that the future was attached to a nation’s technoscientific competence? What made them so sure that, by achieving scientific and technological development, victory and prosperity were around the corner? Our final link concerns the ideological, discursive aspects of the arms race and its most exuberant characteristic, namely the faith in technological development and rationality exhibited in the aftermath of the Second World War. With a mixture of national pride, fear of the enemy and a wish for a better future, post-war faith in the rational capability of humanity cannot be thought of outside the frame of Cold War politics and the geopolitical order after the Second World War. Simultaneously proposing a method and a rationale, supposedly rational, scientific and formalist theories painted a picture of a world that was controllable, predictable and, hopefully, better. This, for a world that had left its ‘darkest hour’, should indeed have sounded reassuring. On the one hand, if the geopolitical conflict accounts for the technical and economic developments that made possible computer technology (and consequentially computer art), on the other hand, a particular rational discourse provided early computer art with a frame in which to conceptualise its practice. Consequentially some computer art pioneers, seeing themselves as harbingers of a new society, a modern one, appropriated these discourses in order to justify their actions; theirs was the true new art for a new society. A product of the Enlightenment and integral to modernity, the post-war faith in rationality was both a cause and a result of rapid technological development to accept these changes as pivotal to the whole AST field, and not only to computer art specifically, consider that the very idea of the group E.A.T. (see Chapter 3), born in the heart of AT&T’s Bell Labs, would have been impossible without this institutional setting. These relationships will be outlined in detail later on.
that would, theoretically, achieve social and economic progress\textsuperscript{32}. The reader would be correct in pointing out that this was not a new phenomenon. Misa (2004, p. 5), for example, reminds us that the ‘tie between modern technology and social progress was much in the minds of “modernists” in the early twentieth century’. What differentiates the post-war rationality and the early twentieth-century one, however, is not the object of this faith itself (rationality) but rather the scope of its effects. Despite the Cold War, people were genuinely optimist in relation to their future. Although brief, since we know that by the end of the 1960s this optimism had all but vanished, for a while there was a near consensus that the best was yet to come. This new rationality, an unreasonable one (Erickson \textit{et al.}, 2013), since it also dictated the precepts of mutually assured destruction, was so pervasive that it attempted to formalise, universalise and define all aspects of human activity, from art to science, from commerce to policy and so on. This general disposition is herein referred to as ‘rational formalism’. In its attempt to control the fate of mankind, rational formalism found in the digital computer both a tool and a symbol of its intent. The artists in this section, then, in a way, colluded with this program.

This chapter (and Chapter 3) will describe the exogenous events that allowed AST to develop before dropping into the case studies themselves. Endogenous factors that were important for the development and reception of the new field, however, will be included within each particular artistic example. In other words, I shall first look at society at large and then settle into the artistic field. A final subsection, a conclusion, follows this pattern and works as a way to tie together the social and artistic events explored in each chapter. Arranged in chronological order, this collection of thoughts should give a clear picture of the dynamics between the arts, society and the historical context. Hence, for now it suffices to say that the next subject concerns the formative factors of early computer art.

\textsuperscript{32} For an in-depth discussion of rationality, modernity and technology, see Misa \textit{et al.} (2004).
2.1 The Cold War era

If there is one clear and documented narrative central to Cold War technological development, it is that digital computing technology is the result of the Truman Doctrine’s ‘containment’ – itself a reflection of ‘perceived Soviet globalist intentions’ (Edwards, 1996, p. 8). Under this perspective, as characterized by Edwards (1996), the paradigmatic narrative of politics and foreign policy was that of the closed world. That, in essence, constituted the global imperative frame in which most relations, both within and between states, were characterised. The closed world of Edwards can be defined as ‘a radically bounded scene of conflict, an inescapably self-referential space where every thought, word, and action is ultimately directed back toward a central struggle. It is a world radically divided against itself. Turned inexorably inward, without frontiers or escape, a closed world threatens to annihilate itself, to implode’ (Edwards, 1996, p. 12).

Borrowing the term from literary criticism, Edwards creates a narrative of digital computing development based not on interrelated scientific discoveries, as usually done by historians of science, but concerned with the social and discursive conditions that informed its development during those turbulent years (Eriksson, 1998). His main argument, that computing technology was as much a product of pragmatic necessities arising from the complexity of an ever-watched world as it was a product of the belief in digital computers as tools for control, is constructed with the help of two elements, identified by him as pivotal in this undertaking: the ‘closed world’ and ‘cyborg’ discourses. These two discourses, which he constructs from the works of Foucault and Wittgenstein, share the aspects of being discourses in the sense that:

33 If on the one hand closed world discourse provided the frame for all actors to think and act according to the other, the outside, on the other hand the cyborg discourse provided the metaphorical insight in which this other could be controlled. The cyborg discourse, as we shall see later in the description of
Foucault conceives of discourses as the sites where the objects of knowledge are constructed. In a sense, for Foucault the idea of a discourse replaces the more traditional notions of ‘institution,’ ‘convention,’ and ‘tradition.’ Discourses are the Wittgensteinian *forms of life* which institutions and traditions structure for their inhabitants. A form of life is not – or is not only – a form of experience. Discourses create and structure experience, but they are themselves primarily conventional, material, and linguistic, rather than experiential. (Edwards, 1996, p. 38)

Hence, Edwards concludes that:

A discourse, then, is a self-elaborating ‘heterogeneous ensemble’ that combines techniques and technologies, metaphors, language, practices, and fragments of other discourses around a support or supports. It produces both power and knowledge: individual and institutional behaviour, facts, logic, and the authority that reinforces it. It does this in part by continually maintaining and elaborating ‘supports,’ developing what amounts to a discursive infrastructure. It also continually expands its own scope, occupying and integrating conceptual space in a kind of discursive imperialism. Like a paradigm, much of the knowledge generated by a discourse comes to form common sense. (Edwards, 1996, p. 44)

Right after the end of the Second World War this scenario, the closed world one, was already in place. On 12 March 1947, with a new struggle already on the horizon, President Truman delivered a passionate and alarming speech at the US Congress. Its first paragraph 34 paints a picture of imminent disaster. This ‘Truman Doctrine’, as it would later be known, provided the first arguments towards Soviet containment. According to its rationale, the US, which had already spent over $341,000,000,000 in the Second

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Norbert Weiner’s *Cybernetics* and Edwards’ cyborg discourse, provides then both the fundaments of human–machine analogies and a logical description of how one can understand the cognition and behaviour of another being, in this case, the other, the enemy. By rationalising and formalising humans, these discourses not only equate humans to machines but also open up the idea that, as machines, as objects, the *other* and the *self* can be controlled, modified and transformed.

34 ‘The gravity of the situation which confronts the world today necessitates my appearance before a joint session of the Congress. The foreign policy and the national security of this country are involved’ (Truman, 1947).
World War effort, should, then, continue to spend in order to stop ‘the seeds of totalitarian regimes’ (Truman, 1947). This definition of priorities and the quickly evolving events, soon resulting in the Marshall Plan and the formation of NATO, not only signalled the start of the Cold War, as an economic and technological race against the enemy, but also drew attention to the demarcation of boundaries between the Soviets and the West.

From the perspective of conflict, of containment, three policies may be regarded as pivotal to the US strategy. Firstly, in foreign policy, the formalisation of a union between the US and its allies, in the form of the NATO alliance, not only sought to provide a military deterrent but also signalled a minimum political understanding between its participants. Underneath the rhetoric of its charter\(^35\), however, the hegemonic position and national interests of the US would undermine its allies’ economic interests and, furthermore, create tension between its participants (Maier, 1977). US foreign policy was so important in fact that it would inform two other pillars in the struggle against the Soviets. Trade policy, then, can be considered the second front on which the US would impose its will, via an ideologically motivated economic plan directed at both the US itself and its allies. Not only was there a push towards the isolation of the Soviet economy in the form of an embargo (Mastanduno, 1988) – since it was seen as a ‘war economy’ – but also US trade policy pushed for the creation of a new monetary and trade system, based on multilateralism and foreign assistance, which in effect would push its allies

\(^{35}\) ‘The Parties to this Treaty reaffirm their faith in the purposes and principles of the Charter of the United Nations and their desire to live in peace with all peoples and all governments. They are determined to safeguard the freedom, common heritage and civilisation of their peoples, founded on the principles of democracy, individual liberty and the rule of law. They seek to promote stability and well-being in the North Atlantic area. They are resolved to unite their efforts for collective defence and for the preservation of peace and security’ (NATO, 1949).
closer to its influence while, at the same time, keeping the Soviets away. Despite not directly affecting its own business, the pressure on its allies was such that the US had to intervene. Foreign aid, which reached its peak with the Marshall Plan, became both a tool of military containment of the Eastern bloc, via a massive investment in rearmament (detrimental to local economies) and political containment (via the exercise of financial dependency). This dependency on Marshall aid, which redrew national politics as much as it did economies,

was not only conditional on coalition governments marginalizing the influence of Communist parties but was also intended to push Europeans along the path toward closer economic integration. The secretary of state implied that Europeans were to view the problem of recovery as a whole, and see what contribution each could make to the mutual benefit of all. The program, he said, ‘should be a joint one’; rather than come to the table with individual shopping lists, European governments should think how best to coordinate their requests […] In short, the Marshall planners took the American structure of a federation of states with a single market as a ‘model’ for the direction in which Europe should move – not by force, but by persuasion. (Krige, 2006, pp. 21–22)

The construction of this ‘informal empire’, done not by force but by allure and/or lack of alternatives, moved Western Europe closer to the US not only politically but also symbolically, in that it would be thought of and managed as a United States of Europe – under US guidance and control. The approximation between allies, already then a political, military and economic matter, also presented itself socially, in the sense that

36 The US’s firms, unlike the firms in Western Europe, had no links to the Eastern bloc and so did not oppose the commercial isolation of the East (Mastanduno, 1988, p. 128). In fact, ‘extreme anti-communism exposed any firm that expressed even a passing interest in East–West commerce to the charge of trading with the enemy’, harming its own position in the American domestic market (Mastanduno, 1988, p. 129). That is not to say, however, that America’s own economy was not affected by the new order of Cold War geopolitics. Once a staunch advocate of antitrust and free market practices within a decentralized economy, the US turned to a rather interventionist approach in the name of productive efficiency (Maier, 1977, pp. 614–615). This economic warfare, however, was not without costs from the US perspective.
Europeans, distraught by war, simulated US institutions, resulting in their ‘Americanisation’\(^{37}\) (Kipping and Bjarnar, 1998; Krige, 2006, p. 268; Alberts, 2010). Despite this hegemonic position, ‘one can also detect a desire on the part of many officials to promulgate a postwar system that would have a normative appeal to elites in other nations’ (Ikenberry, 1992, p. 320).

The final pillar in the US strategy for Soviet containment – science policy – was also exerted under the scope of geopolitical struggle. As early as 1945, at the request of President Roosevelt, Vannevar Bush published the famous *Science: The Endless Frontier* (1945) as a ‘blueprint for postwar science and technology policy’ (Edwards, 1996, p. 58). This tract, which sought to not only inform but also direct research over the coming years, pleaded not only for more resources but also for a continuous statist engagement between the scientific establishment and government:

> The Government should accept new responsibilities for promoting the flow of new scientific knowledge and the development of scientific talent in our youth. These responsibilities are the proper concern of the Government, for they vitally affect our health, our jobs, and our national security. It is in keeping also with basic United States policy that the Government should foster the opening of new frontiers and this is the modern way to do it. For many years the Government has wisely supported research in the agricultural colleges and the benefits have been great. The time has come when such support should be extended to other fields. (Bush, 1945)

This new view, of a government-led science, relatively new from the US perspective in peacetime, resulted in continuous investment, at war levels, and rapid technological change. Here we find the birth of the military–industrial complex\(^{38}\). Apart from these

\(^{37}\) Although I have focused on the Americanisation of business practices, I do not negate the same influence on culture in general. For a broader overview of the implications of this phenomenon for culture (and also resistance to it), see Kuisel (1993), Poiger (2000), Scott-Smith *et al.* (2003) and Stephan (2005).

\(^{38}\) Bush called for a ‘civilian-controlled National Research Foundation to preserve the government–industry–university relationship created during the war’ (Edwards, 1996, p. 58). There was indeed a valid
obvious material effects, Cold War politics also interfered with the scientific establishment in a cultural and institutional manner. Firstly, whereas during the war effort science was centralised, done under the auspices of the military, the Cold War era brought to the fore the participation of both private companies and universities. The newly created agencies that supported research in both industries and universities were, in effect, all contributing to projects of national security. The main beneficiaries, however, were private companies that worked within the high-tech sector. From the early 1950s up to the late 1960s long boom, ‘computer, electronics, and other high-technology firms such as GE, IBM, Xerox, Polaroid, DEC, Texas Instruments, and ITT came to represent the new mainstream of corporate America’ (Haigh, 2010, p. 14).

Secondly, science policy, similarly to trade policy, sought to bring the two sides of the Atlantic closer. Yet again the devastation of Europe presented an opportunity to an American-led restructuring of another field. If on the one hand the push for scientific integration could be seen as ‘a vehicle to promote American values’ (Krige, 2006, p. 2) and ‘to support doctrinal arguments about the superiority of liberal capitalism and democracy over Marxism-Leninism’ (Manzione, 2000, p. 49), on the other hand this integration, because of its imbalance, was responsible for the reconfiguration of the European scientific landscape by an American-led effort (Krige, 2006, p. 3). This argument in his rationale. After all, it was only consequential to maintain and sustain the investments made during the Second World War in relation to the technological development of the war machine.

39 That is not to say that basic research was done in an altruistic manner (Edwards, 1996, p. 59), nor that military involvement with the academy was only a Cold War phenomenon. For a complete and detailed discussion of the features of science policy, and how it affected the US’s allies in Europe, see Krige (2006).

40 For detailed information on the construction of the military-industrial complex and its relation to academia, see Edwards (1996).

41 This reformist effort could also be seen in the creation, between 1943 and 1950, of the ‘Food and Agriculture Organization, International Monetary Fund, World Bank, United Nations Educational, Scientific,
internationalist push, similarly to the trade one, also contained a streak of self-serving American pragmatism. This scientific policy was perhaps best described as an instrument to foreign policy by 1951, with the publication of the Berkner Report, officially titled *Science and Foreign Relations*, produced for the US State Department as a guideline for scientific cooperation. Quoting the report, Miller (2004) details its objectives:

The Berkner Report offered a four-fold rationale for a foreign policy of promoting expert cooperation. First, ‘science is essentially international in character’; ‘it is therefore an effective instrument of peace.’ Scientists, by virtue of their unique moral character, could avoid the political difficulties of cooperation faced by others, and scientific cooperation could serve as a model for other forms of international cooperation. Second, American science depended for its success on ‘access to foreign scientific sources,’ which could be best achieved through free and open ‘scientific intercourse.’ Third, science contributed to ‘economic welfare,’ which in turn contributed to ‘political security and stability,’ and therefore helps to ‘counter the occurrence of economic depression and thus to offset the threat of Communist infiltration.’ Finally, science had become the keystone of national defence, which demanded that ‘the scientists of this nation be kept currently aware of the latest advances of modern technology, in whatever nation these may occur’. (Miller, 2004)


42 Another characteristic of aid devoted to the US’s European allies in relation to its scientific policy was the many constraints imposed on the recipient countries. Not only would they need to pay for the reconstruction of science, with aid money, but they were also expected to concentrate on basic research only. Cash-strapped governments, however, had to convince that that aid money would help economically as well as socially, since aid was thought of as an essential resource directed at basic necessities. The results across the different European countries were mixed (Krige, 2006, p. 36). Geopolitically, however, the emphasis on basic research can be thought of, again, in relation to the Soviet threat. ‘The obvious advantage was that basic research was a long-term investment with no immediate or obvious interest to the Soviets’ (Krige, 2006, p. 33).
2.1.1 The computing industry

Integral to science policy, computing technology developed within the same frame of Cold War conflict and Soviet containment. The full rationale for its development was, predictably, control: control over the enemy, control over the future, control of discourse, control of the battlefield, control of one’s own nuclear capacity and, if possible, control over reality. For two decades, from the early 1940s until the early 1960s, the armed forces of the US were the single most important driver of digital computer development (Misa, 1985; Edwards, 1996; Haigh, 2010). Edwards reminds us that, ‘though most of the research work took place at universities and in commercial firms, military research organizations […] paid for it’ (Edwards, 1996, p. 43). Indeed the ‘military–industrial complex’, as President Eisenhower thoughtfully defined it in his farewell address to the nation, was akin to the ‘technological revolution’ in its capacity to change the industrial and military posture of the US: ‘For every old blackboard there are now hundreds of new electronic computers’ (Eisenhower, 1961).

This massive state investment in high-tech industries and academic institutions allowed the development of behemoths of industry and of the academy. However, despite the enormous influence, mainly in the form of grants or by providing a market for computers, government-led sponsorship allowed for a great deal of freedom for researchers in both the industrial and academic establishments (Krige, 2006, chapter 8). The rationale for this arrangement, as exemplified by the development of operations research theory in the US, was that the scientific community had to be placed in an environment where its ideas could evolve freely. Developed during the Second World War, operations research, rather in the same mood as the Bush report, placed a heavy emphasis on basic research, free of direct military influence. It is thought that the results of such techniques were better than the results of a simply objective-based research approach (usual in military involvement in the sciences prior to the Second World War).
That is not to say that these scientific advances were not shared with the military. In fact, military observers were placed close to these research centres in order to peek at the very latest results in science and, in turn, provide feedback to scientist in order to help the development of actual equipment and/or techniques. The relationship between scientists and the military in operations research was, in the view of one of its proponents, akin to the relationship between a doctor and a patient (Krige, 2006, p. 232), where confidentiality, independence and mutual respect are pivotal for appropriate diagnostics.

Apart from massive military investment, a multidisciplinary focus and the relative freedom given to researchers, three other characteristics define the military–industrial complex and, in particular, the computing industry that arose from it.

(i) Firstly, before the 1960s’ heavy investments, which created a niche and protected the industry, and despite being mostly financed by government agencies, the early computing industry was mostly composed of private institutions that did not have customers outside government (National Research Council, 1999, p. 87). IBM, for example, ‘underwent a dramatic shift toward defence work. Its first stored-program electronic computer to reach market, the IBM 701, was originally code-named the “Defense Calculator” and was launched as a response to the outbreak of the Korean War’ (Haigh, 2010, p. 16). Indeed, IBM would retain its central position, especially in mainframe computers, up to the 1980s, dictating both the development and use of technology (Bresnahan and Malerba, 1999, p. 82). From there on, as technology matured, its market expanded. Government was still an important player, being responsible for most investments in both equipment and research. New technologies, however, created new opportunities for new players that could not compete with the dominant IBM (Bresnahan and Greenstein, 1999). Apart from creating giants such as IBM, state investments and a growing market (as well as the demystification of the computer), combined with a number of specialists drawn from the war effort who would end up as entrepreneurs or as employees, resulted in many other smaller but technically significant
companies focused on specialist technologies. The main idea was that, although the gigantic IBM dominated the world market for mainframe digital computers, a number of small firms would also develop with time. From the 1960s ‘this newly vital industry, dominated by “Snow White” (IBM) and the “Seven Dwarfs” (Burroughs, Control Data, GE, Honeywell, NCR, RCA, and Sperry Rand), came to have several effects on government-supported R&D’ (National Research Council, 1999, p. 96).

(ii) Secondly, given its protected and guaranteed market, some of the behemoths of technology also became investors in basic research. Their extraordinary position allowed for the support of ‘several large and highly productive research facilities, such as IBM’s T. J. Watson Research Center, American Telephone and Telegraph’s [...] Bell Laboratories, and the Xerox Palo Alto Research Center’ (National Research Council, 1999, p. 31). These centres, later even referred to as ‘industrial Versailles’ (Knowles and Leslie, 2001), represented the peak of Bush’s recommendation of fostered research and Morse’s operations research, free of direct military interference and championing a multidisciplinary approach to science and its relationship to industry. It is no surprise, then, that the term ‘big science’ had emerged within this context (Weinberg, 1961, in Reynolds, 2010, p. 378).

(iii) Finally, the privileged position of those businesses was also reflected towards employees who, differently from their European counterparts, enjoyed a revival in the early twentieth-century idea of welfare capitalism in their industry (Haigh, 2010) at the same time as the social policies of the New Deal were under attack (Griffith, 1982; Haigh, 2010, p. 13). The rationale in the minds of corporate liberals, as the historians recall those in favour of welfare43 capitalism, was motivated by a twofold strategy: they wished to avoid government intervention, in the form of New Deal policies and

43 For an in-depth review of welfare’s historiographical construction – and consequential debate – see Delton (2013).
regulations, while repelling any attempt at unionisation by their employees (Delton, 2013, pp. 63–64). The early computing industry, largely a development of companies stemming from the ‘office machines’, was already devoted to such practices in the pre-war years. With the advent of Cold War policies, and of anti-communist sentiment, the desire to avoid unions became paramount. As a result, the US had the smallest unionised work force of the Western bloc (Western, 1993). The effects of welfare capitalism, the desire for non-interventionist practices, the creation of larger-than-life scientific–industrial establishments and the relatively guaranteed market for some of those high-tech industries resulted in a unique corporate culture. Whereas before people in academic institutions would be confined to their departments, now the norm dictated that they should mingle. Not tied by academic discipline or by military procurement, scientists were free of economic and managerial pressure to pursue their own ideas. These were the times of large suburban developments, creating not only new neighbourhoods but also new scientifically and industrially oriented communities (Kaiser, 2004; O’Mara, 2006). As we shall see later in this chapter, these three characteristics were pivotal to early computer artists, who, unsurprising, sat at the centre of the military–industrial complex.

2.2 Faith in rationality

If so far I have discussed the material context that computer art emerged from; the next topic shall be the discursive and ideological scenario of computer art – namely, rational formalism. It is important to begin this section by affirming that I will not attempt to
survey the many ideas of rationality\textsuperscript{44}. Instead, my intention is to delineate the characteristics of rationality specific to the Cold War. It is from the perspective of rational formalism that the conflict was managed, planned and conducted. Moreover, not only did it provide a framework for action (as in the strategies of mutually assured destruction, the RAND Corporation, radar networks, war games etc.) but rational formalism also provided the legitimate, authoritative discourse of action. Serving both as instrument and justification, since its theoretical output assumed a scientific, universal and timeless character, rational formalist theories are central to understanding both early computer art and the Cold War. While the conflict specifically nurtured computer art via a supporting network of institutions and industrial practices, rational formalism was a much broader phenomenon and affected not only computer art but also the artistic and intellectual fields in general (the subject of Section 2.2.1).

\textsuperscript{44}This monumental task, unfortunately, cannot be achieved within this thesis. Moreover, the very definition of ‘rational’ presents another problem: What is rationality and how does one go about in order to be rational? This is a philosophical exercise that, I am afraid, is perhaps endless. This text is preoccupied more with the assumptions of rationality, embodied as a rational discourse of reality, and is therefore close to Weber’s conception, in the sense not only that we experience a rationalised attempt to organise and improve our condition but also that there is a conscious effort to do so. The effects of ‘means–end’ and not the dangers of the ‘iron cage’ interest us. The difference here, in modernity, is that the discourse of rationality becomes prevalent, is detriment of all other forms of knowledge and, again, is exemplified by Weber’s paradox of disenchantment (Kalberg, 1980). This thesis thus assumes that there are many rationalities and not one. It is not that humans before the Enlightenment, for example, were savage beasts without any trace of rational thought; after all, ‘even everyday actions of “primitive” man could be subjectively means–end rational, as for example, when specific religious rituals were performed with the aim of receiving favours from a god’ (Kalberg, 1980, p. 1148).
‘Cold War rationality’ (Erickson et al., 2013), simply put, can be thought of as a guiding principle in which technocrats could think and act in a scenario of increasing complexity where ‘the traditional forms of practical reason and statecraft, which emphasized prudence, experience, deliberation, and consultation, seemed inadequate to the challenge, as outmoded as conventional weapons in comparison with nuclear arsenals’ (Erickson et al., 2013, p. 3). Its central characteristics (formalist, universal and computable) were as much a result of conflict, perceived as increasingly demanding and complex, as they were part of a long intellectual tradition that sought to formalise, via an axiomatic structure, all areas of knowledge. Resulting in a ‘formalistic language’, interpreting ‘war using categories of games, bargaining, production and management’, it ‘reinforced the view of war as a rational problem, rather than a struggle with its roots in ancient feelings of patriotism, desires for justice, and resentments of foreign intervention that might not respond to a “rational” challenge’ (Edwards, 1996, p. 143). This formalisation of procedures, as a means to an end, was therefore pivotal to policymakers and, under the guidance of rational discourse, not only created an apparently unstoppable discourse (perhaps a nod to Weber’s ‘unstoppable force’) but also informed much of the investment being made during the cold conflict. It is important to stress that the rational formalist discourse was not only present in the Cold War rationality as described by Erickson et al. (2013). Its influence was much broader. Although not constituting a single field or theory, it was instead felt as a general disposition of intellectual fields.

Before we proceed to some clear examples, we must, however, briefly discuss the raison d’être of these numerous rational formalisms. In other words we need to discuss the meanings of ‘rational’ and ‘formalism’ and, in relation to the first two, the post-war ‘faith’ in the approach’s capacities. The rational, as conceived in this text, should be perceived as an obligatory prerequisite for truth-searching methods. It is then a disposition, a modern one, derived from the Enlightenment and thus substituting for all previous forms of knowledge where truth was found. To be irrational, in other words, is
to be immoral, false and hence lacking the foremost requisite of truth. The first contours of this discourse can be found in the works of Descartes. Under Descartes’ predicate, truthful, real knowledge could only come into existence by the exercise of reason and not, as he thought of his rivals and ancient predecessors, by ‘just following the passions or memorized patterns of actions’ (Jones, 2001, p. 53). Descartes’ reasoning, understood by him to be common to all humans and exercised by training, was the basis for real knowledge since it spoke to universals and particulars alike. To read reality as history, as a series of interconnected discrete events, allowed one to be dependent on genius, luck or, even worse, deceptiveness. Under this view, ‘epistemic failings led inevitably to moral ones’ (Jones, 2001, p. 58). The break with classical thought is found, then, in the construction of a systematic and clear description of events. For Descartes and his contemporaries, Greek and Roman thinkers were geniuses but not less lucky to have constructed their body of knowledge since, under this new epistemological (and moral) assumption, particulars were not of importance: one should aim to explain the general in order to claim truth. Only from the general would the particular be understood. For Descartes, geometry, then, can be seen as an attempt to exercise this discourse since, for him, ‘all problems in Geometry can easily be reduced to such terms that there is no need to know more than the lengths of certain strait lines to construct them’ (in Jones, 2001, p. 51). Histories (as he decried its competitors), with their collections of disparate events, relied too much on memory alone and not on reason. To not be able to comprehend the

45 For thoughtful, deeper discussions of Descartes and the development of the modern mindset, refer to Jones (2001) and Gray (2008).

46 This ‘spiritual exercise’ was akin to a physical exercise in the sense that it virtuously protected and improved the body. According to Jones (2001, pp. 42-44), this idea, coming from Cicero, was widely disseminated in early modern Europe. The virtuous mind would find in this exercise a mathematical, game-like quality (his geometry), ‘the deeper truth of things’.
whole picture and instead to focus on the units of a thing was akin to losing the capacity to think.\footnote{Lachterman (1989, p. 135) reminds us that history, ‘in the following crucial respect, is like pre-Cartesian philosophy (and theology): it is a matter of opinion, more exactly, of many, diverse opinions […] it designates the antithesis to Cartesian science, for we are passively exposed and can succumb to opinions, while science is always a matter of the mind’s active invention’.
}

For Descartes, then what could be universal, clear and self-sufficient? Here we find the paradigmatic importance of mathematics as the universal language of science (the general) as opposed to the humanities (the particular). At the core of this new conception of ‘mathematics as poiésis is the technique of construction’, where the newly conceptualised (Cartesian) mind ‘uses as its template the adeptness of the intelligence in solving problems by means of this [mathematical] technique’ (Lachterman, 1989, p. 26) and, in its most radical version, presents a novel, modern ontology. Mathematics, a product of the newly conceptualised mind, representative of a spiritual exercise, equated to goodness and virtuousness, was then thought not to renovate ancient Greek knowledge but to propose a completely new method of inquiry. The intention behind Descartes’ method, however, was not in mathematics per se. In fact ‘Descartes rejected standard mathematical proof […] no consensus existed around the objects of mathematics, its proof techniques’ (Jones, 2001, p. 45). Mathematics, true mathematics, was yet to be realised and for Descartes it ought to be constructed and not merely used or applied. That the ancients had written so many books was, for Descartes, proof that ‘they did not have the true method for finding all’ solutions (Jones, 2001, p. 49); only a new mathematics, constructed by his reason, systematic and pure, could explain it all. Exercising its own philosophy, Cartesian geometry – which sought to replace lines with points in coordinates, and in effect created symbols to represent itself – according to John Stuart Mill, ‘far more than any of his metaphysical speculations, immortalized the name of
Descartes and constitutes the greatest single step ever made in the progress of the exact sciences’ (in Lachterman, 1989, p. 141). Following Descartes’ philosophical postulates concerning universality of methods, this was a geometry that ‘proposed to explicate the phenomena of nature’ (in Lachterman, 1989, p. 142), not discreetly, bit by bit, but as a whole, as an undivided being.

Descartes was but one of many early modern thinkers. Their methods naturally varied. Nevertheless Descartes serves as an example of a new rationality, a modern one, anchored in the new truth-seeking methods exposed by the Enlightenment, which, suffice to say, came at the expense of previous methods for truth, particularly the religious ones. That is not to say, of course, that God, the Christian one, disappeared overnight.

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48 For a complete introduction to this history, see Gower (1997). According to him, ‘there were at least two dimensions to the debate about scientific method in the seventeenth century. One of these dimensions was concerned with the roles of mathematics and experiment. Galileo and Descartes recognised a role for both in their accounts of method, though they placed the greater weight on mathematics. Their view was shared by Hobbes in England. Bacon, too, recognised a role for both mathematics and experiment, but both he and Harvey placed the greater weight on experiment. Their view was shared by Boyle, Hooke and other founders of the Royal Society. A second dimension was determined by reactions to conflicting conceptions about the aim of scientific method. Some, like Bacon and Descartes, sought to preserve the traditional view that science is concerned above all with knowledge of causes, and that methods should be devised which will help us achieve this aim. Others, such as Galileo and Harvey, took the view, also sanctioned by tradition, that the absolute certainty of conclusions reached is crucial, and methods should secure that aim’ (Gower, 1997, p. 67).

49 This disenchantment with the world, a modern characteristic, meant that ‘in earlier times the ultimate purposes of life were seen as part of the fabric of the world, as part of the Greek “cosmos” or of Christian “creation”; the description of fact and the affirmation of norms were not sharply distinguished. The modern era, by contrast, has recast rationality as simply the calculation of efficient means to given ends. This narrower, instrumental conception of reason was what, in Weber’s eyes, brought about the unprecedented increase in knowledge and power, prediction and control, characteristic of modern science’ (Larmore, 1996, p. 190).
Instead it was the creation of a method, not the substitution of God, that would produce effective rational results and truth. This development, one of emancipation – that is to say, humans emancipated by reason, as in Kant (Dupré, 2004, p. 7), where people should not blindly follow theological predicates but instead themselves – resulted in a declaration of war against unexamined traditions. Hence Kant ‘regarded no act as truly free unless it was based on reason and promoted the rule of reason. Good and evil depend on the law of reason: they are constituted in and through that law’ (Dupré, 2004, p. 11).

Paradoxically, many early moderns did not lose their faith:

Christianity, for centuries the core of European culture, had left a tradition of values on which even secular intellectuals remained dependent long after having abandoned their faith. Most professed a belief in God even while adhering to a philosophy that emptied the idea of God of its traditional content. They continued to regard the idea as indispensable for morality, though morality had largely ceased to rely on it. (Dupré, 2004, pp. 14–15)

This new morality, born out of the Enlightenment, which equated knowledge and freedom, ‘associated political intolerance with monotheism in general and Catholicism in particular, and advocated the separation of church and state as a necessary condition of individual liberties’ (Turner, 2011, p. 131). Ironically, Turner reminds us that:

Kant distinguished between religion as cult, which seeks favours from God through prayer and offerings to bring healing and wealth to its followers, and religion as moral action that commands human beings to change their behaviour in order to lead a better life. Kant further elaborated this point by an examination of ‘reflecting faith’ that compels humans to strive for salvation through faith rather than the possession of religious knowledge […] In order to have autonomy, human beings need to act independently of God. In a paradoxical fashion, Christianity implies the ‘death of God’ because it calls people to personal freedom and autonomy without any divine assistance. Hence the Christian faith is ultimately self-defeating, because human maturity implies that

50 For a broader discussion on the topic, viewed under the scope of sociological theories of secularisation, see Turner (2011).
an autonomous individual would no longer need the support provided by institutionalised religion. (Turner, 2011, pp. 4–5)

Secularisation, from this point of view, is intrinsic to Judeo-Christian monotheism and thus ‘does not consist in the illegitimate expropriation of the divine attributes and in their Promethean transference to man’ (Larmore, 1996, p. 42). The new modern does not, then, replace God with himself. They cannot control reality at their will, neither are they able to account for its totality (although I think rational formalists would very much appreciate that). With the end of religion we have the transference of authority from an all-powerful entity to a method: no longer would men require God to explain the world, nor would God’s word command it. The new human, rational and hence free, now responded to a good and correct system. It was this new authority, emanating from its own rational method, that would command human action. I should stress then that, when referring to faith in relation to a certain method (e.g., the rational formalist one), I am referring to a belief that this particular discourse is authoritative. It was from these ideas that reality would and could be explained and consequentially controlled. Rational formalism’s wide impact, covered in the next section, can be seen to be acting within various academic fields transformed or created in order to accommodate it. But that is not to say that rational formalism would only affect intellectual and academic playgrounds. This faith, in fact, was externalised as action, for example, in the form of modernisation theories of the post-war order. And, in this sense, for ‘the modernization theorists, the whole world was destined to converge with the model of modernity limned by the contemporary United States’ (Gilman, 2003, p. 14). Modernisation theory(ies), in short, broadly refers to the contentious idea that economic and technological progress equates the development of democracy to increased communal well-being (Lipset, 1959; Feldman and Hurn, 1966; Grew, 1977; Stearns, 1980; Gilman, 2003; Berman, 2009; Inglehart and Welzel, 2009). The contentiousness of its assertions, however, is more of a recent development, beginning with the cultural turn of the late 1960s (the subject of Chapter 3) and, although
yet professed by certain intellectuals even today (Berman, 2009; Inglehart and Welzel, 2009), modernisation is mostly seen as the by-product of the 1950s’ and 1960s’ Cold War faith in rationality (Grew, 1977; Gilman, 2003). This theory, exercised as part of the US’s foreign policy, ironically resulted in the support of autocratic governments from Africa to Latin America. In this respect the work of Gilman (2003) is illuminating. By tracing the network of academic institutions, government agencies and intellectuals, as well as the development of the very idea of progress in the post-war scenario, Gilman’s work maps the influence and perverseness of this (naïve) faith. By referring to Habermas’ reading on the topic, Gilman reminds us that:

The modernism of the modernization theorists was not the modernism of Nietzsche, Kafka, or the Dadaists, but rather that of August Comte, Piet Mondrian, and Le Corbusier. Rather than a modernism of iconoclasm, madness, and irrationality, it was a modernism of order, plan, and mastery. Rejecting the emotionality and spirituality of romanticism, this form of modernism celebrated the ideals of the Enlightenment: the power of science, the importance of control, and the possibility of achieving progress through application of human will and instrumental reason. Modernists in this tradition, like the modernization theorists,

51 Bockman (2006, p. 51), succinctly describing Gilman’s (2003) theory, says that: ‘In the early days, modernization theorists argued that economic development would bring political and social liberation, but they later changed their tune and supported the funding of authoritarian governments and military regimes to enforce stability in the supposedly childlike Third World. Gilman proposes several explanations for the hegemony of modernization theory: that the modernization theorists’ shared assumptions about American society “made [these] scholars believe that they were onto something” (p. 16); that the deep insularity of the group caused them to ignore other, countervailing intellectual trends; and that the status of modernization theory as the dominant paradigm induced its adherents to continue working within this paradigm and to ignore criticisms and anomalies until a paradigm shift occurred in the late 1960s.’

52 Retrospectively, by looking at the assertions of one of the founding intellectuals of this movement, one can see the naïveté of its propositions: ‘Perhaps the most widespread generalization linking political systems to other aspects of society has been that democracy is related to the state of economic development. Concretely, this means that the more well-to-do a nation, the greater the chances that it will sustain democracy’ (Lipset, 1959, p. 75).
saw themselves as the culmination of an Enlightenment purged of the intellectual conceits of the *philosophes*, the sanguinary hubris of the Jacobins, and the epistemological naïveté of positivism and realism. Thus the modernization theorists saw their project as the Enlightenment writ large: a welfare state based on progressive income taxation, democratic accountability, social levelling and ‘integration’ as a solution to social conflict, techno-logical fixes, and industrial prowess. (Gilman, 2003, pp. 7–8)

Hence, by way of Lyotard’s commentaries on Parsons, another pillar in modernisation theory, Gilman concludes that:

> These discourses shared a hidden faith that rationalism, social scientific universalism, and cultural relativism represented the convergent tendency of all states and societies in the modern world. Built on a foundation of American national self-confidence, these various social modernist discourses were mutually reinforcing during the 1950s, and modernization theory stood at the center of this discourse. (Gilman, 2003, pp. 241–242)

Modernisation theory might not have been fully formalist in the way that other disciplines were. Its axiom, however, is evidently closer to our topic: faith in (a particular kind of) rationality.

### 2.2.1 Rational formalism in action

Rationalists of all types were the backbone of early Cold War intellectual authority in the US: they commanded the big budgets; they promoted the idea of modernity abroad; they endorsed the military–industrial complex; they constituted the big science projects; they held the key to knowledge and truth. Representing a new authority, this ‘new priesthood’ (White in Erickson *et al.*, 2013, p. 10), flown around the US for consultations and conferences, worked for government and industries alike and were central in shaping Cold War policies. For some of them a particular method, a scientific, rational formalist one, by way of mathematics and reason, was what could universally explain the world.
They were the new authoritative voice of reason. Similarly to early moderns however, Cold War rationalists, with their many distinct approaches and emphases, cannot be thought of as a single entity. Yet, we can argue that what united a large section of this group was a faith in axiomatic, formalist and universal mathematical structures. A product of mathematical formalism, the projects and ideas of this new priesthood evolved not only towards a mathematical description of conflict but also of society itself53. Economic systems, social interactions and communication could all be described by a limited string of symbols, drawing upon the abstraction of mathematics itself. Mimicking Maddy (1989, p. 1123), it is possible to ask: What is it, then, to regard mathematics as a formal game? Maddy, a staunch Platonist – that is, believer in the existence of mathematics as external to itself – defines formalism (mathematical) in relation to its limitations:

What you hear from the mathematician intent on avoiding philosophy often sounds more like this: ‘All I’m doing is showing that this follows from that. Truth has nothing to do with it. Mathematics is just a study of what follows from what. This position is Formalistic in that it denies truth-value, and perhaps meaning, to mathematical statements as standardly understood, and it treats the choice of mathematical assumptions as arbitrary. On the other hand, mathematics is neither a game with symbols nor pure metamathematics; rather, it is the study of logical consequence.’ (Maddy, 1989, p. 1124).

More recent debate has come to see this difference, between different schools of mathematics, as mere miscomprehension of theory (Marek and Mycielski, 2001, p. 451). The characterisation between these schools is even more problematic for physicists and economists (Weintraub, 1998), for whom mathematics is the language of the trade. Yet we can, despite our partial knowledge of the subject, discern some characteristics that are

53 Ironically this rational discourse, of rationalism, that is to say, with an emphasis in reason and a priori knowledge (as in Descartes), opposes that which we today have come to recognise as proper scientific thought – that is, empiricism (Dupré, 2004, p. 7).
common to all discourses of formalism in mathematics. Firstly, mathematical formalism regards mathematics itself as a game of finite symbols that attempts to describe mathematics according to its own logic. In this formalistic approach, there is an attempt to describe, prove and construct axioms of the approach’s subject (the corpus of a certain discipline) via a rational effort that describes the most basic units of the subject itself. Formalism in mathematics, usually ascribed to German mathematician David Hilbert\textsuperscript{54}, notwithstanding its method, can be seen as proposing

a new foundation of mathematics based on two pillars: the axiomatic method, and finitary proof theory. Hilbert thought that by formalizing mathematics in axiomatic systems, and subsequently proving by finitary methods that these systems are consistent (i.e., do not prove contradictions), he could provide a philosophically satisfactory grounding of classical, infinitary mathematics (analysis and set theory). (Zach, 2006, p. 411)

The tendency to rethink or rewrite all previous knowledge in a set of axiomatic postulates was hugely influential. It attempted, in a way, to build a corpus of knowledge without inconsistencies and that, consequentially, could be used as a basic structure for the construction of further knowledge. It was rational in the sense that it was based on reason alone and its was formal in the sense that it could be described by finite units

\textsuperscript{54} Gray (2008, pp. 26–27), however, also highlights that formalism, in the mathematical sense, had already been sketched in the eighteenth century with an emphasis on mathematics as a (successful) language. Nevertheless Hilbert, for Gray (2009, p. 5), was the one mathematician who ushered modernism into mathematics, not because of ‘individual works that change the world, but [because of] the messages they convey. Those messages go from people to people and, to succeed, must articulate genuine concerns that are also expressed elsewhere. The intellectual concerns therefore must be those of people able to advance them, and so those of significant groups of people with the right opportunities. The professional situation of mathematicians, in particular their relative autonomy from scientists, did not cause modernism to happen, but it enabled it and it promoted it.’
ordered by an axiomatic structure. Mathematical knowledge, as such, is not empirical (Russell, 2004, p. 741). So how could an unempirical model of the world be able to describe that world? This limitation, however, did not impede mathematics’ authority. Although ‘most of the Cold War rationalists were acutely aware of the limitation of their models’, the alternatives were no better: irrational and with no ‘gain in accuracy’ (Erickson et al., 2013, pp. 48–49). Rational formalism, despite its inherited limitations, was popularised during the Cold War. It was the authoritative method of inquiry despite having ‘no end of critics who disagreed, on technical, philosophical, or moral grounds’ (Erickson et al., 2013). Its allure was such that many fields adopted its precepts. Economics is such an example:

The metamorphosis of economics in the late 1940s and 1950s is aptly called a ‘formalist revolution’ because it was marked, not just by a preference, but by an absolute preference for the form of an economic argument over its content. This frequently, but not necessarily, implied reliance on mathematical modelling because its ultimate objective was to emulate the notorious turn-of-the-century Hilbert program in mathematics by achieving the complete axiomatization of economic theories. (Blaug, 2003, p. 145).

The assumption in economic formalism is that, in order to comprehend the interaction of economic actors that ought to maximise allocation of resources, economic interaction must be thought of as a game between rational participants that, in turn, are assumed to be ‘farsighted’ (Colander, 2000) – that is, they are assumed to be fully aware of their circumstances. The problem with this method, as any other that assumes rational actors, is that it formalises a scenario that can only be seen in a thought experiment (Granovetter, 1985), detached from existing historical social relations. Content and context are, therefore, excluded from such a formalist approach. Another criticism directed at formalism in economic thought can be seen in formalism’s characteristic tendency to assume not only perfectly rational actors or axiomatisation (a result of a
purely formal view of mainly subjective phenomena) but also a constant and, hence, universal formula (Klamer, 1998, p. 49).

A similar wave hit the work of linguistics. Again, following the rationale of prevalent rational discourse, it was only natural to develop a scientific – rigorously mathematical and formal – description of language. This development, in fact, would not only affect its field but also would inform the new field of computer science. The key name within this development was Noam Chomsky, who is still as central to linguistics today as he was in the 1950s and 1960s (Martin-Nielsen, 2012, p. 66). Chomsky, in order to ‘determine and state the structure of natural languages without semantic reference’, sought to ‘inquire seriously into the formality of linguistic method and the adequacy of whatever part of it can be made purely formal’ (Chomsky, 1953, p. 242). Given the complexity of his project, I shall not dwell on its intricacies: what is important to us is to demonstrate the sweeping influence of rational discourse in the fields that had been,

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55 Amadae’s (2003) work can supplement this narrative. Instead of looking at economics only, she contends that, as much as military containment and economic might, the Cold War was an ideological victory by ‘rational choice liberalism: a philosophy of markets and democracy that was developed in part to anchor the foundations of American society during the Cold War’ (Amadae, 2003, pp. 2–3). In this context, and converging into my analysis: ‘The mathematical formalism structuring rational choice theory is impelled by the same academy-wide momentum propelling an increased emphasis on formal models as an indication of scientific standing […] The priority given to mathematically articulated research findings has two rationales. First, in the wake of World War II, during which scientific analysis of strategic problems proved useful to the war effort, additional mathematically oriented research was supported as a response to the Soviet Union’s successful launch of the Sputnik satellites. Money was thus channeled to research endeavors that provided quantitative analyzes [sic] of social issues. Second, this preference for mathematical formulas and models served the function, as RAND leaders realized, of depoliticizing research by translating contentious social debates into the “objective” language of mathematics’ (Amadae, 2003, p. 158).

56 For further information on the topic of linguistics and formalism, see the extensive research of Tomalin (2006).
until then, detached from formalist impulses. The linguistic turn, evolving from a semantically to a syntax-based research effort, would also stem from some practical aspects of the Cold War. In a war in which propaganda and intelligence were as important as brute force, the ability to

read the enemy’s public and private documents in a timely manner was of the utmost importance. Machine translation was neither flashy nor dramatic [and] it did it work not by deciphering the meaning of the input text, but by using a lexicon and knowledge of the syntactic structure of the input output languages to build a translation. Since ‘meaning’, or semantics, was not part of the strategy, the success of machine translation depended on firm understanding of syntax […] as such. (Martin-Nielsen, 2012, p. 68)

Hence, in true formalist fashion, linguistics, predating Chomsky himself, was ‘interested in syntax of its own sake’ (Martin-Nielsen, 2012, p. 70). Both the formalist turn and the material necessities of the Cold War created a ‘pressing need to develop a new legitimate scientific framework of linguistics’ (Martin-Nielsen, 2012, p. 70), which, following the usual theoretical battles, was then occupied by Chomsky. A brief definition of Chomsky’s view is as follows:

The first step in the linguistic analysis of a language is to provide a finite system of representation for its sentences. We shall assume that this step has been carried out, and we shall deal with languages only in phonemic or alphabetic transcription. By a language then, we shall mean a set (finite or infinite) of sentences, each of finite length, all constructed from a finite alphabet of symbols. If A is an alphabet, we shall say that anything formed by concatenating the symbols of A is a string in A. By a grammar of the language L we mean a device of some sort that produces all of the strings that are sentences of L and only these. (Chomsky, 1956, p. 114)

We can all agree, then, on those postulates: sentences and alphabets are finite, any word/sentence is a combination of finite symbols and, consequentially, it is in grammar that we find the rules for combining those finite symbols. Chomsky here not only recalls early formalist traditions, in mathematics, but also stresses the ‘game’ of combinations, as defined by grammatical rules. A result of this combinatorial ‘game’, its strings, was not
exclusive to linguistics and certainly was not thought of by Chomsky. What he had done in effect was to translate mathematical ideas into the realm of linguistic inquiry. Another important development arising from such inquiries of the mathematical formalist game, as proposed by Hilbert, came from none other than Alan Turing. Turing machines, or the paradigmatic idea that would eventually led to digital computers, were, in essence, described some decades earlier in a paper titled ‘On Computable Numbers, with an Application to the Entscheidungsproblem’ (Turing, 2004 [1936]). Given its pivotal role, it is important to quote a key passage in full:

Computing is normally done by writing certain symbols on paper. We may suppose this paper is divided into squares like a child’s arithmetic book. In elementary arithmetic the two-dimensional character of the paper is sometimes used. But such a use is always avoidable, and I think that it will be agreed that the two-dimensional character of paper is no essential of computation. I assume then that the computation is carried out on one-dimensional paper, i.e. on a tape divided into squares. I shall also suppose that the number of symbols which may be printed is finite. If we were to allow an infinity of symbols, then there would be symbols differing to an arbitrarily small extent. The effect of this restriction of the number of symbols is not very serious. It is always possible to use sequences of symbols in the place of single symbols. Thus an Arabic numeral such as 17 or 9999999999999999 is normally treated as a single symbol. Similarly in any European language words are treated as single symbols (Chinese, however, attempts to have an enumerable infinity of symbols). The differences from our point of view between the single and compound symbols is that the compound symbols, if they are too lengthy, cannot be observed at one glance. This is in accordance with experience. We cannot tell at a glance whether 9999999999999999 and 999999999999999 are the same.

The behaviour of the computer at any moment is determined by the symbols which he is observing, and his ‘state of mind’ at that moment. We may suppose that there is a bound B to the number of symbols or squares which the computer can observe at one moment. If he wishes to observe more, he must use successive observations. We will also suppose that the number of states of mind which need be taken into account is finite. The reasons for this are of the same character as those which restrict the number of symbols. If we admitted an infinite of states of mind, some of them will be ‘arbitrarily close’ and will be confused. Again, the restriction is not one which seriously affects computation, since the use of more complicated states of mind can be avoided by writing more symbols on the tape. (Turing, 2004, pp. 75–76)

Computers, hence, have to operate in formalistic processes. In order to be configured indefinitely, its input, mere meaningless symbols, should be finitely defined. Whereas Chomsky thought of this as an alphabet of discrete and finite symbols, Turing simplified
this thought to an extreme position. By using only two symbols, 0 and 1, ‘on’ and ‘off’, he conceived a machine that could calculate any given logically defined and systematic mathematical operation; it could resolve any algorithm it wished if the algorithm were properly described. It is important to note, however, that when Turing speaks of ‘computers’ he is not talking about analogue or digital computers, since these technologies would still take some time to be created. He is literally talking about human computers:

A computer – sometimes also spelt ‘computor’ – was a mathematical assistant who calculated by rote, in accordance with a systematic method. The method was supplied by an overseer prior to the calculation. Many thousands of human computers were employed in business, government, and research establishments, doing some of the sorts of calculating work that nowadays is performed by electronic computers. Like filing clerks, computers might have little detailed knowledge of the end to which their work was directed. (Copeland, 2004, p. 40)

Long before the advent of digital computers (i.e., digital computing machines), the increasing complexity of modern institutions demanded increasingly complex calculations that, then, could only be done by humans. Turing’s insight was not only mathematical but also metaphorical in that he saw a resemblance between those tedious mental processes and his universal machine. By likening the human mind to the processes of his machine, Turing contributed both theoretically and practically (by creating the basis for the digital computer itself) to the discourse that united human and machine. Albeit not the sole contributor to this development, Turing perhaps was the mostly

57 See Grier (2005). Moreover, for a comprehensive history of human computers see Croarken (2009). It is also interesting to note, in relation to the ideas of mechanisation and increasingly complex bureaucracies, that the history of computers in Britain – as told by Agar (2003) – was much based upon these problems present before the advent of the digital computer.

58 Later described in his artificial intelligence program; for more see Copeland (2004).
influential since he put forward the cyborg vision of human–machine integration in his theoretical machine well before it became popularised via cybernetics.

2.3 Cybernetics: A consequence of rational formalism

Although it seems that rational formalism was very similar to Cartesian rationalism, much was different. Perhaps nothing demonstrates this more readily than the different ways in which the human mind was conceived. As previously stated, to define rationality as a single cohesive concept is perhaps impossible. There were indeed many different approaches to the question, many different ‘flavours’ in the theories proposed during the Cold War\(^5\). During the Enlightenment reason was traditionally conceived as the highest mental capacity in terms of understanding, memory, judgement and imagination (Erickson et al., 2013, p. 8). Mathematical reasoning, as a mechanical problem, such as the one dismissed by Descartes, was seen as a lower form of thought; one valid for exercises only. In fact ‘human reason was often defined in opposition to mechanical rule following’ (Erickson et al., 2013, p. 32) and, as such, the idea that machines ‘might reason better than human minds was alien to Enlightenment thinkers’ (Erickson et al.,

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\(^5\) This heterogeneity makes sense, for none of these component features inexorably summoned any of the others. Economic rationalization does not necessarily lead to algorithmic procedures, any more than game theoretical matrices intrinsically favor Bayesian statistics or even highly formalized war games. Nuclear strategists often laced intricate calculations with pop psychology. Proponents of the social science “situation” may have attempted to mechanize observation, but they did not aspire to mathematical models. These domains did not “belong together,” if by that one expects there to be a rigid logic linking A to B to C” (Erickson et al., 2013, p. 8). Nevertheless, in the same text Erickson et al. posit that Cold War rationality, first and foremost, must be ‘formal, and therefore largely independent of personality or context’ (Erickson et al., 2013, p. 5).
2013, p. 8). By the second half of the twentieth century, however, a shift had occurred. Cybernetics, perhaps the most extreme and logical consequence of rational formalism, had become central in blurring the boundaries between humans and machines.  

It would not be overstating the importance of cybernetics to say that, together with the computer itself, it was one of the most pervasive theoretical developments of the early Cold War. Given the impact of cybernetics, it is difficult to describe all the disciplines, technologies, metaphors, discourses and frames arising from it. I will try, at least, to show the areas that were undoubtedly affected by it and, in turn, to show its development in both the Western bloc and the Soviet one. In the previous section we saw that rational formalist discourse, dating back to the early twentieth century, was responsible for changes not only in intellectual fields but also in geopolitics and policy. This attempt, to control, quantify and formalistically define human interaction will become even clearer to the reader once I have surveyed some intellectual developments that were consequential to one another. Hence, attention must be paid to cybernetics and its consequences, for both social theory (rational choice, game theory, cognitive psychology) and for art itself (computer and concrete art).  

In order to begin to talk about the influence of something as originally distant from the arts as cybernetics entails some thought on not only the origin of the term, cybernetics, but also the reason it became incorporated in the artistic discourse in first place. From the 1940s through to today, cybernetics and its concepts would not only become part of the artistic debate and theory but also a theme in themselves, presented in many different forms throughout the decades. Given its great theoretical and historical importance, as well as its artistic presence to this day, both in specialised circles and in popular culture, it is fair to question how this scientific discipline was adopted, discussed  

60 This blurring will be a central concept later on. For now it suffices to say that its most preeminent description comes from Hayles (1999).
and translated by the artistic and intellectual fields in general. The very fact that it happened, it seems, points to something larger than both specialised fields in question and dates back to our concern of rational formalism. The adoption of this cybernetic discourse in the arts, for example, was markedly a worldwide phenomenon with distinct local characteristics. Given the different states of the economies and societies of the Americas, Europe and Asia following the Second World War, this is no revelation. For now I should stress that what is strange and startling about this adoption is the very fact that it happened in the first place. Despite being mostly incomprehensive to common readers in its own terms and language (maths), cybernetics found a warm and welcoming audience in the art world. Therefore, as our problem becomes clearer, what was the raison d’être of this theory in the field of artistic practice in the first place? This section aims to answer some of the questions raised by this theme (the adoption of cybernetics as part of the artistic discourse) and, in turn, to discuss how it helped to catapult early computer art production.

Cybernetics, as an academic discipline, was above all a converging philosophy of the sciences via an abstract, formal (and consequentially impartial) language: mathematics. It was all about control and feedback in the organic, physical and psychological systems. Following the end of the Second World War and its atomic climax, one could argue that it would have been untimely to publish a book aiming to unite almost all disparate fields of scientific knowledge using insights and concepts taken from the very practical problem of the trajectory of missiles and warplanes. Nevertheless, this is what exactly happened when in 1948 Norbert Wiener published his Cybernetics: Or, Control and Communication in the Animal and the Machine. Wiener, who received his PhD from Harvard at the tender age of eighteen, was, like most of his contemporaries

\[\text{References to this book are based upon the second edition, from 1961, republished in 1965 by MIT Press.}\]
in the American academic establishment, a creature of academic and industrial ties. After his graduation in 1912, Wiener went to Europe to continue his studies as a fellow researcher visiting from Harvard. From 1913 to 1914, in an academic trip cut short by the upcoming war, Wiener studied mostly at Cambridge and travelled through Europe pursuing his interest not only in the works of fellow mathematicians and logicians such as G. H. Hardy and J. E. Littlewood but also in the philosophical works of Edmund Husserl and Bertrand Russell (Paty and Freire Júnior, 2005). By 1919 Wiener had received a post at MIT, an institution that gave him ‘the encouragement to work and the freedom to think’, an attitude in contrast to his opinion of Harvard (Vallée, 2001). He would spend most of his academic career there, forming the Cybernetics Group with a fellow scientist following meetings known as the Macy Conferences (from 1946 to 1953). He and his colleague coined the famous term ‘cybernetics’\(^{62}\). The central concern of those monthly meetings at Vanderbilt Hall (an influence on his work) was to discuss the scientific method alone, with each participant talking about their method in relation to their own field of specialisation. It was during these encounters that it became clear to Wiener and to others that ‘the most fruitful areas for the growth of the sciences were those which have been neglected as a no-man’s land between the various established fields’ (Wiener, 1965, p. 2). For Wiener and others the problem resided within not only in the academy but also in the way we thought about the sciences and their applicability:

If the difficulty of a physiological problem is mathematical in essence, ten physiologists ignorant in mathematics will get precisely as further as one physiologist ignorant in mathematics, and no further. If a physiologist who knows no mathematics works together with a mathematician who knows no physiology, the one will be unable to state his problem in terms that the other can manipulate, and the second will be unable to put the answers in any form that the first can understand. (Wiener, 1965, p. 2)

\(^{62}\) For a full biographical and intimate description of Wiener, please see Segal (1992) and Conway and Siegelman (2005).
From Wiener’s point of view this problem of separating knowledge into disparate scientific fields had a real applicability and was not only an epistemological question to be reckoned with. There was a perception that science was not only limiting itself as a method but also as an institution, the result being the creation of barriers that did not stand the facts of reality:

we had dreamed for years of an institution of independent scientists, working together in one of these backwoods of science, not as subordinates of some great executive officer, but joined by the desire, indeed by the spiritual necessity, to understand the region as a whole, and to lend one another the strength of that understanding. (Wiener, 1965, p. 3)

This holistically oriented proposition would become much more real with the start of the Second World War. Cybernetics’ precepts would not be conducted, however, by a spiritual necessity. Instead, they would be developed under the light of the very real problems involved in ballistic trajectory. Working at the time on projects relating to anti-aircraft defence, Wiener realised that in order to understand his task he had to apply the concepts developed in those early, light-hearted meetings. When we think about the problems he faced, his rationale – and perhaps the reason behind cybernetics’ allure – becomes quite obvious. In order to build an automated defence system that works, in other words one that destroys its target, the machine needs to recognise patterns of movement, predict the future of curvilinear trajectory and, more importantly, understand the ‘performance’ of the human behind the equipment:

It will be seen that for the second time I had become engaged in the study of a mechanico-electrical system which was designed to usurp a specifically human function – in the first case, the execution of a complicated pattern of computation, and in the second, the forecasting of the future. In this second case, we should not avoid the discussion of the performance of certain human functions [...] It is essential to know their characteristics, in order to incorporate them mathematically into the machines they control. Moreover, their target, the plane, is also humanly controlled, and it is desirable to know its performance characteristics. (Wiener, 1965, p. 6)
An important insight of his work can be seen in the very simple idea that a human was also part of the very system that he was required to create. From this point of view he concludes that:

the central nervous system no longer appears as a self-contained organ, receiving inputs from the senses and discharging into the muscles. On the contrary, some of its most characteristic activities are explicable only as a circular process, emerging from the nervous system into the muscles, and re-entering the nervous system through the sense organs […] This seemed to us to mark a new step in the study of that part of neurophysiology which concerns not solely the elementary process of nerves and synapses but the performance for the nervous system as an integral whole. (Wiener, 1965, p. 8)

For Wiener the relationship between human, machine and communication was naturally understood as part of a single system and subsequent to his quest for a unifying science that used mathematics as its only language. Despite these fundamental insights, it is a fact that Wiener’s work for the war effort did not conclude in any practical solution. His anti-aircraft systems were only marginally superior to other much simpler and cheaper systems (Galison, 1994; Mindell et al., 2003) and, as a consequence, he lost his commission and his opportunity to collaborate in the war effort, something that, as his biography shows, he aspired to (Segal, 1992; Galison, 1994). It was only when he lost his contract that he could develop cybernetics freely. It is important to note, however, that when I say ‘free’ I am not talking metaphorically about freedom. During Wiener’s period working for the military, he was under strict contractual obligations that prohibited him from talking about his research. Similarly to most academics who were contributing to the war effort, such as Turing, most of his technical work was classified and, as a consequence, he could not publish anything that was related to it (Mindell et al., 2003; Conway and Siegelman, 2005). The texts produced by Wiener after his involvement in the war effort show reluctance to discuss military matters (Wiener, 1964, 1989) and instead focus on the rather larger, holistic applications of cybernetics such as
multidisciplinarity, human–machine analogies, feedback in the physiological and psychological realms, mathematics as a unified language for the sciences, etc. His famous book also follows this tendency of not discussing the technicalities of the process that led him to a complete theory of his cybernetics. Historians of the science picked up on this and are usually surprised by the lack of acknowledgement Wiener dedicates to his contemporary precursors.\footnote{63}{Most indicative of this alienation and reconstruction is Wiener’s consistent hesitation to acknowledge any of the multiple traditions of feedback in engineering which preceded him. In all his writing on cybernetics, he never cited Elmer Sperry, Nicholas Minorsky, Harold Black, Harry Nyquist, Hendrik Bode, or Harold Hazen — all published on the theory of feedback before 1940 (their publications became standard citations); all were recognized as important to the field; all speculated on the human role in automatic control; some even wrote on the merger of communications and control and the epistemology of feedback. But Wiener only rarely cited any servo theory later than Maxwell’s 1867 paper “On Governors.” The omissions are striking… Wiener’s chapter on “Cybernetics in history,” from The Human Use of Human Beings, refers only to Leibniz, Pascal, Maxwell, and Gibbs as “ancestors,” of the new discipline’ (Mindell \textit{et al.}, 2003, p. 72).}

His contractual obligations, one can suppose, despite being a restraint, do not explain his sudden change of heart. The fact that he did not acknowledge some of these scientists was mainly due to an ideological position, one that had a civilian tone rather than a militaristic one. It appears that Wiener wished to think of cybernetics within a humanist and illuminist context, more fundamental than its initial technicalities and pragmatically involved in rethinking science and its institutions. For him such a program should be remembered and developed as ‘civilian philosophy rather than military engineering’ (Mindell \textit{et al.}, 2003, p. 73). After the war, Wiener’s discontent with the scientific establishment and its emphasis on military research would become a quite public affair and, in January 1947, in the \textit{Atlantic Monthly Magazine}, he published a letter titled ‘A scientist rebel!’ (Segal, 1992; Triclot, 2006). In this letter Wiener swore ‘not to
publish any future work [...] which may do damage in the hands of irresponsible militarists’ (Wiener, 1989, p. xxviii). Wiener was alarmed not only by a renewed militaristic impulse in science, even with the end of the war, but also by the application of new technologies and cybernetics’ own insights. In time, he turned increasingly pessimistic about the future of the world following the intellectual development of the Second World War and Cold War theoretical apparatuses. Turning to an ever more prophetic discourse 64, he still saw salvation as a possibility but, nevertheless, acknowledged the capacity for both bad and good arising out of changes he himself had participated in:

Yet this pessimistic sentiment is only conditional upon our blindness and inactivity, for I am convinced that once we become aware of the new needs that a new environment has imposed upon us, as well as the new means of meeting these needs that are at our disposal, it may be a long time yet before our civilization and our human race perish, though perish they will even as all of us are born to die. However, the prospect of a final death is far from a complete frustration of life and this is equally true for a civilization and for the human race as it is for any of its component individuals. May we have the courage to face the eventual doom of our civilization as we have the courage to face the certainty of our personal doom. The simple faith in progress is not a conviction belonging to strength, but one belonging to acquiescence and hence to weakness. (Wiener, 1989, p. 47)

During the war, at the peak of the carnage, the image of the other, the enemy (later turned into the image of the Soviet) was of central concern not only materialistically, with the increasing development of war technology, but also ontologically, with the development of ‘decision sciences’, in Heyck’s terms (2012, p. 99) and ‘Manichean sciences’ in Galison’s terms (1994). These sciences, which in essence cybernetics were part of, were not concerned with the human in the sense of humans’ well-being. Rather the opposite: they were focused on very real and time-specific warfare problems in which humans were only a part of a larger system:

64 For example in his God and Golem, Inc. (1964).
cybernetics’ ideas of a human–machine system came into being, as we have seen, from the problems of ballistics; operation research concentrated ‘on maximizing efficiency in locating and destroying German U-boats’ (Galison, 1994, p. 231); game theory was ‘a way of analysing what two opposing forces ought to do when each expected the other to act in a maximally rational way but were ignorant both of the opponent’s specific intentions and of the enemy’s choice of where to bluff’ (Galison, 1994). However, despite being initially concerned with problems specific to their time, they all had an afterlife following the end of the war. Supported mostly by American military agencies, think-tanks, university departments and conferences – central institutions of the military–industrial complex – those theories provided the underpinning of rational control on which the closed world and cyborg discourses, as defined by Edwards, could be constructed. Hence,

The centrality of these metaphors reflects a number of features of early cyborg discourse and the emerging cybernetics community. First, these machines embodied shared wartime experiences. Second, semiautomatic weapons systems integrated humans and machines through both mathematical description (formal structure) and embodied practice (mechanism), making them prototypical cyborg devices. Finally, before computers, in terms of information activity such machines were the most advanced devices known to the group. So the war machines were not simply one example among others, but a central, unifying metaphor of early cyborg discourse. (Edwards, 1996, p. 186)

We should remember, then, that the developments described earlier, in regards to both policy and industry, were not isolated cases. These policies were conducted under the spell of a rational discourse and the urgent necessities of Cold War conflict. Consequentially, despite manifesting in various fields and circumstances, these are not isolated or unrelated events. Whether by motives of the closed world perspective,

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65 Another example of rational formalistic discourse (and consequentially closed world and cyborg discourses) can be seen in the emergence of decision sciences. The end-goal of those ‘techno-social sciences of choice was the design of systems that would generate rational choices automatically, whether humans
whether by the rationale of various factions within the US itself (Amadae, 2003, p. 30), the fact was that the view of human rationality, and consequentially its agency, should and could be explained formally by mathematical prepositions and, hence, logical descriptions of human action. Erickson, for example, even downplays the importance of military funding for the emergence of this new paradigm:

If anything, the widespread adoption of theories of rational choice during this period speaks less to the power of funding to direct research or the strength of some hegemonic discourse, and more to the interpretive plasticity of the mathematics of choice and rationality. Game theory, utility theory, and social choice theory provided mathematical tools that could be reworked to engage with any number of debates over the nature of ‘rationality’ and ‘choice’ that often unfolded independently of state funding, but that nevertheless were characteristic of American intellectual culture during this period. Many social and behavioral scientists of the 1950s and 1960s worried that traditional decision-making procedures in government and industry simply could not cope with the demands of a society increasingly dependent on complex technologies for its economic development as well as for its defence. As a result, techniques that had initially been developed to maximize the combat effectiveness of new guns and aircraft – most notably, systems analysis and operations research as practiced at the RAND Corporation and elsewhere – were readily adapted in the 1960s to help manage the provisioning of health care, education, and urban services, all of which were seeking to better manage the introduction of new technologies. (Erickson, 2010, p. 388)

It seems that the applicability of rational formalist discourse was indeed the reason behind Wiener’s anxiety and his pacifist turn. As long as he was contributing to the ‘just war’, he felt his acts were legitimate. The reason behind his denouncing, a involved were rational creatures or not’ (Heyck, 2012, p. 106). It is in these ‘techno-social sciences’ of choice that rational formalism is embodied, not only as a theory but also as a policy and geopolitical strategy (similarly to my previous example of modernisation theories).

66 A proposal that would certainly have horrified Descartes, since this proposition would equate humans to animals and, hence, automatons without reason. Wiener engages in a discussion regarding the motifs of Descartes’ anti-mechanistic position by saying that he equates animals to automata (but not humans) in order to ‘avoid questioning the Christian attitude that animals have no souls to be saved or damned’ (1965, p. 40).
religious and moral turn, was indeed the misuse of his ideas; cybernetics after all was, as in the title of one of his books, aimed at the ‘human use of human beings’. This turn may also explain Chomsky’s political activism in later years, in the same way that it might explain the change of heart in many practitioners of early computer art (a subject seen in Chapter 3 and best exemplified by Frieder Nake and Gustav Metzger). By the end of the 1960s the dreams of a perfectly rational world were disappearing and many in the rational formalist fields were either abandoning it or becoming ever more insular (also discussed in Chapter 3). If we can explain the development of digital computing technology through US science and foreign policy, conceptualised in the light of the Cold War, the same cannot be true of rational formalist discourse. Discourse, differently from massive machines of war, does not require large amounts of (material) investment and, similarly to an infectious disease, it may spread quickly via very simple means of transmission.

The next topic touches on the development of cybernetics into a completely different field: the artistic and, consequentially, computer art.

2.3.1 Cybernetics and the arts: Transnational examples

Only partly explained by his prestige in the scientific world, the pervasiveness of Wiener’s work can be seen in fields far beyond its birthplace.67 Differently from its more technical theoretical cousins, information and system theories, cybernetics had overreaching intentions and a not so subtle social commentary.68 Despite its heavy

67 Part of this section was presented at the Meeting Margins International Conference: Transnational Art in Latin America and Europe 1950–1978, at the University of Essex in 2010.

68 Wiener is especially assertive in the later section of his Cybernetics (section already present in the first edition of 1948). There he describes, for example, contrary to small communities that have ‘a very
scientific content and strange new ideas, cybernetics was not only adopted as a reclusive intellectual discourse. In fact, the book was quite popular, selling more than twenty-one thousand copies in six months (Mindell et al., 2003, p. 75). It was discussed in newspapers from Rio de Janeiro to Paris. Artists found in its pages analogies for their processes and practice. Social scientists understood society by adopting its terminology. People in general marvelled at the idea of self-governing automata. Cybernetics, perhaps more than any other scientific theory, because it was translated over and over again into so many distinct contexts, nations, periods and intellectual fields, became a prime topic for researchers interested in the adoption and translation of foreign ideologies, discourses and frames into varied scenarios. This thesis’ interest in it is similar to this. Not only did cybernetics represent a huge leap of logic, from rational formalism’s postulates to a whole new intellectual enterprise, but it was also widely disseminated into artistic circles. Because it was ubiquitous, cybernetics provided an incredible opportunity for researchers interested not only in artistic objects but also in the construction of artistic discourse.

Despite its popularity, cybernetics had a distinct flavour amid the paranoia of the Cold War. In fact, given Wiener’s pacifist discourse, his critique of the military’s emphasis on scientific research and his refusal to collaborate with ‘militarists’ (as shown in his open letter to the Atlantic Monthly Magazine, for example), it is surprising that he did not encountered more resistance from his more nationalistic peers, the government or the press. Ironically, it could be argued that ‘there may be nothing more cybernetic than the Soviet model of society with its attempts at a universal system of centralized information control (cf. Moscow-based bureaucracy), feedback (cf. socialist democracy),

considerable measure of homeostasis’ – that is to say, are self-regulated towards equilibrium – ‘the large community, where the Lords of Things as They Are protect themselves from hunger by wealth, from public opinion by privacy and anonymity, from private criticism by the laws of libel and the possession of the means of communication’, saying that, there, ‘ruthlessness can reach its most sublime levels’ (Wiener, 1965, p. 160).
and noise reduction (cf. censorship)’ (Peters, 2008, p. 71). If cybernetics can be seen as a Soviet model par excellence, it is ironic to see how it was received in the USSR during the 1950s. ‘Russian Scandal’ is both a traditional game⁶⁹ and an article by historian Slava Gerovitch that explains, in the nature of the game itself, the climate in which cybernetics was adopted in the USSR. For those who don’t know it, Russian Scandal is

a parlour game in which players sitting in a circle pass a message from one to another by whisper and finally observe how it has been transformed […] In the Soviet Union, however, cybernetics itself became the subject of a true ‘Russian scandal’. Literally, in Soviet public discourse in the early years of the Cold War cybernetics acquired the scandalous reputation of a ‘modish pseudo-science.’ Figuratively, the mechanism of a Soviet anticybernetics campaign resembled the ‘Russian scandal’ game, for it involved profound discursive transformation. (Gerovitch, 2001b, p. 547)

Cybernetics, as we have seen before, differently from its sibling theories – system and information theory – had an incredibly dense moral and idealistic undertone to it. It is quite funny to imagine then what would have been be the reaction of the Soviet nomenklatura when its members read Wiener’s text for the first time. Soviet scientists, who were discouraged from accepting and conforming to alleged Western scientific knowledge, originally denounced cybernetics as a reactionary pseudo-science and an ideological weapon of imperialist America (Gerovitch, 2001b, 2002; Mindell et al., 2003; Peters, 2008, 2012). It is important to note that the same treatment was given to information theory and, consequentially, both had their original meanings changed in a very blunt and Stalinist manner⁷⁰. Seeking a pure, technical and truly scientific theory, Soviet science would strip information theory and cybernetics of any trace of ideology and social commentary, preserving instead the material and mathematical aspects of both theories. These Soviet translations, however, would only appear to Soviet scholars

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⁶⁹ In English this game is usually known as Chinese Whispers.

⁷⁰ A form of newspeak, with obvious Orwellian contours, according to Gerovitch (2002).
generally after Stalin’s death in 1953 and at the beginning of the ‘thaw’\(^71\) (Gerovitch, 2001b, 2002). As Gerovitch reminds us, ‘discussions of genetics, relativity theory, quantum mechanics, and various Western-born theories in economics, chemistry, physiology, linguistics, and mathematical logic became saturated with the pejorative labels \textit{idealism, mechanism, metaphysics, formalism, and cosmopolitanism}’ (Gerovitch, 2002, p. 19). Talking about the translation of \textit{Cybernetics} and Claude Shannon’s book \textit{Mathematical Theory of Communication} (1949), one of the works that laid the foundations for information theory, Mindell \textit{et al.} clarify the problem in a lucid manner:

Soviet critics charged that Shannon’s theory of communication reduced the human being to a ‘talking machine’ and equated human speech with ‘just a “flow” of purely conditional, symbolic “information,” which does not differ in principle from digital data fed into a calculating machine.’ Wiener’s formula, ‘information is information, not matter or energy,’ provoked a philosophical critique of the concept of information as a non-material entity. Repeating Lenin’s criticism of some philosophical interpretations of relativity physics in the early twentieth century, Soviet authors castigated cyberneticians for replacing material processes with ‘pure’ mathematical formulae and equations, in which ‘matter itself disappears’. (Mindell \textit{et al.}, 2003, p. 82)\(^72\)

Russian art had taken notice of cybernetics only by the late 1950s, following the excitement for all things scientific, resulting especially from the government campaign for the sciences (exemplified by Sputnik’s launch in September 1957 and Yuri Gagarin’s flight into space in 1961).\(^72\)

\(^{71}\) Nikita Khruschev’s reforms from within attempted to de-Stalinise the USSR; in other words, repression, in general, began to relax. There is an incredibly detailed scholarship on this process. To name a few: Khruschev (2000), Taubman \textit{et al.} (2000), Jones (2006) and Tromly (2014).

\(^{72}\) Cybernetics would eventually be adopted by the Soviet state and its scientists as a truly scientific and Soviet enterprise. In a complex and confusing \textit{symbiosis of ideology, translations and commentaries}, cybernetics would become, and according to the Soviet narrative it already was, a historically anchored Soviet tradition central to the Soviet future (Gerovitch, 2002; Mindell \textit{et al.}, 2003; Peters, 2012). Its critique of the human–machine analogy, however, would still be preserved. For a complete contextual and political history of cybernetics in the USSR see Gerovitch (2002).
short trip around the earth in orbit in 1961) and made possible by Khrushchev’s softening of cultural control. According to Matthew Jackson, in synchronisation with Gagarin’s trip, the Communist Party adopted ‘the “scientific and technological revolution” (nauchno-tekhnicheskaia revoliutsiia, or NTR) as one of the cornerstones of its political and economic program. In this atmosphere of pervasive technophile sentiment it is not surprising that the experimental filed of cybernetics rapidly brought the sciences and humanities into its orbit’ (Jackson, 2010, p. 34). Two artists stand out in the adoption, or rather conversation, with cybernetics: Ilya Kabakov, at the time a young man but established as an official Soviet artist, and Yuri Zlotnikov, a long-time friend of Kabakov and an unofficial underground artist without the support and acknowledgement of the state and, consequentially, Soviet society at large (Jackson, 2010). Of those two, Zlotnikov was the first and most intensely involved with cybernetics. Mirroring Max Bense’s\(^3\) approach (but as far as we know with no connections to it) he ‘strove to rid his art of all “excessively human” expression and clung to the new sciences’ (Dyogot, 2012) and is considered to be among the first Soviet artists to return to abstractionism. Zlotnikov’s paintings, heavily influenced by cybernetics’ ideas, were primarily interested in communication, signs and language. His large-scale paintings on paper, Signal Systems (1957–1962) (Fig. 1), also translated as Signalling Systems by Dyogot, are a collection of quasi-repetitive compositions using very limited forms, which resembled, in a way, a confusing Morse code. In these works Zlotnikov emphasises the process rather than the final object (Gutov, 2003). According to him, ‘the fundamental meaning of work became an interest in language’ (in Jackson, 2010, p. 37). The influence of cybernetics’ concepts on his discourse and practice is widely accepted (Gutov, 2003; Chukhrov, 2010; Jackson, 2010; Dyogot, 2012; Kovalev, 2012). His emphasis on communication, very close to the

\(^{3}\) Max Bense is an enormously important figure later on this chapter, for both computer and concrete art.
cybernetic idea that everything can be defined and interpreted as information, can be seen as an example of this. Likewise, cybernetics’ idea of feedback is a central concept in this kind of endeavour. His *Signal Systems*, being a series, aimed to explore phenomenological reactions against a rather systematic stream of compositions. The artist’s feedback is there to consequentialy ‘steer’ (the original meaning of *kyber*) the series towards the most ‘effective’ possibilities.

It is important to understand the context of Zlotnikov’s work in relation to the thaw. Zlotnikov himself describes the situation as ‘stormy’ (in Simms, 2007, p. 53). With the gradual thaw, Russian artists were becoming familiar with their own history. Some artists, previously imprisoned for not conforming to social realism, were freed. Although restrictions were imposed until 1989, artists who did not conform to the official style no longer feared for their lives (Simms, 2007, p. 86). The thaw also marked a larger cultural trend, felt in all aspects of cultural life (Tromly, 2014, pp. 20–21), but for Zlotnikov it meant a possible path for personal development.

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74 Zlotnikov’s words in full: ‘The “Doctors” trial, Stalin’s death, confusion in the country […] the Twentieth Congress, romantic hopes of the “Thaw” – it was a stormy time. It was the time of the new discovery of strange culture of the 20’s. It was also the time of the first exhibitions of Western art: beginning from Picasso’s exhibition which led to the reconsideration of all stable values of our lives. The artist himself was becoming an object of his own study. Picasso and the element of game in his art, Pollock, Mondrian, Nicholson, Pasmor all this material was “chewed”, analyzed and with a great difficulty digested. Sometimes it was a dramatic turn from the past ideas and beliefs. This drama is a distinctive characteristic of our generation from that of the present’ (in Simms, 2007, p. 53).

75 Or, as Condee would describe it: ‘the story of Thaw politics is about culture. The story of Thaw culture is about politics’ (Condee, 2000, p. 160).

76 We also should remind ourselves that without the thaw any reading of cybernetics would have been banned since it was seen as formalist, lacking a (Stalinist) social context and hence against the proletariat. Gerovitch reminds us that the ‘word formalism acquired a much more ominous meaning during
This emphasis on individualism, via his co-option of cybernetics, can be seen as a resistance move of not just Zlotnikov but also all abstract artists of the time (Simms, 2007, p. 93). It was not coincidental, then, his emphasis on rationalism. While ‘most Soviet nonconformist artists of the period who chose abstraction as a style were under the direct influence of the works of Mark Rothko and Jackson Pollock […] Zlotnikov went in the opposite direction and insisted that it was important not to give into the chaos of emotional self-expression but to analyse’ (Kovalev, 2012). Cybernetics, as a rational formalist discipline, did not allow for subjectivity or emotion. Whereas his colleagues embraced abstract expressionism, Zlotnikov looked for a different path for his abstractions, closer to his Russian heritage but yet denying the Soviet utopia. Within this contextual opportunity, cybernetics and computers ‘came to symbolize a new spirit of rigorous thinking, logical clarity, and quantitative precision, contrasting sharply with the vague and manipulative language of Stalinist ideological discourse’ (Gerovitch, 2002, p. 8) and, hence, were central to the de-Stalinisation efforts promoted by Khrushchev. Sadly, the very thing that Zlotnikov saw as potentially liberating became central to Soviet control. ‘After Brezhnev replaced Khrushchev, the academic and political establishment began to appropriate cyberspeak and computer technology as means of conserving the existing administrative hierarchies and power structures’ (Gerovitch, 2002, p. 8). It should not be surprising then that Zlotnikov would abandon his cybernetic methods. In a move resembling those of some later computer arts pioneers (and Wiener himself), he refused to use his work to promote the status quo (and militarism) and ‘returned to

the militant debate over the interpretation of Marxist philosophy in 1930. One group of Marxist philosophers accused another of “formalistic views and errors”, which consisted in “the repetition of abstract formulas instead of solving concrete problems posed by life itself”. The accused charged that their opponents were themselves guilty of “formalistic deviations,” and qualified formalism as an “idealistic” departure from dialectical materialism’ (Gerovitch, 2002, pp. 31–32).
figurative Cézannist painting in the early 1960s and would only go back to abstract art, this time the expressionist style, in the late 1960s’ (Kovalev, 2012).

The Brazilian context, my next example, differently from the situation found in the USSR, did not present any restrictions whatsoever for cybernetics. In fact the opposite was true: the full text was fairly well known and debated, especially within the artistic field related to the Brazilian concrete movement77. Brazil of course was a very different place from the USSR. Riding the 1950s over a wave of populism, industrialisation and developmental nationalism, which would culminate with the capital city Brasilia’s heroic foundation in 1960 (under President Kubitschek), the ideologically flexible government of Getúlio Vargas aimed to promote a vision of a modern, new Brazil. Artists, thinkers and activist were a reasonably free bunch, despite Vargas’ close relationship with fascist groups some decades earlier. Hence, differently from the Soviet reading, the Brazilian one did not focus on the mathematical, technical work of cybernetics. What interested readers was the very ideological formalist discourse that had been considered bourgeois garbage and pseudo-science by the Soviet state78. In 1958, ten years after Wiener’s publication, cybernetics was given five weeks of coverage in the Sunday supplement of the Jornal do Brasil (Fig. 2), a now extinct newspaper published in Rio de Janeiro. It is important to note that the Suplemento was, at the time, one of the main vehicles of debate and promotion for constructivists’ art, poetry and theory in Brazil. It was in its pages that, almost a year later, the neoconcrete manifest would be published79. On 19 October 1958

77 Not entirely surprising, given the close ties between German and Brazilian concrete artists at the time, via the Ulm School (Max Bill and Max Bense) and its emphasis on mathematics, formalism and abstractionism. Campos (2011, p. 182) explicitly posits Bense, for example, as the interlocutor between the two groups.

78 Which was latter reworked as an attempt at de-Stalinisation (the purge of Stalinist ideology) in the Soviet sciences.

79 Ironically a fiercely anti-rational formalist movement.
the manifesto was published on its cover, and thus it is important to quote the passage in full:

It could be said, and it is not an overstatement, that the word ‘cybernetics’ was spread within the Brazilian literary circles by the *Suplemento Dominical* of the JORNAL DO BRASIL during the debates about concrete poetry. Until then the word belonged to specialised circles and to telegraphic news, which, once in a while, would briefly refer to it. Yet, despite the fact that that the word ‘cybernetics’ has become familiar, what is cybernetics after all? It is with the purpose of providing our readers with a more or less satisfactory answer to this question that we begin here a series of articles regarding the subject […] In general it could be said that cybernetics is a very recent science that studies the relationships between human behaviour and the machine. It is evident that such a definition does not empty the subject and does not even allows us to predict this newest human science. In truth, cybernetics not only studies the relationships between human physiology (or animal) and the machine but also looks to transfer to the machine properties that until now were exclusive to the animal and human worlds, such as the capacity to react to exterior stimulation, to correct its reaction and to ‘think’ and resolve highly complex mathematical problems. (Barroso, 1958, p. 1, my translation)

Unfortunately I could not find within the paper’s archive earlier quotations about cybernetics. Despite this, it is quite clear what type of emphasis the Brazilian constructivists were stressing, namely, ‘the relationships between human behaviour and the machine’. The remaining text of the five articles was not in fact Brazilian or from someone within Brazilian concretism. Instead it was a French reporter, Pierre de Latil, who wrote the text. His book *La Pensée artificielle*, published in France in 1953 and in Brazil in 1959, was the basis for the five-week coverage of the *Jornal do Brasil*, a year before the book’s publication in Brazil. Its initial lines for cybernetics are, undoubtedly, very different in emphasis from those in Norbert Wiener’s original text. While Wiener’s initial conceptions were dedicated to a programmatic approach to unite the sciences via a common language, De Latil’s initial commentary refers to the understanding of new phenomena: the autonomous robot and the artificial brain. It is notable that Wiener
himself would only talk directly about robots or automata\textsuperscript{80} in the second edition of *Cybernetics*, some thirteen years after the original publication and, consequently, some six years after de Latil’s book. In this *Suplemento* edition, of 19 October 1958, after his initial commentaries on the robot and the artificial brain, de Latil described cybernetics in the same way that Wiener did. By this I mean that de Latil told Wiener’s history, from his meetings at the Vanderbilt Hall to his involvement with anti-aircraft projects and his subsequent insight concerning the inter-relationship between disparate fields of scientific knowledge. De Latil, however, did not emphasise the institutional and epistemological problems denounced by Wiener. If Wiener saw the ideas that came from his studies as tools for a revolutionary project of merging within the sciences themselves, de Latil instead read cybernetics as virtue, finding an even more esoteric approach to it. As we can see in his flamboyant text, cybernetics, for him, apparently inspired something more than revolution within the sciences only:

The cybernetics revolution has developed, however, with an astonishing and shocking speed. The deflagration appeared between two spheres until now independent; and, even more than that, opposed: between mathematics and physiology, between machines and life. Enormous quantities of knowledge had accumulated in each extremity. And suddenly, with the approximation of those two poles, a spark was produced. […] Within its light the dark abyss that we thought existed between matter and spirit has been revealed to us as a new world. Suddenly, the margins of science, well known for a long time, are enlightened by a new splendour. There is no field of knowledge – or ignorance – that does not receive a reflection of this light. Everything started from the simple thought that life can, if not be explained, at least be approached by rationales and experiences of mathematical character. (de Latil, 1958, p. 7, my translation)

\textsuperscript{80} Although he briefly discussed automata in the original publication of 1949, later in the 1961 edition (only three years before his death), Wiener would dedicate two entire chapters to the subject (Chapter 9, ‘On Learning and Self-Reproducing Machines’ and Chapter 10, ‘Brain Waves and Self-Organizing Systems’). By 1964, the year of his death, his *God and Golem, Inc.* had also touched on the subject, but this time around his tone was more sombre and alarmed.
De Latil’s romanticism is remarkable given the rather cold, mathematical and un-poetic texts of Wiener’s initial work (*Cybernetics*, first edition). The story of cybernetics presented by de Latil may be the same as Wiener’s but, as the former’s initial commentaries show, the way in which the story is told, as well as its emphasis and agenda, are rather different from its initial conception.

Let’s clarify this problem. Pierre de Latil, coming from the French context and its tendency to “franconise” perceived Anglo-Saxon scientific knowledge, especially in the turbulent years following the Second World War, framed cybernetics within a French tradition. Similarly to the process that occurred within the Soviet Union and its campaign against un-Soviet knowledge, the French press and public only accepted cybernetics as a valid and worthy discipline once it had been translated and harmonised into the national agenda and post-war discourse. In fact de Latil, following the French trend that he was part of, rewrote cybernetics’ epistemological origins away from its technical and mathematical origins. As we have seen before, Wiener himself would try to

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81 Similarly to its Soviet translation, *Cybernetics* in France was initially denounced as ‘American’ in the early years after the war and would only be accepted when recast as a French intellectual tradition. Anti-Americanism in France, up to the late 1940s, should be seen as both a product of the Soviet relation to cybernetics and the rise and exclusion of communism’s ministers from government: ‘In 1947, France was marked by political instability. In the November 1946 legislative election, the French Communist Party came first, with nearly a third of the votes, but in May 1947, the Communist ministers were dismissed by the [sic] President Ramadier who followed Truman’s appeal from March 15th to all Western countries to exclude all communist forces from governments. French people still had to live with rationing […] Strikes in October and November led to the resignation of the Ramadier cabinet’ (Mindell *et al.*, 2003, p. 76). We have seen before that science was a central tenet in American foreign policy. The adoption of cybernetics in France can be seen as an extension of the tension between American and French interests, between international science and national science. This topic, too varied and detailed to be seen in this text, can be much better seen in Kuisel (1993) and Krige (2006). For a historiographical account and critique of the concept of internationalism versus nationalism in the study of technosciences, see Edgerton (2007).
frame cybernetics outside these technical fields. The difference here is that de Latil framed cybernetics within an exclusively French tradition. He talked, for example, in the same piece for the Suplemento, about how this idea, that life could ‘if not be explained, at least approached by rationales and experiments of mathematical character’, was not something new. He attributed this rationale to Claude Bernard, a nineteenth-century French physiologist. Moreover, not only did he give the emphasis on mathematics to someone else but he also attributed interdisciplinary emphasis to Henri Poincaré, who is quoted by de Latil as saying that ‘the great progresses are produced when two sciences approach each other, when they become conscious of the similarities of its forms, despite the dissimilitude of its object’ (in de Latil, 1953, p. 14). We should note that neither Bernard nor Poincaré are quoted in Wiener’s original work. That is not to say, however, that there is no similarity between their conception and Wiener’s. Obviously this propensity to reframe theories and ideas for one’s own purpose is commonplace and not an exclusively French or Soviet activity. What I aim to show here is rather the extent to which de Latil and others would go to legitimise their conviction on cybernetics: namely, to create a nationalistic discourse that sought to contextualise cybernetics within their own national and intellectual traditions.\textsuperscript{82}

I am not aware of any attempt to nationalise cybernetics discourse within Brazil. In fact, the case was pretty much the opposite, with cybernetics seen as an international phenomenon, being solely the result of modernity. When the Suplemento claimed to have introduced the theme to Brazilian readers, it plainly stated that the theme came from somewhere else and not Brazil. Hence it was introduced to Brazilian readers and not

\textsuperscript{82} A process that, similarly to the example of the USSR, could only happen with the death of Stalin and in the context of the thaw.
simply readers\textsuperscript{83}. When the \textit{Suplemento} stated that its Brazilian readers were about to see ‘the birth of this ultramodern science’, even though it was publishing de Latil’s version of cybernetics’ history, the \textit{Suplemento} was nevertheless attaching cybernetics to its own present time and not to some French, American or Soviet intellectual tradition. Unfortunately I cannot say for sure who introduced cybernetics to the \textit{Suplemento} in the first place. Yet, it is interesting to note that cybernetics’ ideas of rationalisation and mathematical formalism regarding human affairs, as well as its analogies between human and machine, would be utterly rejected by the neoconcrete manifesto less than a year later. Being a rift between the São Paulo and Rio de Janeiro artists over what was often perceived as a dogmatic rationalistic attitude from the São Paulo concrete group, the neoconcrete manifest would be a pivotal point in the development of Brazilian concretism. In this case, given the \textit{carioca} rejection of human–machine analogies and the \textit{paulista}\textsuperscript{84} close relationship with mathematical dogmatism, as well as the fact that both groups had shown an ‘uncompromising stance throughout the decade’ (Asbury, 2006, p. 73), it is fair to assume that it was via the São Paulo group that cybernetics’ principles, and specially the feedback analogies, would come under discussion.

São Paulo indeed could be seen as the main motor behind rational formalism in Brazil. Again we may say that the politics of the Cold War were pivotal to these

\textsuperscript{83} This I believe represents more the status of Brazil in the post-war order than a lack of nationalism. Still perceiving itself as peripheral, Brazil(ians) wanted to see the country and promote its image as a modern entity. It was not that they did not want to cast cybernetics as Brazilian; rather, being modern, equal to Europeans and Americans, seemed to be the objective of these attempts to introduce cybernetics to a wider public. It seems that it was through its architecture, arts and industries that Brazil would attempt to claim its modern status, an attempt that started at the beginning of the twentieth century with the first Brazilian modernist wave.

\textsuperscript{84} \textit{Carioca} is the name given to Rio de Janeiro’s natives whereas \textit{paulistas} are people born in São Paulo.
developments, which positioned São Paulo at the heart of Brazilian concretism. Firstly we need to take into consideration the Brazilian geopolitical context of the early Cold War. Differently from Europe, Brazil did not benefit from huge sums of money in American aid. Successive Brazilian governments, throughout the late 1940s up to the late 1960s, and even after the military coup of 1964, despite constant pleas for aid, were side-lined as second-class allies. Desperate for funds for their modernisation project, Brazilian governments throughout the early Cold War felt betrayed by the lack of American interest despite Brazil’s continuous effort in the Second World War. Since Brazil was the only South American nation to provide troops for the Allied effort, it had felt that its relationship with the US would become a special, generous kind of relationship. Frustrated by this feeling of neglect, successive governments came to stress the need for autonomy in relation to the US on top of industrial and economic emancipation. These developments, narrated and documented by Hilton (1981), would have a lasting result: they entrenched the idea that the US could not be trusted and at the same time reinforced the idea that industrialisation, and hence modernity, would only be achieved by forging a new, independent path of self-reliance concluding with desenvolvimentismo (developmentalism). The US policy towards Brazil, which provided not aid but instead a moralising discourse favouring private investment, can be seen, for example, at the opening of the first São Paulo Biennale, in 1951, where protesters outside chanted slogans denouncing US imperialism (Oliveira, 2001). The protest was not aimless, though. Oliveria (2001) reminds us that some days before the opening the left-oriented press would emphatically highlight the union of Nelson Rockefeller and Ciccillo Matarazzo in a Museum of Modern Art fundraising ball, promoting then a new cosmopolitan, private-led and industrious Brazilian modernity some few days before the opening of the Biennale. São Paulo, the industrial capital of Brazil, would indeed become the de facto centre for this new, idealised modern Brazil. ‘Positioning itself as a rupture within the visual arts, the paulista concrete paradigm positioned itself as a proposal for
a modern art’ (Sant’Anna, 2007, p. 34, my translation) that tactically rejected the previous modernity of the early twentieth century, of the Semana de 22 (which heralded Brazilian modernism), based upon a negotiation of industrial–rural and national–international Cartesian conceptions of Brazil (Arruda, 1997; Sant’Anna, 2007). This new modernity would not be based upon the digestion of the outsider, the foreigner; instead, it was conceived as a purely rational exercise, a product universally common not only to concrete poets but also to all artists. Hence ‘concrete poetry, in a Brazilian manner, conceptualised a new poetics, national and universal’ (H. de Campos, 2006b, p. 245, my translation). Ironically, to be modern (and a modern Brazilian), for concrete artists, was to be part of this universal communion of rational beings. The adoption of cybernetics, then, can be seen as just one of the many developments towards this conception of Brazilian modernity, universal (but national), rational and formalist, as developed in São Paulo but not necessarily elsewhere.

Augusto dos Campos, Haroldo de Campos and Décio Pignatari, exponents of the São Paulo concrete poetry movement, would dedicate some pages to reflections on the virtues of cybernetics’ feedback, as de Latil would put it. Haroldo de Campos, talking

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85 Haroldo de Campos would describe at length this quite paradoxical relation, between the national and the universal, between antropofagia and poesia concreta, between subdeveloped modernity and developed modernity, in an article published in 1981 (H. de Campos, 2006b, pp. 231–258).

86 For Arruda, for example, post-war economic growth anchored by desenvolvimentismo would mainly impact São Paulo. Hence, ‘there was a clear coincidence between the concrete movement […] and the increase of industrial production changing [paulista] society, which, eventually, would validate the ideal of progress as its most important [paulista] social feature’ (Arruda, 1997, p. 47 my translation).

87 A pause is necessary to clarify this term. Negative feedback, very basically, refers to a tendency in systems towards equilibrium. In this kind of system, the output is opposed to its input; that is, it is directed in order to counter it and, consequentially, reach an equilibrium between the two. This is actually much simpler than it sounds. Your body, for example, regulates its temperature in this manner. It always works towards equilibrium and, as everyone knows, this is found at around 36 degrees Celsius. The body, however, also
about Pignatari’s famous *Earth Poem* (Fig. 3), explains that the poem, ‘as Pignatari himself refers to it, used the process of retro-alimentation [feedback] of cybernetics as a structural resource of the poem’ (A. de Campos, 2006, p. 112 my translation). Central to Pignatari’s work and his conception of feedback is the idea of *negative feedback*. In fact, negative feedback is what usually artists mean when they refer simply to feedback. What interested the São Paulo concretists was the very possibility of evoking such self-regulatory capabilities in their poems. With interests similar to Zlotnikov’s but dissimilar in their application, the São Paulo concretists saw feedback not only as a tool aiding the creative process but also as a quality inherent in the structure of the poem itself. Instead of experimenting with negative feedback via a repetitive process, thus aiming for a trial-and-error method in which the artist is a regulator, the concrete poem should instead correct itself in the eyes of its readers. The concrete poem, for the paulistas, has a will, and that is what the artist attempts to communicate to the observer via the poem’s self-regulatory structure. The São Paulo artists, despite their radical rationalist tendencies, were interested in cybernetics as an ideological tool and not in its mathematical work. Cybernetics for them, via its conception of feedback and its analogies between human and machine, provided paths in which concrete art could be understood and commented

needs to produce heat in proportion to the outside weather in which the body in question is located. If it is too hot, it needs to reduce the heating. If the weather is cold, it increases heat production, always towards 36 degrees Celsius. This kind of process can be seen everywhere. Cybernetics as a programmatic discipline highlights the similarities in this process in humans (in body and mind), machines and nature.

88 ‘The error on the verbal and procedural level, as we saw, expresses the self-correction of the poem, coerced by the will of structure in which the poet pitched his creative option. A topic of cybernetics, correlate, still needs to be called in scene: the method of solving problems by “trial and error”, which in the same way interests the psychologists of Gestalt’ (A. de Campos, 2006, p. 113, my translation).

89 Later on this would be precisely one of the arguments Ferreira Gullar used to denounce the *paulista* rationalistic doctrine (Gullar, 1959, p. 3).
on as a modern phenomenon. This culminated, as we saw, in the idea that such principles could be attached to the poem via its compositional structure.

Another Brazilian artist, Abraham Palatnik, would have a similar interest in cybernetics. Yet his involvement was a rather practical affair and not only an ideological one. A native of Natal, in the northeast of Brazil, and the son of Jewish Russian emigrants, he was unusual in the Brazilian artistic context of the 1950s. Usually associated with the second exhibition of the Grupo Frente, which included many future members of the neoconcrete opposition to dogmatic rationalism, Palatnik’s work, it could be argued, presented the most rationalist tendencies of all Brazilians involved in the concrete/neoconcrete debate. His rationality, however, did not involve the championing of rationality per se but instead can be seen in his methods. A pioneer of kinetic art, he probably had a much more intimate experience with cybernetics, closer to that of its initial creator and context, than the paulistas could hope for. While claiming intuition as his main guide (Palatnik, 2004, p. 22) – like most of his neoconcrete peers – Palatnik had a very orderly conception of intuition himself. The artist’s role, in his words, was ‘to discipline the perceptive chaos’ (in Morais, 2004, p. 164). His position within the Brazilian concrete/neoconcrete debate, for me at least, is far from conclusive.

90 Asbury lucidly stresses this problem as mainly one of labelling. For him the ‘notion of precedents is always problematic since on the one hand, origins are always evasive, while on the other, Palatnik’s work, in its own evolution does not fit comfortably with the Kinetic art “movement”. The same could be said about the artist’s relation to the field of art and technology, there is a relation at the origin, but Palatnik refuses to submit to this strand, remaining faithful to mechanical operating systems, that is, to his own process of working and creating […] such interpretations are fundamentally teleological and […] within such a context Palatnik’s position remains awkward. Undoubtedly the product of the specialization of academic practice, whether formalist, sociological or technological in their orientation, these respective fields have, often inadvertently, created barriers that forcibly lead the work of an artist such as Palatnik to either escape between the interstices of categories or alternatively to be framed inappropriately’ (Asbury, 2013, p. 62).
to drift between both extreme positions, *carioca* and *paulista*, and at the same time reconcile many of their disparate concepts. From this point of view we can say he was more of a moderate than a radical. Amaral tells us that Palatnik ‘embodies well the artist as an inventor in our century, one in which the control of technique and inventiveness could achieve, through the visual poetics of the image, the formal creation; that, for the same reason, interested concretists as much as neoconcretists’ (Amaral, 2006b, p. 155, my translation).

Palatnik’s entry into the Brazilian artistic context of the time is attributed to his relationship with another artist, Almir Mavignier\(^1\), and their visits to the psychiatric hospital Engenho de Dentro (Osorio, 2004, p. 49; Asbury, 2013). There, Palatnik tells us, he himself was ‘in front of people who had never studied, that had not gone through any kind of tuition, producing works of complex and profound language’ (in Morais, 2004, p. 164). For the young Palatnik, who had a rather classical artistic education, this was a shock. In his biographical profile, Barcinski tells us that:

Mavignier, seeing his friend so disturbed, resolved to introduce him to Mario Pedrosa, who knew and admired the work of Engenho de Dentro’s patients and considered it to be legitimate art. Both went to visit the critic in his house and Palatnik reported his enormous conflict. Pedrosa laughed off the young artist’s despair and tried to settle the situation by declaring that he ought to know the other ‘aspects of form’ and lent him a book that dealt with psychology of form and the Gestalt, and a book about cybernetics, because Palatnik had expressed the ‘desire of activating something in space, but not randomly’ to the artist in control. And so, Abraham Palatnik initiated his experiments with light. (Barcinski, 2004, p. 98, my translation)

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\(^1\) Later on Mavignier would become an Ulm student under Max Bense’s tutelage. Not coincidentally, given his modernist credentials and proximity to the rational abstract artists of the time, he would also be one of the founders of the New Tendencies exhibitions in Zagreb, exhibitions that would have a central role in the history of computer art. For more on Mavignier and his relation to computer art see Rosen (2011a).
This ‘desire of activating something in space’ would, in 1951, result in Palatnik’s first ‘cinechromatic device’ – a term created by Pedrosa (Kac, 1996; Pedrosa, 1996) – being presented at the first São Paulo Biennale. *Azul e roxo em primeiro movimento* (Fig. 4, 5) (1951) can be read as an example of cybernetics’ ideas being put into practice. To begin with, this was a very complex device, only made possible by Palatnik’s engineering knowledge acquired during his youth in Tel-Aviv. In fact, there are times in which he seems to be more of an engineer and inventor than anything else. Although Palatnik does not possess the kind of advanced mathematical knowledge required for a comparison between his and Wiener’s systems, his artworks were markedly defined by precise mechanisms that, similarly to *paulistas* concretists or Zlotnikov paintings, had to be rearranged, taking the observer (human) and the artwork (machine) into consideration. Similarly to *paulistas* or Muscovites, then, it was not a case of applying cybernetics directly; what came into play for Palatnik were the insights provided by Wiener’s work and not his mathematical techniques. Palatnik, I believe, despite not having the technical knowledge to follow Wiener’s book, could nevertheless understand, as many did, the implications of that book. An example of his intuitive behaviour can be seen in the fact that, despite his not having formal engineering training, not only are there many patents in his name but also his analytical and novel approaches in relation to engineering were quite legendary (Osorio, 2004, p. 51). His first cinechromatic device contained ‘600 meters of electric cables, differentiated by colour, that served 101 focuses of different voltage, that moved, in different speeds, some cylinders. The projection is made through obstacles, lenses and a prism for light refraction’ (Morais, 2004, p. 165, my translation). Unfortunately Palatnik did not write as compulsively about his work as the São Paulo concretists did. There are few instances in which he comments on cybernetics and fewer in which he engages more thoroughly with the subject. In fact, there seems to be confusion regarding his own knowledge of the subject. He recalls that Pedrosa lent him ‘a book about Gestalt, by Norbert Wiener, and at that time there was no talk about that, not
even among artists […] [Pedrosa] told me that it was very important to follow what was written in that book. I read it carefully and it really did open my horizons a bit, the ideas started getting clearer’ (Palatnik, 2013, p. 50). As far as we can tell, however, there is no Gestalt book written by Wiener. In his bibliography compiled by the American Mathematical Society (Bull. Amer. Math. Soc., 1966). Just one entry is explicitly related to Gestalt. This single article, as expected, offers a similar understanding of Gestalt to that in Wiener’s first edition of Cybernetics, where he discusses Gestalt under his own cognitive and cybernetic theories. That is not to say that there were no connections. Not only was Wiener aware of Gestalt but he even briefly sketched ideas of his own. Despite his knowledge of Gestalt, Wiener never fully engaged with the subject and, more importantly, cyberneticists in general seemed to be positioned against it.92

Yet, despite his own inconsistencies, Palatnik is still seen as somehow representing cybernetics, both at the time and today, resulting at times in his positioning within the umbrella of new media or digital art discussions93. In February 1955 Augusto

92 Riskin, in fact, reminds us that ‘Cyberneticists such as Norbert Wiener were hostile to what they saw as the organicism and mysticism of Gestalt psychology’ (Riskin, 2010b, p. 22). Moreover, ‘in 1951, the preeminent Gestalt psychologist Wolfgang Köhler published a review of Norbert Wiener’s seminal work, Cybernetics, which included a famous chapter entitled “Computing Machines and the Nervous System.” Though he praised certain features of the book, including the important theorization of feedback, Köhler had serious reservations about the idea that electronic calculators and other machines could serve as models for the human nervous system and thereby help to explain the origin and nature of human thought. As Köhler put it, this “now popular comparison” was entirely ungrounded – the kind of information processing carried on by these new computing machines was, he believed, “functionally” and “generically” different from human thinking’ (Bates, 2010, pp. 239–240).

93 Tellingly, Palatnik himself did not move towards the computer: ‘In a 1960 article in the Jornal do Brasil, Pedrosa challenged the artist to immerse himself into the emerging field of electronics. The fact that Palatnik did not respond to such a challenge is perhaps revealing of his relation to technology itself […] It is problematic therefore to associate Palatnik unquestionably with the constructivist tradition, since by the
de Campos wrote to Palatnik in order to discuss the possibility of using luminous objects or ‘letterfilms’ for his poems. His brother, Haroldo, would clarify this by stating that the ‘possibilities of a combinatory art, obtained through electric means, cybernetics etc., is extremely interesting to the concrete poet as a new organizational perspective for poetic material’ (H. de Campos, 2006a, p. 148, my translation). The cinechromatic devices, as well as Palatnik’s later works, the Objetos Cinéticos (Kinetic Objects) series (Fig. 6), all share the same controlled and constrained process. For Palatnik this would have been natural and would have resulted not only from his interests in cybernetics (as a metaphor) but also from the materials he used. His objects are deconstructions, similar to hacking in today’s terms, of industrial objects that were primarily intended to be something else. For someone who wanted to experiment with light and not the reflection of it, this was (and pretty much still is) the only way to work. His devices follow plans, charts and schematics and those, in turn, follow the rationale of industry, which created those objects in the first place. Given his material limitations and his belief in control over perception (via intuition), one could argue that this was a very restricted practice, yet this could not be more mistaken. This is a playful and ludic practice, based on an intuitive trial-and-error method rather than a mathematical one. Palatnik’s control over the object was limited – so limited in fact that the first cinechromatic took around two years to be realised and was a very precarious machine. Furthermore, this interest in the ludic aspects of creation was translated into a series of game-like artworks and objects developed throughout the 1960s. Reading Palatnik, as we can see, it is never straightforward. His position in relation to intuition can be seen as an argument against cybernetics’ rational principles, similar to those adopted by the São Paulo concretists. I am not aware of any development in Palatnik’s work that came about as a result of Augusto de Campos’ letters.

1950s the association between art and technology, which presented the artist as engineer, as in Tatlin’s vision for instance, could no longer be sustained, particularly in a country such as Brazil’ (Asbury, 2013, p. 76).
to him and, honestly, this is not surprising. I might be wrong but this may show that, despite their apparent similarities, Palatnik’s artistic process and understanding of cybernetics were incompatible with the approaches professed by the de Campos brothers. For Palatnik, rationality cannot be disassociated with the intuitive characteristics of humanity. In his own words:

The comprehension of the formal aspects, not only in the external world but also at the unconscious roots of human activity, would dismantle the doubt and the controversy that exists between the relations of art, science, technology and communication. The subconscious is also gifted with mechanisms that are activated spontaneously and in such extraordinary manner that not even the powerful science could yet comprehend all its processes. One of these, intuition, is undoubtedly one the most important human faculties. The evolution of technology would largely depend on this faculty, being that the acting of the denomination ‘intelligence’ would be integrated in the intuitive process. A complex problem merges in our head but its solution jumps unexpectedly and, suddenly, we see order and logic in the diverse irregular facts within the disorder. (Palatnik, 2004, p. 22)

If in Brazil we may say that Palatnik and the concretists were the first examples of cybernetics being appropriated for artistic discourse prior to computer art’s first public exhibitions of 1965, for a European audience perhaps the most recognisable name of a cybernetics-concerned artist is Nicolas Schöffer. Born in Hungary but living most of his life in France, Schöffer came to be regarded as the pioneer of kinetic art and, consequentially, cybernetic art (as he liked to call his later works). His CYSP I (Fig. 7) (1956) undoubtedly incorporates cybernetics’ ideas of input, output and feedback, not only as concepts but also as physical properties manifested in artistic machines. CYSP I was originally commissioned by choreographer Maurice Béjart for the Festival of Avant-Garde Art in Marseille (Fernández, 2009, p. 472) but it was shown in many other places and contexts after its first public appearance. CYSP stands for ‘cybernetic spatial dynamism’, ‘spatial dynamism’ being a term coined by Schöffer some years earlier in order to explain his practice and his early kinetic works. Not coincidentally perhaps, in
1951 Pedrosa also played with the idea of dynamism, but this time chromatic, in order to discuss Palatnik’s work at the first São Paulo Biennale (Pedrosa, 1996).

When we compare Schöffer and Palatnik, however, there is a sense of an uneven game being played. While Palatnik created his projects mainly by himself, using old machines for his constructions, Schöffer had the comforting experience of having Phillips engineers working alongside him. Schöffer’s machines were not precarious linear constructions. Rather the opposite: CYSP 1 was a very complex machine for its time. It did not have a beginning, middle or end, unlike Palatnik’s linear constructions. Instead, CYSP 1, in true cybernetic fashion, would react to the observer and its environment in a never-ending process, limited not by time but by its input. The machine here reacts pretty much as if alive, having, therefore, a will exterior to that of the observer. We could say that if Zlotnikov used feedback as a form of conceptualising his repetitive practice, if the São Paulo concretists saw the poem itself as a repository of possibilities regulated by the observer’s mental feedback and if Palatnik saw feedback as a conceptual tool for controlling our chaotic perception, Schöffer created an object in which feedback was not within the mental capacity of the artist but rather in the object itself. The electronic brain (as computers used to be called) developed by Phillips gave CYSP 1 a self-regulatory system, which reacts to exterior stimuli, in a kind of homeostatic system that tends to equilibrium, similarly to the cybernetic system described earlier. This work was, finally, an incorporation of a real, independent, cybernetic system. This was clearly a major step in the conceptual development of feedback as a resource for artists. Instead of being an intangible virtue, feedback becomes embodied in the artwork. We should note, however, that this important step was not secluded and was pretty much in tune with its French context. Although cybernetics and its involvement with the arts would develop in Europe mainly via a British influence from the 1960s onwards, with names such as Roy Ascott and Mark Hamilton, it was in France that cybernetics was first discussed in an artistic environment. It was not only de Latil and other popular writers who professed cybernetics.
as a French historical institution. Wiener’s own *Cybernetics*, for example, despite being the product of an MIT staff member and a work primarily bounded by Weiner’s institutional contractual obligations, was published some months earlier in France rather than in America. If there was an intense public debate in France, similar to the Soviet experience post-Stalin, it was because the general public was incredibly drawn to cybernetics ideas. As early as 1948, for example, only some months after the publication of Wiener’s book, there was a full-page article in *Le Monde* dedicated to the ‘new science’ with the subtitle ‘Towards a Governing Machine’. In this article, ‘the author, Dominique Dubarle, [similarly to de Latil] sticks close to the myth of the robot, predicting that man would be replaced by machine even for the functions which require man’s intelligence. Far from the technical questions linked to servomechanism, this perspective was clearly driven by a kind of technological optimism’ (Mindell *et al.*, 2003, p. 75).

Very much in tune with the article published in Brazil some ten years later, both de Latil and Dubarle professed a very particular kind of cybernetics, one much closer to the conception we have today than to its original intent. Even though Wiener himself would over time align his work with this very particular reading (and then turn against it), we cannot ignore his original programmatic emphasis: the reformulation of scientific institutions and methods. For the French press and public, still living under rationing and in a devastated country, the call for an optimistic technological future had a much wider appeal than simply a reformist impulse directed at the sciences. Their relationship with technology, which cybernetics in many ways represented, was tied up with the French national project following the devastation of the Second World War. Culminating with Brasilia, this same relationship can be seen in the Brazilian developmental and nationalist fervour of the same period. Likewise, the project of a true Soviet scientific enterprise, very dear to Stalin, followed the same pragmatic line of developing a modernising national narrative via a myth of supposedly historical and technological superiority. The
term that would later describes this post-war game, the arms race, only epitomised the competitive character of this sort of social process that invariably ties technological development to the modern nation state. Varying in degree but not in kind, this process could be seen in most industrialised countries at the time and persists today. Perhaps inaugurated in Victorian times by the Great Exhibition of 1851, these readings of science and consequentially cybernetics are products of Enlightenment ideals anchored in the belief in rationality and reason. The automata or robot, the most shocking result of the analogy between human and machine, would in the most optimistic narrative replace and surpass humans in the workplace and therefore free us from the mundane and miserable ordeals of our daily lives. The pessimistic narrative, by far the most popular one, is usually presented in literature and pop culture as the scientific products of humans turning against their creators: in these, Frankensteinian monsters and Terminators abound.

Despite the pervasiveness of the rational formalist discourse, the adoption and framing of it by different individuals in many different local contexts is far from homogeneous. Nevertheless, its wide adoption, for better or worse, shows the extent of a predisposition to adopt a rather alien and technical concept into varying artistic practices. In West Germany, for example, prior to Bense’s information aesthetics efforts, cybernetics can be traced to as early as 1949 (Aumann, 2011, p. 17). Even the popular press took notice: ‘The German news magazine Der Spiegel first reported on cybernetics in 1950. It described cybernetics as the science of intelligent robots that could bring about a “second industrial revolution.” The article concluded: “A time could come when those super brains reign.” Cybernetics was the “magic” of this modern computer era and Norbert Wiener its prophet’ (Aumann, 2011, p. 18). Similarly to my previous examples, albeit manifested at an earlier date, the development of cybernetics in West Germany on the one hand resembles the Brazilian and French appropriation in that popular conceptions emphasised the human–machine metaphors as the ones professed by Der
On the other hand, West German scientists resembled their Soviet and American counterparts, who saw cybernetics as ‘clouded’ by unscientific or unspecific ideas. As Aumann succinctly points out:

In the US, cybernetics left the field of science soon after its initial phase. Serious scientists no longer called themselves cyberneticists by the mid-1960s because the term had become a mass media phrase that covered all hopes and fears concerning the mechanization of thinking […] Whereas cybernetics became a popular culture term in the US, it was ideologically charged in the socialistic French society of the postwar era and even more in the countries of the Eastern bloc […] One part of the cybernetics ideology was present in all countries: The ‘technocratic dreams’ of the 1960s found their scientific counterpart in cybernetics. The desire to rationalize, mechanize, and plan all social systems dominated debates all over the world. Representing this style of thinking, cybernetics was used as a weapon against irrational ideologies. It became the ideology of anti-ideologism, the science to interpret the modern mechanized world and guide people through it.94 (Aumann, 2011, p. 23)

The sort of cross-cultural analysis seen so far illuminates particular national readings, very different in emphasis and nuance. From this point of view, cybernetics, particularly in its earlier forms, was indeed a nationally and culturally linked social phenomenon and not some sort of unified and international grouping, as it is usually perceived to be today. Similarly, cybernetics in artistic contexts cannot be taken for granted as a unifying narrative for so many different practices. Despite the pervasiveness of rational formalism and its optimistic attitude towards the technosciences, as exemplified by cybernetics and the various intellectual fields described above, the different appropriations acquire different forms and shapes according to each distinct national, artistic or intellectual context. We need to remind ourselves that, despite not mentioning computer art directly, those are the events that circumscribed it. Similarly to

94 This inherited problem with cybernetics in the US can then explain Jack Burnham’s assertion that ‘early inquiries into the aesthetic implications of cybernetics took place primarily in Europe, whereas the United States lagged behind by five or ten years’ (in Shanken, 2001, p. 20).
the diverse ways in which cybernetics was adopted, early computer artists were also unlike each other.

2.4 1965: Year one

If we had to determinate a year for the emergence of computer art, that year would be 1965. Despite such art being produced some time before then, with both digital and analogue computers, 1965 can be seen as the year when computer art made its public entrance within established artistic contexts via its first public exhibitions. This story is not new and many historians and artists have already described in detail this sequence of events. In order to comprehend the circumstances of its emergence, instead of simply restating these histories, I will concentrate my efforts on contextualisation. So far in this chapter I have mostly concentrated on the political and intellectual circumstances responsible for allowing computer art to be in the first place. Firstly, without the consequences of the Cold War for industry and national politics everywhere, especially under the auspices of the US, the institutions that were responsible for early computer would not have come to fruition or would not necessarily have allowed computer art to come to be in the exact way it did. Had the computing industry not developed hand in hand with the American military, for example, there would not have existed the push towards digital computers, which, as we have already seen, initially were not necessarily more productive and reliable than analogue ones. Secondly, we also need to remind ourselves that the very push towards digital computers was done under the assumption that it could help control the Cold War itself. Importantly, I am not talking about the control of military matters only. Rational formalism, a general intellectual and cultural disposition anchored in the belief in a particular instrumental rationality, provided both the rationale and the framework for a whole new set of academic disciplines and artistic
practices based on very broad assumptions: formalist, axiomatic and rational. Although this was not a consensual shift, the rational formalists were positioned very close to the centre of power, on the central stage of the Cold War: these were the intellectuals who provided the narrative, the methods of containment and the policies conceptualised in the light of international conflict.

Now, while the circumstances described above may account for the development of computer art and later AST, these are not the only factors at play. Exogenous factors as they are – that is to say, exterior to the art world in question95 – they may have prepared the ground and allowed for a certain configuration between actors, institutions and technology, but we cannot assign computer art’s existence to those external factors only. Had the art world at the time been a strictly technophobic one, for example, computer art would not have had a chance to develop. That is not deterministic in the sense that this does not imply that no one would have created computer art. That is certainly not what I mean. The point here is that, given the available technology, there was probably someone who would have attempted computer art anyway, whether the art world was technophobic or not. The difference is that, from the point of view of a technophobic art world, no one would have cared about that art done with computers. All in all, what can be observed in the history of computer art is that, although not widely celebrated and in fact very much questioned, it was indeed possible to conceptualise and produce an art form with computers. In the end, and despite huge resistance, people commented on it and there were exhibitions, university departments, academics, publications and artists dedicated to it. What I want to stress is that there was indeed a positive attitude towards science and technology. It can undoubtedly be said, then, that part of the art world at the time was indeed technophilic. The rest of this chapter is dedicated to these technophilic tendencies and to computer art’s symbiotic relationship to them.

95 For more information on this topic refer to Chapter 1 (‘Method, Scope and Rationale’).
Three exhibitions were produced over the course of 1965. Despite some differences, they had much in common. Surrounding these exhibitions was a sense of both bafflement and excitement, not all positive, regarding the purpose of arguably conservative plotted drawings. In order to understand the initial settings of these new cultural products, we should therefore proceed by looking at each individual exhibition. I intend to demonstrate the effects of both exogenous (Cold War and rational formalism) and endogenous (artistic technophilia) factors in relation to the art world in general. These factors together account for the emergence of computer art and were responsible for shaping both the content and discourse of these new artistic endeavours as much as its reception by both internal audiences and the general public. It is impossible, however, to talk about these first exhibitions and not to talk about the institutional and intellectual context of their main characters: Max Bense, Frieder Nake, Georg Nees, A. Michael Noll and their parent institutions. To ignore these propositions is analogous to ignoring the history of not only the exhibitions themselves but also the history of the ideas behind them. Turning a blind eye to the context of computer art’s birth, and focusing solely on the works and possibilities of the genre, would be the same as accepting a fully formalist narrative that, invariably, rejects any notion of temporality and influence of external factors such as political and material contexts. This section investigates the three first exhibitions of computer art. We will track their appearance chronologically, and, hence, we should first look at Georg Nees’ *Generative Computergrafik*.

Opening on 5 February and running to the 19th day of that same month, this first exhibition was held at a gallery in the Technical College of Stuttgart, later renamed the University of Stuttgart. Under the guidance and curatorship of renowned philosopher Max Bense, this exhibition only featured works produced by the mathematician Georg Nees. The title today associated with this first exhibition, *Generative Computergrafik*, however, was not used at the time. This would be adopted by Nees himself some years later and refers to his 1968 PhD thesis, written under the tutelage of Bense and perhaps
the first thesis dedicated solely to the theme of computers and the arts. Produced at Siemens, where Nees worked, these may be considered to be the first public events presenting visual algorithmic output – that is, abstract drawings plotted on paper. The gallery itself (Studiengalerie der TH Stuttgart) was part of Bense’s philosophy department and was founded by him in 1959. In regard to the works shown at the gallery, neither the artist himself nor historians are completely certain of which ones were shown. The only clue we have to this are the illustrations contained in rot19 (Fig. 8), a booklet series published by Bense’s department that in this specific edition contained a small passage written by Nees discussing some of his works. Moreover, the same publication also contained Bense’s introduction to generative aesthetics, a text closely related to his larger, analytical information aesthetics theory. This first show was part of a colloquium, also organised by Bense, where he aimed to demonstrate the uses and practicalities of his rational method for both producing and analysing art (information aesthetics).

96 These events have been retold time and time again in the literature. We will not gain any new insight by rephrasing them yet again. For a personal history, which provides the viewpoint of an eye witness, refer primarily to Nake (2008, 2009, 2010, 2013). For a description more concerned with the contextualisation of these first German exhibitions, see Klütsch (2007a, 2007b, 2012). For one of the first histories written on computer art, including the Stuttgart scene, see Franke (1985). In addition to these, I have added insights from personal emails and conversations between Nake and myself (Nunez, 2015) and an interview by Nees (2014).

97 Nees (2014) tells us that both rot19 and the exhibition itself were a surprise to him. After a failed attempt to enroll for a PhD under Helmar Frank in Berlin, Nees was recommended to Bense. Nees then sent Bense the pictures that he was working on and a small text describing his method: these were the materials that made up both the exhibition and rot19. Despite our not knowing exactly which works were shown, rot19 is a valuable source of information.

98 Information aesthetics was ‘based on mathematician David Birkhoff’s attempts in the 1930s to define a numerically specified aesthetic measure as order in complexity’ (Oberquelle and Beckmann, 2008, p. 21). Simplistically we could say that, if information aesthetics was concerned primarily with mathematically
‘generative aesthetic’ (Bense and Nees, 1965; Bense, 1971), nonetheless, was not produced without external references. Drawing heavily from information theory (Claude Shannon), cybernetics (Norbert Wiener), generative grammar (Noam Chomsky) and semiotics (Charles Sanders Peirce), Bense’s attempt was to rid art and aesthetics of all subjectivity and move towards a mathematical and analytical description of ‘aesthetical states’.

Even though Bense himself was a rather well-known and respected individual in the German art scene of the time, the show’s public reception was rather lukewarm if not outright hostile. This reaction was not necessarily directed at the artworks themselves but rather at their creative method. Nees had programmed a computer to draw and did not know, as might be expected, the results of his algorithms before committing his punch cards to the machine. What his work showed was, in fact, a visual representation of pre-detailed arguments written in a specific computational language (ALGOL). Even though the actual work arguably required creativity, logical/mathematical for that matter, the product of this programming, its visual outcome, was lambasted as soon as it was considered art. If we cannot say that the critics aimed at the artworks themselves, neither can we say that their anger was related to the pretensions of Bense’s tentatively rational method for considering art practice and critique. By 1965 Bense was very well known for his positions and many at Stuttgart (and indeed beyond) knew of his theoretical work. He had been active for at least twenty years prior to this event. His position at Stuttgart was achieved when he was already an important character in post-war art, present mainly within the circles that had concretist concerns at their core. Indeed he was a leading figure measuring art, Bense’s program for generative aesthetics, published in the small booklet rot19 (Bense and Nees, 1965), which accompanied this first exhibition, was interested in the creation of artworks informed by information aesthetics.

99 For a complete discussion of Bense’s philosophical postulates, refer to Klütsch (2007a).
in the constructivist-oriented art and poetry movement, which reverberated well beyond West Germany’s borders, into Brazil, France, Japan etc.\textsuperscript{100} Bense’s connection with concretism and its rational/mathematical theorems can also be attested by his institutional links. As early as 1954, for example, invited by the Bauhaus alumnus Max Bill, Bense held a teaching position within the prestigious Ulm School of Design, itself an institution that favoured a rational approach and the use of semiotics. It suffices to say that Ulm, founded by Bill, saw art in the same utilitarian, rational and holistic manner that made the whole Bauhausian method legendary. Moreover, as Bense himself studied at Dessau Bauhaus, it is fair to say that, despite being a physical scientist by training (he had previously studied geology, mathematics, philosophy and physics at Bonn University), he was greatly influenced by a collection of old traditions: from the enlightened belief in rationality to the romantic the idea of Gesamtkunstwerk; from the abstractions of Kandinsky to Bill’s form-and-function designs; from Wiener’s cybernetics to Peirce’s semiotics; from art to industry and science (Walther, 2000). His output and influences are so vast that a separate thesis would be necessary to cover them\textsuperscript{101}.

Artist and mathematician Frieder Nake, in one of his many descriptions of this same event, might provide us with a clue to the rationale behind that terrible reaction by Bense’s own peers. In the context of a now famous verbal exchange between Nees and a member of the audience, Nake recalls the debate:

\begin{quote}

\textsuperscript{100} Both Max Bill and Bense, for example, were very close to the Brazilian concrete artists. Bill not only was awarded the first São Paulo Biennale award (in 1951) but is also considered a huge influence on local artists such as Waldemar Cordeiro (Amaral, 2006b, p. 216) and Almir Mavignier (Galanternick, 2010), his professor in Ulm. Bense, meanwhile, had a close relationship with the paulistas and even wrote a book commenting on his Brazilian travels (Bense, 2009).

\textsuperscript{101} Döhl et al. (no date) have compiled a huge, freely available resource of Bense’s output. For a more focused study on Bense’s generative aesthetics, see Klütsch (2007a).
\end{quote}
Tell me, Mr Nees, can you make your machine draw like an artist’s flow? Nees ponders for a moment. He is a calm, patient, friendly mathematician of about thirty-five years of age. Then he says, ‘Yes, I can. If you can tell me precisely how to define your way of drawing’. That is too much for the professors from the Academy of Fine Art. They leave, some slamming doors: ‘Who does he think we are?’ Bense tries to calm the tempers: ‘Please, dear friends, what you see here is only artificial art’ […] The opening would have gone as smoothly and amicably as any previous opening had it not been for a single but most sensitive detail of the situation – the questioning of one aspect of the artist’s existence […] the artist intuition and creativity. (Nake, 2009, p. 77)

As a matter of fact, it was not the artworks, themselves quite traditional, nor the theoretical pretension of Bense’s work, a rational method for evaluating and practising art, that cause the furore. Contentiousness is found, therefore, in the very fact that the machine had produced those pictures, even though the programmer (Nees) had specified the parameters responsible for them. For Nake, himself a mathematician with artistic inclinations, it was the attack on a cherished characteristic of the art world that caused the uproar. Had the machine been hidden from the equation, the event would have unfolded differently. ‘Artificial art’, the term chosen by Bense in order to calm the nerves of the audience, was not only redundant since all art is artificial by nature but also representative of a deep apprehension and, in some ways, coherent with Bense’s expectations. As historian Christoph Klütsch summarises, artificial art

on first glance looks like an excuse, but referred implicitly to artificial intelligence. This comparison, in combination with his manifesto on ‘generative aesthetics’ and Bense’s reference to the implications of Chomsky’s concepts, superseded the aesthetic theories of his time […] Just as Chomsky was looking for the laws of natural language, Bense was looking for the laws of aesthetics. (Klütsch, 2007b, p. 421)

The title for rot19’s article, the ‘Project of Generative Aesthetics’ (Projekte Generativer Ästhetik), presented as a kind of manifesto for computer art, seemed to present a similar strategy, where the term ‘art’ is capriciously excluded. At the same time that it extrapolated Bense’s theory into the realm of a rational pursuit, conceptualised as a scientific analysis of human perception (since the very term ‘art’ is excluded from its
title), it seemed also to appease concerned artists (a view not necessarily shared by Klütsch but held by Nake). As Bense detaches the ‘aesthetic state’ of an artistic object from its very definition of art, he reveals his theory and program under a veil of scientificity and, under this same logic, manifests his predisposition against ‘art historian chatter’ (Klütsch, 2012, p. 67). In Bense’s own words:

Today we have not only mathematical logic and a mathematical linguistics, but also a gradually evolving mathematical aesthetics. It distinguishes between the ‘material carrier’ of a work of art and the ‘aesthetic state’ achieved by means of the carrier. The process is devoid of subjective interpretation and deals objectively with specific elements of the ‘aesthetic state’ or as one might say the specific elements of the ‘aesthetic reality’. These elements are pre-established and their appearance, distribution and formation is described in mathematical terms. Thus this new aesthetics is simultaneously empirical and numerically orientated. (Bense, 1971, p. 57)

For whatever reason, it seems that it was not only Bense who was interested in keeping art out of the discussion. For Nees at least, the term ‘art’ had to give away to ‘aesthetics’, although in his case the reason was a somewhat institutional problem, a different kind of external, institutional pressure that Bense never faced. We need to remind ourselves that the expensive machines producing these artworks were not intended to produce art. While Bense’s preoccupation with the term ‘art’ had a theoretical and, perhaps, political underpinning, for Nees it was a rather straightforward problem: his employees did not want to be involved with art since, for them, computers and engineering were their occupation. Unfortunately, we do not have any direct reference to pinpoint his hesitation. We can, however, reach this conclusion by conjecturing over some very important facts that are deceptively unrelated. Firstly, there is Nake’s own account, where he clearly repeats this argument, by stating that Siemens ‘did not want to be connected with the term [art] when the subject matter, from their point of view, was computers’ (Nake, 2008, p. 3). A personal friend of Nees, Nake reinforces my hypothesis by stating in another article (and also over personal emails) the idea that previous articles published by Nees in Bense’s journal Grundlagenstudien aus Kybernetik und
Geisteswissenschaft were ‘in terse, technical language, describing only the programming. Anything that could come close to the idea of art [was] carefully avoided’ (Nake, 2009, p. 80). Another occurrence also supports this view. A. Michael Noll, another pioneer among computer artists (our next topic), also faced similar constraints at the hands of his employer, this time AT&T. Similarly to Siemens, although for different reasons, AT&T did not wish to be related to artistic practice and, hence, both Noll and Nees produced artworks in their spare time. Since AT&T’s Bell Laboratory, Noll and their subsequent role in the second exhibition are part of our next topic, this will have to wait. For now it suffices to say that they also disliked the idea of being related to artistic practices by way of computers. While we cannot be sure why Siemens disliked Nees’ activities, AT&T’s rationale was straightforward: it was a publicly funded monopoly that had a very clear mandate and consequently it was also constantly afraid of losing its privileges via public inquiries and scrutiny. It is a pity that much of Siemens’ corporate history covering this period has not been researched as deeply as AT&T’s (at least in English, that is). Yet another piece of evidence for Nees’ reluctance may be found in the very content of his doctoral thesis, written under Bense’s guidance. Published some years later, in 1969, by the publishing arm of Siemens (Nake, 1998, p. 163), the thesis can be considered ‘as a practical proof of Bense’s aesthetic’ (Klütsch, 2007b, p. 423) and a technical piece that explored logarithms and their visual representations. Beware that, when I say it is technical, I am saying that it is primarily concerned with the technical aspects of computer-aided visual production, similarly to Nees’ earlier texts for Bense’s Grundlagenstudien aus Kybernetik und Geisteswissenschaft, and is hence a text concerned with the technicalities of production, from the coding itself to the plotter used. By using pseudo-random number generators to achieve the variability of the graphical outputs shown at the exhibition, Nees tried to put into practice Bense’s theorems of macro- and micro-aesthetics. In Bense’s words:
The metrical method of describing an aesthetic state uses numerical data in the same way as older schematics, i.e. theories of proportion in art. This method will establish the macro-aesthetic constitution of an art object, in other words, the composition dealing with form, figure and structure. The statistical method is involved with the concept of frequency or probability of appearance of elements. Also with numerically assessed characteristics of elements in their relationship and organization. Thus we arrive at the micro-aesthetic constitution of a work of art which can be used to arrive at, not the ‘principle of formation’, but the ‘principle of distribution’. (Bense, 1971, p. 57)

The reader may question the importance of this institutional link, between Nees and Siemens, as mere coincidence and may argue that the reason both Nees and Bense abandoned the term ‘art’ shows more a theoretical preoccupation than some obscure outside pressure. To that, however, can be replied that even though the institutional pressure was not explicitly shown it would, nevertheless, have had an important impact on how this early production would be read. The main point here is to ask: Why, if both Bense and Nees were not interested in art, would they show those computational compositions in an artistic environment? Why, given Bense’s relationship with the worldwide concrete art scene, would he abandon decades of his own artistic theories? Why would these artists frame those compositions, hang them up on walls and invite people – art people – to an opening if they were not interested in art? Again we should remind ourselves that these were images produced in an environment not interested in the frugalities of art and that this same company and not some art publisher published Nees’ thesis. Personally he was, from an early age, interested in art and considered himself an art enthusiast (Nake, 2009, p. 79). How could Nees justify the use of an expensive machine if not by using the ‘this is proper science, and hence good’ argument? Also noteworthy is the fact that it was only in 1987 that Siemens would gain an official artist-in-residence programme102. Ironically, only five years after his first show, Nees would

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102 Related to the changing nature of companies such as Siemens, and mirroring the fate of many artist-in-residence programs developed in the 1970s, Siemens’ program’s social value changed according to the tastes or trends of the time. The link to its arts programme (http://www.siemensartsprogram.com) has
participate in the first computer art section at the 1970 Venice Biennale (Franco, 2013b). Klütsch asserts that the abandonment of the term ‘art’ was a purely conceptual exercise, but I think material, contextual and testimonial evidence seems to contradict this. Both Bense and Nees were producing, thinking and proposing a new art; a different one but nevertheless art.

The theoretical aim to distance themselves from the arts as defined by Bense – subjective and historical – was further eroded as the years passed by. The Venice exhibition mentioned above was one of the many produced in the following years. Other individuals eventually joined the circle of computer-oriented art and, for this first wave at least, two things kept this embryonic group together. Firstly, none of them were artists. Again institutional and material constraints played a huge part in shaping the early computer art world. Computers were complex, expensive and industrial machines very distant from the personal computers of today. Siemens was one of a handful of companies that had both the material resources necessary to own a computer and also the immaterial resources of individual knowledge that could operate the machine in a way apart from the obvious, for that required very specialised knowledge from its employees. For most of the industry, computers were giant calculators, used for very specific tasks and not thought to vanished from the web. We can still find evidence of its existence in two documents, one on its Ukrainian website and the other on its archive website (Siemens, no date; Siemens Archive, 2008). This program and others now seem to have been substituted by a new foundation, established in 2008, the Siemens Stiftung, which focuses on ‘fields of basic services, education, and culture’ with the ‘aim to help people improve their living conditions’ (Siemens Stiftung, 2015). The history of artist-in-residence programs within industries is still in its infancy. For various perspectives on their qualities and problems, whether historical, practical or theoretical, see Shanken (2005) for a general overview; for a study of E.A.T.’s activities, refer to Goodyear (2004); for insights into AT&T’s Bell Labs, see Kane (2010); for artists within PBS, see Lovejoy (2004, pp. 115–116); for more on E.A.T. in the context of the Pepsi pavilion in the International Exhibition of Japan, see Turner (2014).
produce art, for example. It is incredible that these engineers and mathematicians took an interest in art in the first place and roughly at the same time (technophilia was indeed very pervasive). More surprisingly, though, is that they actually managed to get away with it. I have not managed to find a single individual who was more severely reprimanded by their parent institution. There was institutional discouragement, from both AT&T and Siemens, for example, but it seems the tactic to associate the artistic output with some kind of scientific research, consciously or otherwise, worked quite well not only for Nees but also for Noll. More importantly perhaps, both also managed to enter a notoriously closed field. In the past hundred years, how many times have mathematicians and engineers been talked of as art pioneers? By claiming scientific concerns, these two individuals got away with it. They were, after all, claiming to resort to that all-powerful authority, the scientific one. Had they engaged in more romantic things such as ‘feelings’, the result of these works could have been their total dismissal. It is right to point out that, in certain institutions, given their internal culture, the mingling of art, science and technology was easier.

Nees’ and Noll’s discourse of promoting science, then, was applied in a twofold manner. Firstly it allowed these new artists to continue their production within highly structured and goal-oriented institutions. That both Noll and Nees produced highly technical texts discussing their artworks should not be seen with surprise; it was with those texts, framing their production as legitimate science, that they managed to continue their experiments. Secondly, and perhaps more importantly, it was with the same scientific discourse that they managed to get within the art world. Here is where the intellectual context, a rational formalist one, is so important. The authority of their artwork cannot be found in the artworks themselves. Rather it was the discourse, a rational formalistic one, that provided both with the opportunity to break into both worlds, industrial and artistic. By resorting to the authority of science, they managed to convince both fields of the importance of their work. In other words, they become
legitimate in the eyes of their contemporaries. It is important to note that I am not proposing they were misleading their partners in art and industry. The opposite is true: they were true believers that computers could and would achieve proper (whatever that might mean) art-making capability. The name generative aesthetics, and not generative art, therefore, is indicative of a defined strategy. Nees, being a career engineer at the time, seems to have been reluctant to be remembered as an artist rather than a proper engineer, a fact that would in various ways affect his work at Siemens. At the same time, however, it could also provide him with a legitimate argument for both his experiments and his positioning within art. Bense, on the other hand, knew very well the implication of his theory. By excluding ‘art’ from the exhibition, he would rid the show of any vestige of subjectivity and at the same time reach a compromise with his artistic peers. Information aesthetics, after all, was not aimed at a subjective practice – that is, traditional art. Rather the opposite. Bense’s proposed aesthetic was an empirical science that could be numerically represented to behave in a similar fashion to the natural sciences, and his protégé, Nees, was only showing the practical output of that method: artificial art. Despite the fact that Bense’s circle was one of constructivist-concerned artists – belonging to the long line of Bauhausian thought (after the war centred in Ulm) that advocated both explicitly and implicitly for a rational method in the arts – his ideas might have seemed quite extremist to artists of his circle. Even though Bense did not have the same institutional constraints as Nees did (the academic setting was not per se critical of his positions), he also chose to soften the polemic in this exhibition. Despite these precautions, the reaction could not have been worse.

103 Apart from the conflict in that first exhibition, Klütsch reminds us that ‘Art critics in the Stuttgart newspapers were furious, and an article in Der Spiegel (Germany’s most prominent weekly magazine at the time) published a one-page article about Bense’s aesthetic’ (Klütsch, 2007b, p. 422).
Meanwhile on the other side of the Atlantic, in New York, nearly simultaneously to the first exhibition, two engineers were presenting computer-plotted pictures in an artistic environment. Béla Julesz and A. Michael Noll’s exhibition *Computer-Generated Pictures* (Noll, 1994, p. 41) ran from 6 to 24 April at the Howard Wise Gallery. As expected, since in 1965 computers were extremely expensive and specialised machines, these two engineers, similarly to Nees, worked for a massive corporation, namely Bell Laboratories, part of AT&T, by then the biggest corporation in the world and owner of a monopoly in telephone infrastructure that would only be dismantled some twenty years later (Temin, 1989, p. 16 table 3). Despite this apparent similarity, their introduction to an artistic context could not have been more heterodox. Whereas Nees had effectively gone after Bense in order to exhibit, Julesz and Noll were invited to their show by almost pure chance. Accordingly, the rationales for the shows were completely different in emphasis and intentions. Not only were there differences between the German and the North American groups but there were also some differences between the two members of this exhibition. Between these two scientists, only Noll felt comfortable calling his creations art. Julesz, despite also producing visuals with computational apparatus, saw his works as part of an ongoing and rather successful series of experiments that focused on human cognition and, therefore, were not produced with any aesthetic interest (Noll, 1994, p. 40). Ironically, it was Howard Wise who first approached Julesz, after seeing his work on the cover of *Scientific American* magazine (Noll, 2014a) (Fig. 9). This conflict resulted in a compromise and the title for the exhibition did not, therefore, contain the term ‘art’.

Another reason for keeping the term ‘art’ at bay, similarly to the first German exhibition, was institutional interference. AT&T, in a similar fashion to Siemens, wanted to keep its distance from any unwanted publicity. That is not surprising. Given the fact that it was in effect a private company that had a state-backed monopoly, AT&T’s PR and legal department tried to discourage the exhibition in order to avoid any commentary regarding Bell Labs’ activities as non-scientific (Kane, 2010). ‘Hence an effort was made
by AT&T to halt the exhibit, but it was too late, since financial commitments had already been made by Wise’ (Noll, 1994, p. 41). After the failed attempt to halt the show, in another move to distance itself, AT&T granted permission for Noll and Julesz to copyright in their own names the pictures produced at their labs. Julesz might not have been interested in seeing his work as art but for Noll that was the intention all along. Differently from Julesz’s, Noll’s research was focused on sound rather than images. He was given an internship in the research department in 1962 and was responsible for the ‘exploration of a new method for determining the fundamental frequency of speech’ (Noll, 1994, p. 39). In order to achieve his goals, he was given a new microfilm plotter. The plotter would be used to print the various graphs of speech data and one day, by mistake, a data plot was wrongly inputted into the computer. The product of this error resulted in a plot that Noll and a colleague jokingly described as ‘abstract computer art’. After that first error Noll would actively write code that would create these new abstract compositions, and so he continued, informally and ‘for fun’ (Noll, 1994).

The venue of Noll and Julesz’s exhibition, the Howard Wise Gallery, is also markedly different from Stuttgart University. If the German venue indicated a concrete, rationalistic and academically oriented show, with Bense’s influence at the helm, the American one lacked the conceptual rigour of the German show and also had a more commercial, free experimental intention. Howard Wise was, first and foremost, an art dealer. Springing from a rather wealthy family, he is remembered as a patron of ‘technological art’ (Glueck, 1989). Although not financially successful (Gaines, 2006), he was indeed an important patron of video and kinetic art. In a 1984 article in the journal Afterimage, part of a series dedicated to discussing the main benefactors of video art, Wise is the sole subject (Sturken, 1984). His On the Move, produced in 1964, was an exhibition intended to present to an American audience artists such as Agam, Calder, Le Parc, George Rickey, Takis, and Tinguely (Sturken, 1984). The Lights in Orbit exhibition, this time in 1967, presented ‘Jones, Le Parc, Mack, Piene, Takis, Uecker,
USCG, and Wilfred, as well as several artists who soon after began experimentations with television: Jackie Cassen, Rudi Stern, Earl Reiback, Thomas Tadlock, and Nam June Paik, who had been working with television since 1963’ (Sturken, 1984, p. 6).

Wise’s interest was focused on technology rather than anything else. His ‘genuine interest in new technologies soon led him to electronics’ (Sturken, 1984). Epistemologically, Wise and Bense are a world apart. Nevertheless both discourses, of rationality and technological experimentalism, have persisted in the vocabulary of computer art (and AST more broadly) to this day – a subject that will be discussed further later on. For now suffice to say that the combination of economic might, exemplified by both Siemens and AT&T, and the respective national contexts of post-war developmentalism resulted in artworks that, although sharing a certain aesthetic limited by its very primitive medium, emerged from completely different discourses. In other words, the lowest common denominator between these early cultural products was the material context and not, as usually portrayed, the art historical one. Whereas Nees actually pursued that new technology for art practice, appropriating Bense’s discourse originally intended for concretism, Noll stumbled on it by accident, for ‘fun’, and would only discuss art itself some years later in a series of technical memorandums produced within Bell Labs\textsuperscript{104} and sporadic articles in specialist journals.

Despite the fact that Noll, differently from Nees, did not conceptualise his works within a certain artistic tradition, he still thought about his art process, albeit at a later date than that of the Howard Wise Gallery show. In general, his arguments for digital computer art (so called at the time in order to differentiate it from analogue computers) can be divided into two, interrelated ones: experimentation and process. The first argument, the ‘experimentalist’ one, similarly to the arguments of many AST

\textsuperscript{104} His own personal website contains a vast and rich source of original memorandums, patents and articles (Noll, 2015).
practitioners, aims to justify computer artworks as attempts to ‘explore the possibilities of the computer as an artistic medium’ (Noll, 1967, p. 89)\textsuperscript{105}. For Noll the computer can and should be more than a utilitarian apparatus, and it is up to artists to engage with the new technology in order to decipher its possibilities\textsuperscript{106}. The second argument explored by Noll is seen in the article ‘The Digital Computer as a Creative Medium’ (1967), where he discusses not only the possibilities of this new practice but also his rationale for it. In this paper Noll, in order to justify the use of the computer (and his ‘experiment’ with it), tells a little anecdote, attributed to Henri Matisse. In it he describes Matisse’s process as taking a

blank white canvas, the French artist said, and after gazing at it for a while, you paint on it a bright red disk. Thereafter, you do nothing further until something occurs to you that will be just exiting as the original red disk. You proceed in this way, always sustaining, through each new gambit with the paint and brush, the initial visual excitement of the red disk […] even if we take it lightly, it can do a number of things for us. For one thing, it dispels some of the sense of mystery that hovers over the procedures of the creative person. It tells us something concrete and easily visualized about the creative process while emphasizing the role of the unexpected ideas […] Most of all, the Matisse anecdote suggest that the artistic process involves some form of ‘program’. (Noll, 1967, p. 90)

We cannot be certain whether the German group had any influence on Noll’s assertion that the artist, in the end, is acting according to an internal set of rules, a program. This text, written in 1967, after both Nees and Noll had met in some previous exhibitions, perhaps represents this German influence; perhaps it represents an increasing awareness

\textsuperscript{105} This emphasis on experimentalism can be seen in the narratives of Shanken (2001), Paul (2003), Taylor (2004) and Salah (2008), to name a few.

\textsuperscript{106} Again a matter of ‘exploration’; Taylor (2004, p. 151) would name this characteristic the frontier myth of computer art. Unsurprisingly, Noll had a very active pedagogic intention, and not only in computer art. The bibliography on his website (full of articles beginning with ‘The Introduction of…’) as well as his emphasis on exploration and experimentation seem to corroborate the myth (Noll, 2015).
of artistic discussions of the day. Although Noll does not frame his works under Bense’s theory, he shares an assumption mostly specific to German computer art – that the artist works in a process-oriented manner. We have reason to believe that, despite the artists being aware of each other in 1967, Noll’s metaphor of the artistic method as a computer program predates their meeting. On 14 April 1965, while his exhibition at the Howard Wise Gallery was still going on, Noll published an internal memorandum that would become something of a statement of the confidence professed by the initial generation of computational artists. Later published in 1966 in the journal *The Psychological Record*, the article, titled ‘Human or Machine: A Subjective Comparison of Piet Mondrian’s “Composition with Lines” (1917) and a Computer-Generated Picture’ (Noll, 1966b), if read by the public present at the first exhibition in Stuttgart, would perhaps have caused a yet more aggressive reaction. In ‘Human or Machine’ Noll describes a simple and small-scale study that pitted Mondrian’s *Composition with Lines* (1917) (Fig. 10) against one of his computer programs to determine the aesthetic preference of his peers at Bell Labs. His method was simple:

Reproductions of both pictures were then presented to 100 subjects whose tasks were to identify the computer picture and to indicate which picture they preferred. Only 28% of the [subjects] were able to correctly identify the computer-generated picture, while 59% of the [subjects] preferred the computer-generated picture. (Noll, 1966b, p. 1)

Noll’s experiment and process, then, are very different from the kind usually seen in artistic discourses. The Mondrian experiment depicts both his ideas (experimentation and process) together. With this paper Noll not only produced an analogy between human and computer, as equal entities, but also put into practice his experiment. If we cannot say that artistic canon or theory unites both artists, Noll and Ness can, nevertheless, be united by their position within a certain material and intellectual culture detached from artistic concerns. Early computer art at least – that produced between 1960 and 1965, before the
first exhibitions – was an art interested in a scientific experiment and not, as one may suppose, an artistic one. Despite sharing the noun ‘experiment’, these early computer artists were mainly interested in developing an aesthetic science. Noll may claim he did it for fun but, as his Mondrian experiment suggests, it was far from disinterested fun. Likewise Ness (who also professed an inherent interest in the arts), via Bense’s adoption of Birkhoff’s scientisation of aesthetics (Klütsch, 2012, pp. 67–68), also partook in this very specific kind of experiment. It is not that they were interested in investigating various new aesthetic states, as we would usually expect today when confronted by the claim of ‘artistic experiment’. They were attempting to formalise aesthetics and, in turn, to transform it in a proper, legitimate science. When looking at this production retrospectively, it is easy to misunderstand this very simple yet central distinction, between the scientific and aesthetic experiments. With computer art and AST practitioners becoming more intertwined with the artistic field and its discourse, this distinction seemed to dissipate in favour of the aesthetic kind. In his rather unscientific Mondrian experiment (since his sample stems from a small and homogeneous crowd), Noll typified the exact reason for the terrible reaction of Bense’s peers at the opening of Nees’ exhibition. In other words, not only could the computer create art but also, in some cases, its output might be preferred to the human one. The question posed to Nees at his opening is, therefore, reincarnated in Noll’s experiment. Recall the conversation between Nees and his public: ‘Tell me, Mr Nees, can you make your machine draw like an artist’s flow? […] “Yes, I can. If you can tell me precisely how to define your way of drawing.”’ Now, how could two people re-enact the same controversy without knowing each other? The answer, I argue again, lies in the material contexts of both individuals. The analogy between computer and human is indeed a very sensitive topic that can disgust people – not only then but also today. Moreover, it may also be seen as one of the reasons behind the terrible reactions of the art world towards computer art. Given the importance of this discussion, regarding the reception of this cultural production within a largely
technophilic field (the art one), we should look at it in more detail later on. At the moment, it is important to stress that, although Nees and Noll started from different ideas on how to practice and conceptualise computer art, they reached very similar positions on it: computer art is conducted experimentally and procedurally. That, by itself, is testimony to the importance of both artists’ material and institutional context, namely, the technoscientific field of a post-war world. This idea of experimentation is perhaps best summarised by Klütsch; he refers to Abraham Moles, who, together with Bense, was a pillar of information aesthetics and, consequentially, generative art:

While traditional artists – according to A. Moles – work under the dictum of trial and error, computer artists follow the principle of experiment. No longer is the artist a person who might only search for a language of expression, trying out different forms of representation, discarding trials and learning from errors. Instead, computer artists set up an experimental situation, scientifically described and repeatable. (Klütsch, 2012, p. 72)

It is important to note, then, that both their concept of experiment and their process are anchored in the concepts’ relationship with mechanistic conceptions of mind (the human and computer analogy). If by experiment they meant the scientific kind, what about process? In other words, what would lead Noll to produce his Mondrian experiment? We can, to begin with, discard the definition of Zlotnikov’s or the paulistas’ process and cybernetics, which in essence were working under a trial-and-error process. Differently from Noll and Nees, they did not wish a scientisation of art, nor did they take cybernetics to its extreme conclusion: that humans and machines were alike. Process, then, for early computer artists at least, should be seen in relation to the simple, repetitive, logarithmic acts that, in essence, were done by the computer. Humans, in this conception, are nothing more than Universal Turing machines and, appropriately, the artist acts according to their own internal program. For them processes are just consequences of a program, prior to the artwork itself, and embedded in both machines and humans alike. As Nake would later describe:
Each painter is a restricted picture generator. So is each picture generating computer program. At all times, artists have applied the same method most computer programs employ: they tried to vary a theme as often as possible in order to attain a ‘best’ (in their judgment) object. This method became particularly important in recent years with Bauhaus, concrete art, New Tendencies etc. (in Klütsch, 2012, p. 74)

The analogy between humans and machines is, again, a recurrent theme in AST (and not computer art only) and will be seen throughout this thesis. These examples nevertheless, for now, show the limits of reading early computer art history from the point of view of current and previous artistic debates. It was the computer and the post-war culture – rational formalistic, attempting an aesthetic science via formalistic methods anchored in human–computer analogies (a product of cybernetics) – that was characteristic of that production. Given that both emerged from the same material culture (and not an artistic one), as we saw, it is unsurprisingly that something else connects the two exhibitions: both were poorly received. Excepting one ambiguous review by the New York Times (Preston, 1965, in Noll, 1994 and Taylor, 2004), Noll’s exhibition did not sell a single work. Noll recalls spirited discussions, with great expectations, with Wise about how to split the revenue from sales (Noll, 1994, p. 41). If we are comfortable in saying that Wise, given his record, was interested not only in computers but also in technological opportunities in general and that, as Sturken (1984) characterised him as being a different kind of dealer – an anomaly in the 1960s American art world, in that financial gain was not the driving force of his career. Computer art historian Grant D. Taylor may offer some insight into this problem:

Previously, computer art had remained within the confines of the technocratic periodical Computers and Automation. Once exhibited at the Howard Wise gallery, however, it was effectively thrust into the centre of the world art scene […] However, this was no ordinary exposition of work created by artists working with new media. Apart from being organized by scientists and sponsored by a telecommunications giant, the exhibition was showing art generated by a machine. Emerging from the technical sphere, computerised art was inevitably
set on a collision course with the art community and its well-established paradigms of art production and meaning. (Taylor, 2004, p. 31)

If on the one hand the German show was poorly received by its audience, the constructivist/concrete-oriented crowd, on the other hand the American experiment failed to provided its mentor, Wise, with what is the most important thing to any commercial gallery: commerce. We know that the argument used to lambast Nees was focused on the pretension of his ‘artificial art’. The idea of a rational, process-centred artistic practice could not be its problem since Bense was already known for exactly that. However, the erroneous idea that the computer could substitute for the artist is what provoked the outraged reaction of the German public. For Computer-Generated Pictures, however, the bar was set not by an academic and rather restricted academic group but by the larger art world itself. The exhibition’s public profile and impact, although negative, can be seen as impressive. Both The New York Herald Tribune and Time magazine held a very critical view of the show, by stating that its artworks did not have any aesthetic appeal and were simply ‘cold and soulless’ (Taylor, 2004, p. 32). I believe these negative reactions are not random unconnected events but in fact reflect something else, deeper than an artistic judgement and more broadly ingrained in the contemporary culture. Nake, my next topic, may clarify this uneasy relationship.

Computergrafik (Fig. 11), the second exhibition of the so-called ‘Stuttgart school’ group, which started around December 1964 with Nees’ first publication in Bense’s Grundlagenstudien aus Kybernetik und Geisteswissenschaft journal (Klütsch, 2012, p. 65), was the last show of digital computer art in 1965. The exhibition opened on 5 November and ran up to the 26th of that same month (Klütsch, 2005), and it would be considered quite similar to the first German one if not for the introduction of one
character pivotal to the field back then and today: Frieder Nake\textsuperscript{107}. Considered the ‘most radical computer graphic artist’ (Klütsch, 2012, p. 74), Nake has been a central figure of the field, not only as an artist but also as one of the most prolific writers of digital computer art. Nake was not a career engineer though, and, despite spending his early years in an internship at IBM, where he first had contact with computers, he is mainly a scholar. Again, not only did he contribute to the field as a practitioner and theoretician but he is also responsible for the preservation of those early years via a series of papers, interviews and websites. Today, differently from Noll and Nees, who eventually moved on in order to dedicate time to their engineering careers, he is still an active voice and has been chief researcher of an ambitious project responsible for preserving the memory of those early days (University of Bremen, 2015).

Although he frequented Bense’s lectures and had a personal involvement with local artists, in a similar fashion to our other two artists, Nake encountered computer arts rather by accident. As one might expect from the first generation of computer artists, he did not formally study art. It was in his early days at Stuttgart Technical University that, according to him, the most important day in his life happened (Nake, 2013, 2h 10min). Recalling the events, Nake remembers when in 1963 one of his professors said to him the university was buying a ‘drawing machine’. This machine, a ZUSE Graphomat Z 64, constructed by computer visionary Konrad Zuse, did not have any software; it was up to Nake to develop it. Following the invitation by his professor, the young Nake found that opportunity incredible exciting and accepted without hesitation. After being put in charge of this task, he proceeded to develop a program to test the machine. Nake’s first preoccupation was to test the motors of the drawing machine; he realised that in order to

\textsuperscript{107} Most references in this subsection are based on personal emails between the author and the artist. Moreover, I also base my text on the long unpublished interview between Nake and Poltronieri (Nake, 2013). These, together with his various texts, provide a clear picture of his intentions at the time.
achieve this task he would need to systematically write a program that would allow the machine to draw in all possible directions. Knowing that this task would be too strenuous, and taking advantage of his research in probability theory, Nake recalled Bense’s lectures and decided then to combine the two: he would create something artistic and test the machine with it.

It was during the first computer art exhibition, held at Bense’s Studiengalerie, that Nake first came in contact with another person producing pictures using the same method as him. As soon as he saw Nees’ prints he realised that his could also be seen as art and that he was not alone. Recalling the unrest of the first exhibition, with the accusations culminating with the ‘artificial art’ argument, Nake recalled his feelings at that moment:

> For me as a young and innocent witness of the scene, all this was exciting and puzzling. How seriously these famous people seemed to be talking something that, to me, was everyday and business as usual […] Sets, bundles and structures of straight lines, determined by calculated randomness and put on paper by a computer controlled drawing device – it existed all up there, at the centre, too. It had been my job as a student assistant to develop from scratch a basic program package to control the same Graphomat drawing machine that Nees had access to […] Now I discovered that elsewhere, others had had similar ideas. But to top this, Nees had dared to exhibit same [pictures]? (Nake, 2002, p. 7)

How, then, did the final show of 1965 happen at all, with both Nake and Nees together, since it was Nees who was Bense’s protégé? The story told by Nake seems to reveal a lot about the so-called ‘Stuttgart school’ and in reality seems to contradict the idea of a close-knit group. Wendelin Niedlich, a cultural reference in Stuttgart (Nake, 2002), was the gallerist and bookseller responsible for exhibiting Nake for the first time. He had a personal and close tie with Nake and it was Nake who approached him first. Niedlich at the time was already an enthusiast of Bense’s work and, according to Nake, his enthusiasm was the reason he set up his store in Stuttgart. Knowing that Nake’s work somehow involved an idea of rationality and that it was close to Bense’s ideas, he accepted Nake’s proposal. Some days after this initial agreement, Niedlich approached
Nake with an idea: What about if Bense himself did the opening? Nake promptly agreed to the suggestion but, in a turn of events, there was a condition for Bense’s participation: Niedlich would also need to show Nees’ pictures alongside Nake’s. For Nake that was rather uncomfortable. This situation can be explained by the fact that the first time Nake realised that what he was doing was similar to Nees’ pictures he approached Bense, and then invited Bense to see his work and process at his studio (Nake, 2013, 1h 35min). This first approach, however, was not accepted, and Bense never turned up. Indeed, Nake recalls this first contact with Nees as a rather ‘sad story’ (Nake, 2013, 1h 35min). The exhibition, however, went as planned and Nake did not raise any objection to both Nees’ and Bense’s presence. After all, Bense was an icon for both him and Niedlich. Bense’s position as a thinker, an ideologue for rationality, reverberated deeply with Nake’s generation. According to Nake, Bense presented an alternative not only to current artistic discourses but also to Germanic culture itself. For Nake and his colleagues, who had very vivid images of the war, Bense’s rationality was an escape from the emotional appeal that the Nazis held over Germany. The rationality behind this is clear: emotions drove the country and its people to the Nazi regime; if the people had been rational, the crimes committed by the Nazis would never have happened. Radical rational ideology, in retrospect, was seen as a reaction to German fascism. Such was the lure of this ideology that Nake and others did not need to deeply understand Bense’s theories (Nake, 2013). The call for a rational art, as simple and incomplete as it sounds, was enough for them. Despite the exhibition going smoothly this time, something in particular bothered Nake. Neither Nees nor Bense were present. Someone else read Bense’s text at the opening. Nake felt insulted by this lack of commitment and came to understand the situation as Bense having a clear preference for Nees over him.

If on the one hand both Nees and Noll had reservations with the term ‘art’, Nake, on the other, has always seemed more at ease with it. Despite his long reclusion from computer art after 1971 (a subject further discussed later on), Nake fully embraced the
field. And by field I mean not only computer art but also art in the broadest term. Perhaps because of institutional constrains, perhaps because of Bense’s ideas, it seems that Nees did not feel comfortable with being an artist as much as Nake did. Testament to Nake’s artistic commitment is his development as an artistic theorist. Whereas Nees, during his involvement with computer art, developed his work and thought under Bense’s rationalistic ideology, which in many ways wanted to detach this computer-oriented work from the larger art world, by proposing a paradigm shift towards the quantification of aesthetics, Nake, in time, sought to reconcile computer art with current artistic production. Nake may have started because of both Nees and Bense but, as we shall see, he did not confine his production to the purely rationalistic discourse. Not only that, in many ways Nake offered a break from Bense’s ideas and, with that, we may say that he was the first computer artist to attempt reconciliation between computer art and the larger art world. In order to understand his idea of computer art, we should look at the development of it. That is because, as noted previously, Nake began by following Bense’s project and, therefore, most of his earlier texts follow that same rationale. As Klütsch reminds us:

As a mathematician, Nake is concerned about definitions. If we had a proper definition of art, we might enable the computer – a mathematical machine – to produce art […] This approach fits Bense’s program of a rational aesthetics to terminate the ‘art historian chatter’. A theory must be scientific, exact, and reproducible to describe aesthetic properties of a class of certain objects in the world. (Klütsch, 2012, p. 74)

It is no coincidence that Nake’s early ideas reflect those of Nees, particularly the notion of a rationalistic procedure resulting in a view of human action as quantifiable. In this way, Nake drew a parallel between human intelligence/creativity and computer technology. Certainly this point is what truly annoyed artists at the first exhibition in the early months of 1965. There is, however, something rather cheeky in both Nees’ and Nake’s affirmation – a point of view that, if not looked into carefully, results in
computers and humans being considered identical (ironically, not the point of view held by Nake). Firstly, how can one describe exactly how a person behaves? If that is possible, then we can definitely mimic that person’s behaviour with a machine. Secondly, to have a machine mimicking a human being does not imply it is intelligent but, instead, implies exactly the opposite: the machine is not intelligent in the sense that it is cognitively aware of the problem and, consequentially, arrives at a result in the same way a human being does. It is merely, again, mimicking the human. Humans were never put aside in Nake’s ideas, neither were they deemed unessential. Nake’s own (emotional) explanations shed light on his view that ‘you can only program what you can describe’:

Machines will never be intelligent; never […] What Nees’ anecdote [in the first exhibition] tells you implicitly is that we can program only what we can say but we cannot program anything else. That what cannot be expressed (the painter’s will, or action) cannot become a program […] What am I saying here? That function of the mind, that we can describe, we can turn into a program. We can do thousands different functions but we will still be different because we are the sum of all these functions. In the computer we find intelligent functions but we never find intelligence […] Intelligence goes beyond functions. The interpretant (man) is continuous. The interpretant is what we do individually and is subjective; there is nothing objective there […] why the hell would people believe or wish to create such a thing [artificial intelligence] when we know it is just a machine. I am not, therefore, a machine! (Nake, 2013, 54min, 1h 10min)

This narrow and erroneous view of human intelligence, as it was understood by the public in the 1960s, can be traced back to the historical context of post-war computer science, in particular the idea of artificial intelligence (Salah, 2008). Salah describes the phenomenon of artificial intelligence as a tendency found in both philosophical and computer science communities against Cartesian dualism. Such was the importance of the theme, to find an appropriate definition for ‘intelligence’, that ‘the first and foremost effort to frame intelligence came from one of the greatest minds of the era’: Turing (Salah, 2008, p. 22). This effort, which consequentially sees parallels between the human mind and computational processes, in turn, leads one to draw uncomfortable conclusions.
humans from them? How could humans, in an age of limitless automatons, even more capable than themselves, protect their perceived and rightful position as the ultimate ‘creation’? The ghost in the shell, destroyed by the ideas of AI ideology, caused a strong reaction not only from the critics of early computer art but also in society in general\textsuperscript{108}. Despite not being at all what Nake had envisioned, the very idea of computers invading one of the last bastions of humanity was enough to provoke such a disgusted reaction.

Way before 1965, the idea of an artificial ‘electric brain’ thrived in both popular and academic culture. Wiener’s \textit{Cybernetics}, for example, both in its original 1948 edition and in its second edition of 1961, is full of metaphors of the brain and the computer. Tellingly, Wiener’s work, despite being written with a scientific and academic crowd in mind, was mostly adopted by artists and people in the humanities rather than its author’s initial public, the scientific community. Popular culture, on the other hand, not only compared the human mind and computational capacity but also, unsurprisingly, pitted them against each other in antagonistic fashion\textsuperscript{109}. If Wiener and cyberneticists proclaimed the machine as equal in potentiality to humans, the view taken by popular culture usually takes the opposite view and, it seems, the larger art world, the traditional one, followed this tone. In these narratives the human usually wins, by submitting the machine to tests that are, in the human’s view, unmistakably human. Salah sums up this conflict nicely by stating that:

\begin{quote}
With every attempt to move computers into the territory of human intelligence, the definition of intelligence or the understanding of human abilities changed. This poses an unsolvable dilemma, a dilemma Turing has foreseen and tried to
\end{quote}

\textsuperscript{108} For more general and popular interpretations of the computer as well as its consequences, see Edwards (1996) and Julyk (2008). I shall return to this topic later in the text.

\textsuperscript{109} A trend still presented in science fiction. I shall refrain, however, from discussing popular culture since, given the amount of material produced over the past fifty years, this would result in another whole thesis.
avoid when he suggested to use the Turing Test. However, since the source of the problem is rather in the disinclination of humans to accept the capabilities of computers in taking on faculties that are attributable to humans only, even the Turing Test cannot offer a tangible solution. At the bottom of this disinclination lies the narration of humans as superior beings in the universe. This belief, which is obviously religious in its roots, shapes the world view of its adherents in such a way that there is no place for computers beating down humans in logical operations, let alone in more delicate traits like writing poetry, or making art. (Salah, 2008, p. 36)\(^{110}\)

Despite claims that computer art was ‘soulless’, Nake did not interpret it in this way. The human was pretty much an essential part of his artistic process. Bense’s generative aesthetics required, after all, a steersperson, in purely cybernetic terms, in order to select from the innumerable possibilities produced by the computer, in order to write the commands for the computer and in order to define the functions of each individual unit in this process. The randomness of the program, creating various pictures within the same logarithm, would result in an enormous amount of products that, in turn, had to be selected from, consumed by a human. If for Bense, by sheer force, the random characteristics of the computer could replace what is described in art as intuition (Salah, 2008, p. 43), for Nake the human participation, its feedback, was as important as the final piece itself. And how could we describe this ‘selection’ if not as subjective? This ‘communicative process’ would require therefore not only the artist but also a critic, who would ‘digest’ the artwork and produce something else, a critique, as they consumed the artwork (Nake, 2013, 40min). The artist, in turn, would consume (read) the critic’s product and produce a new work of art and so on… Despite acknowledging that this kind of schema is too simplistic (Nake, 2013, 48min), the cybernetic feedback then is not only seen happening within the artist but also between the whole community of artistic

\[^{110}\text{How timely, then, that at the time of this writing a computer program managed for the first time to pass the infamous Turing test only for it to be dismissed, yet again, as insufficient evidence of machine ‘thinking’ (BBC, 2014). In retrospect, Noll’s ‘human or machine’ ‘experiment’ can also be seen as playing with these same anxieties. What else could it be, if not a different method for a Turing test?}

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interested people and/or institutions. Conversely, if the final picture, being a visual representation of the program’s output, is nothing more than the product of its human creator and governor, the picture itself is but a simple unit in this whole system. From that Nake extrapolates that the program itself, the code, where intentions are described and defined, although probabilistically, must be the most crucial element in this whole endeavour. This emphasis on the program, its process and its dematerialised character, differently from Bense’s intention, puts the computer art right back in the path of traditional artistic discourse. If rationality, as proposed by Bense, had sprung from constructivist theories, the perceived programmatic qualities of the computer frame computer art, for Nake, not in the constructivist tradition but in the conceptualist one.

Although preceding the actual term ‘conceptual art’, computer art, according to Nake, is a direct continuation of Marcel Duchamp’s inquiries (Nake, 2008). This repositioning of computer art, from a concrete to a conceptual art reading, is also explored by, for example, Shanken (2001), Paul (2003), Lovejoy (2004) and Taylor (2004). These readings, as well as Nake’s, pay homage to Sol LeWitt’s writings (2003a[1967], p. 846) in which the ‘idea becomes a machine that makes art’. Taylor (2004) is the author who has most scrutinised those claims, both by conceptual and computer artists. The adoption of conceptual but not of computer art into the artistic canon, we shall see later on, provides a valuable example of artistic technophobia and its rationale.

It is important to stress that my intention is not to judge the merits of these attempts. For the purposes of this thesis it is much more interesting that these attempts were made in the first place. Later on I will describe how computer art evolved through these original events. The legitimatory discourse is, consequentially, of the utmost importance in this endeavour since, as I will show, it has divided the field of computer art (and later AST) into different and sometimes antagonistic points of view. For now it suffices to say that we should understand Nake’s late approach in two separate lights. Firstly, his attempt to frame computer art within conceptual art does not wholly reject
rationalism but, instead, admits the failure of information aesthetics insofar as it wished to quantify aesthetic properties. This mature discourse, rather different from his early one, reflects, it seems, Nake’s position not only in relation to Bense’s work but also in relation to his own. Again, for Bense, the whole purpose of information aesthetics was to rid art of subjective criteria and, by positioning computer art within conceptual art, Nake in essence brings forth this same subjectivity. The second point of interest is concerned with the fact that, by approximating computer art with conceptual art, Nake firmly posits, albeit retrospectively, computer art back at the centre of the artistic discussions of the 1960s, in particular those relating to Jack Burnham’s Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of Our Time (1968), responsible for bringing forth the discussion of systematic approaches to a North American audience, and Gene Youngblood’s Expanded Cinema (1970), responsible for conceptualisations of video as a possible means of art making and for making what is perhaps the first connection between conceptual and computer art. If Nake had made this connection earlier in his career, computer art perhaps could have had a different standing today. Finally, we can say that Nake did indeed change the discourse of computer art. His late reaction against much of the early dogmas not only presented an effort to position computer art back within ‘art’ but also showed an unusual effort to position computer art within the artistic discourse and not, as is commonly argued, as something rather different from art in general:

The failure of information aesthetics is due to its most fascinating starting point: the radical idea of an aesthetics of the object. All subjectivism was to be banned from aesthetics: the focus was to be on measure rather than value judgment, number rather than feeling, mathematics rather than psychology. An aesthetics of the object was supposed to produce methods of measuring the object such that a quantitative feature vector would replace the aesthetic object in any matter of value judgment. Information aesthetics failed when it became clear that information was no objective measure, but rather a subjective construct. The constructivist notion of information as an emerging quality when systems adapt to their environment turned information aesthetics into an extreme case of European scientific imperialism. (Nake, 1998, p. 163)
2.5 Conclusion: A bright (technocratic) new future

Augusto de Campos, one of the main exponents of Brazilian concrete art (and poetry), in 1966 wrote an article, originally published in the daily Correio da Manhã (Campos, 1974, p. 13), commenting on the apparent conflict between two groups: one, as he saw it, traditionalist and nationalist, and the other modern and international; between ‘traditional’ Brazilian popular music and bossa nova and iê-iê-iê112 supporters. Although a visual artist, a concrete poet, he saw in this conflict a reflection of a larger, for him unrecognised trend, between the clash of old and new traditions. In rather prophetic terms, he declared that:

The new mass media – newspapers and magazines, radio and television – finds its foundational matrix in the metropolis which, via its ‘centrals’, irradiate information to thousands of people in regions ever more numerous. The universal inter-communicability is ever more intense and unstoppable, in such a way that is impossible for any citizen, over the course of his daily routine, to go about without being confronted with Vietnam, the Beatles, strikes, 007, the moon, Mao or the pope. For this very reason it is impossible to profess an enduring nationalism to movements, trends or popular manias that flow and reflect everywhere. (Campos, 1974, p. 286, my translation)

This vision, commenting on the development of Brazilian popular music, although it seems as detached from computer art as it can be, expressed a sentiment present

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111 Part of this section was presented at the Computer and Art History 29th Conference – ‘Conformity, Process and Deviation: Digital Arts as “ Outsider”’ – at King’s College in 2014. Some elements were also presented at ‘Medical Images and Medical Narratives in Late Modern Popular Culture, 2nd International Conference on Medical Imaging and Philosophy’ at the University of Ulm in 2014.

112 Iê-iê-iê was the name given to pop and Western-inspired rock songs that, although not as internationally recognizable as bossa nova, were immensely popular in the Brazilian 1960s.
everywhere at the time, computer art included. The post-war world, for almost two decades, was one permeated by a feeling of change. Before the counter-culture reverberated in people’s minds, together with a wave of protest that would swipe the world, an optimistic frame of mind came to dominate people seemingly everywhere. Among the new technologies emerging at the time, it was perhaps the computer that was most seen with suspicion (Julyk, 2008; Turner, 2006). Yet proponents of a new society, a modern one, such as Augusto de Campos, would not have found these developments troublesome. The opposite was true: for him and other artists, usually placed within rational formalist efforts, these developments should be celebrated, embraced and not countered. One question emerges, then, from this scenario of technological optimism. Given that Brazil was at the time riding a wave of technological optimism, led by desenvolvimentismo policies, which aimed to foster Brazilian modernisation, allied with the wish of the Brazilian artists (especially in the São Paulo context) for a new rational art, where was a Brazilian computer art? Perhaps a better way to recast this question would be simply to ask: Given Brazilian artists’ previous engagement with concrete art, why were the first computer artists American or German and not Brazilian?

From the point of view of artistic discourse, given its concrete tradition, we may argue that Brazil was more prepared to accept and develop computer art than the United States. The mathematical pretensions of Brazilians, like those of their German counterparts, could, for example, be thought of as a precursor to the rational formalism of early computer art. It is difficult to imagine how abstract expressionists could be interested in the mathematical precision of computers. The similarity between Brazilian and West German artists, with their quest for a precise aesthetic, then, raises a simple but important question: Why did Germany produced Nees and Nake while Brazil produced

113 Although, as Turner (2008) pointed out, mechanistic ideals reverberated well with American Cold War artists.
no computer art pioneer, given that Bill and Bense were widely known among, discussed by and influential for Brazilian concrete artists? Given the similarities between concrete artists in São Paulo, Ulm and Stuttgart, surely computer art would find a safe and welcoming home in the southern hemisphere. Cybernetics, information aesthetics, mathematical pretension and technological optimism: Brazil seems to have demonstrated all the conditions necessary for the development of computer art. Yet, computer art would appear in the country only in the late 1960s and, then, by just one artist, Waldemar Cordeiro\textsuperscript{114}, himself part of the concrete movement, who had a solo show for his computer art only in 1971. To explain why Brazil did not have computer artists in the 1960s we should not, as expected, rely on art historical narratives. The answer to this question, hence, is absolutely mundane: without computers there cannot be computer art. Although computers were bought by Brazilian companies as early as 1957 (Pereira, 2014), these were sporadic and isolated investments when compared to the North American market. It was only after 1960 that computers would be present in cities other than São Paulo (Pereira, 2014). As we have seen, Brazil was not a recipient of aid money, which was instead being poured into Europe and Japan, and, consequently, found it difficult to keep up with the technological development of the wartime Allies. That, alongside the lack of technical knowledge just to operate those complex machines, rendered the computer curious and rare, almost inaccessible in Brazil (Cardi, 2002, p. 53). When we relate the development of computer art to various factors, exogenous and endogenous to art, we are not just attempting to historically describe the artistic movement but also aiming to explain why it happened in the first place. From this wish we can conclude that, although the artistic context, endogenous to art, was important in the development of computer art and later AST, since it would result in different practices

\textsuperscript{114} Cordeiro’s first solo exhibition of computer art, \textit{Arteônica}, will be seen in more detail in Chapter 3.
in Germany and the US, it was not itself essential to computer art and AST’s initial development. Computer art could, for example, develop in completely different scenarios, as with Ness and Noll, but it could not develop without the material support available to these artists. Hence we may say that political opportunity, the national context of different artists at the time, was hierarchically more determinant in the emergence in 1965 of computer art than artistic discourse.

Looking at, for example, the different institutional links of these diverse artists can further exacerbate the question of exogenous factors and artistic production. In other words, why did computer art developed at Bell Labs, for example, and not at IBM? IBM was, after all, the biggest computing company in the world. It was IBM that developed most of the computers used in early computer art (Taylor, 2004, p. 60). It seems natural that it would be from its ranks that the majority of computer artists would emerge. We know, however, that this was not the case. It was within Bell Labs that not only computer art developed but also the broader AST efforts were initiated. Although a research space theoretically focused on improving the American telephone system and technology, Bell Labs was responsible for a huge amount of basic research, from physics to chemistry, from electronics to material science. Not being bound by strict corporate codes and targets, something of a hallmark at IBM, Bell Labs allowed its management to promote a very open culture. The computing industry itself, despite being mostly dominated by IBM back then, owes much to Bell Labs. Given its special status, a state-backed monopoly, ‘in part to satisfy federal regulators, Bell Labs made information about transistors available at a nominal cost’ (Ceruzzi, 2003, p. 65). Had the transistor been created somewhere else, it would have been impossible to disseminate the technology necessary to computer art as quickly as was the case. This knowledge of the then unreliable transistor, which substituted the vacuum tubes in analogue computers, allied with its work for the military, ‘laid the foundation for other companies, who after a decade of development finally began to supply commercial computers using transistors’ (Ceruzzi, 2003).
Noll, for example, fondly recalls his days at the ‘Labs’ (Noll, 2014a, 2015), and mourned the time it changed, for fear of federal prosecution concerning its monopoly\textsuperscript{115}. To be blunt, what IBM lacked was freedom. John R. Pierce, Noll’s boss and executive director of the Lab, himself an engineer with artistic pretensions\textsuperscript{116}, was so open and supportive of the use of computers for aesthetic purposes that, also in 1965, he published an article in \textit{Playboy} magazine titled ‘Portrait of the Machine as a Young Artist’ (Pierce, 1965). If we know that AT&T was not necessarily thrilled with Noll’s experiments, even granting him the copyright of his works (Noll, 1994, p. 41), we can assume that Pierce, being the executive director of the Lab and holding power and prestige within the institution, not only allowed but was also supportive of artists in the Lab. In fact many

\textsuperscript{115} Noll’s recollection is revealing of the kind of feeling he had: ‘After a two-year sojourn in Washington working on the staff of the White House’s Science Advisor, I returned to Bell Telephone Laboratories in 1973, but it was already starting to become a different place. The management that I had in the 1960s had changed: John R. Pierce (formerly executive director of communication principles) had left, and William O. Baker (formerly vice president research) had been promoted to president. Their replacements and other appointments in the research area, in my opinion, simply did not have the vision and wisdom of their predecessors – and this filtered down the management chain. Although I was again in the research area, the freedom to pursue risky projects had diminished. AT&T also began to put pressure on the research area to become more relevant […] Walking the long hallways of the Murray Hill facility, I could feel that the environment had changed, with an emphasis in my research area on the short-term practical. The government’s anti-trust action against the Bell System was having an effect – long before the actual Bell breakup occurred in 1984’ (Noll, 2015).

\textsuperscript{116} Pierce was a musician and one of the first computer musicians. Together with other Bell Labs colleagues, he even published an album in 1962 and another in 1970 (Pierce, 1996). The Bell Labs history has been seen in many details in an assorted collection of books. I am mainly basing my narrative on the very revealing \textit{The Idea Factory} (Gertner, 2012). For more information on the visual art being produced within the Labs, see Kane (2010).
artist–engineers who emerged from the Labs corroborate this view. The engineers at Bell Labs, literally, could afford to produce art. It is important to stress that this theory does not assume the inexistence or the impossibility of someone producing computer art at IBM or other computerised companies such as Siemens. Nees contradicts that. What I am saying, instead, is that it was only because of the relaxed attitude of Bell Labs management and the lack of market pressure that computer-oriented art and music could develop in one of the most important research centres of the post-war era. IBM’s engineers may well have thought about or wished to produce art with computers but, given their professional commitments, as well as managerial pressure, as exerted over Nees in Siemens, the probability of computer art’s development within its walls was much smaller than at Bell Labs. The computers provided by these companies can be defined, in essence, as resources for early computer art. The companies should, then, be thought of as unknowing or tolerant patrons.

If we can say that computer art emerged from, first, the specific geopolitical configuration of the post-war world and, second, the development of digital computers

117 Noll, Klüver and others discussed the positive reaction and feedback from management at length in 1998 (Spivack et al., 1998). According to Noll another person held responsible for this highly liberal environment was William O. Baker, vice president of research. According to Noll ‘more than anyone else [Baker] was responsible for the environment within the research area at Bell Labs’ (Noll, 2014b).

118 Likewise, the magazine Computers and Automation, which ran an annual contest for computer art, can also, despite being a trade magazine, be seen as a resource for the early computer artists. Different from the later journal Leonardo, which was mainly targeted at an artistic audience, Computers and Automation did not in any way see itself as an art magazine. Many of its ‘artistic’ pictures, for example, were merely the result of scientific experiments created within commercial companies, many with military contracts. For more information on this see Franke (1985, p. 97) and Taylor (2004). We can actually look into the magazines thanks to the work of the Bitsavers collective, which since the 1990s has been compulsively collecting all kinds of materials from early computer history (Bitsavers, 2014, 2015). I cannot stress enough the size of its archive and the amount of work its members have done.
and the military–industrial complex, which unknowingly hosted early computer art, the same cannot be said of the rationale behind those artworks shown to the public in 1965. These artworks, despite being created with the tools of the military–industrial complex, are not militaristic or commercial in any sense. Can we frame their rationale and even their impulse, then, within cybernetics? Despite being read by, for example, Bense’s information aesthetics or concrete poets, the short is answer is no, we cannot frame this work within cybernetics. First, Cybernetics, Wiener’s book itself, was not equally understood by everyone, least to say computer artists. The examples provided over the course of this chapter demonstrate that yes, cybernetics was indeed engaged by artists in various contexts but, as a useful master frame, it is too varied, too inconsistent in its adoption, too general to be considered the rationale behind these artworks. Ness was engaged with it via Bense and never directly. Palatnik, despite claiming reading it, misquoted its intentions, erroneously attributing to Wiener a book on Gestalt that never existed. Artists from Brazil, France and the USSR read it differently, usually according to their national contexts, and do not portray a single, unifying picture of cybernetics. Noll specifically denies any interest and in fact is quite critical of its misapplication (Noll, 2011). Can we, then, claim that the impulse to use computers for artistic purposes was the product of C. P. Snow’s calls for the dissolution of barriers between the two cultures, the humanities and the sciences? Klütsch for example, when commenting on the works

119 According to him: ‘I was well aware of Cybernetics by Wiener, but his theories had nothing to do with my computer art. Years later I heard of the work by Moles – but his work had no influence or relevance to my computer art, then or now. In my opinion, information theory has been misapplied to the arts to which it has no relevance then or now. Dr. John R. Pierce of Bell Labs wrote much about this kind of misapplication of information theory, and Pierce certainly influenced my opinion’ (Noll, 2011).

120 Snow’s highly influential 1959 lecture (Snow, 2000), republished as a book in 1961, will be seen in more detail later on. As a historian put it: ‘Snow matters to historians today because he mattered to contemporaries then’ (Ortolano, 2008, p. 144).
of the Stuttgart computer artists, describes the two cultures debate as providing ‘a frame within which to formulate the new artistic approach, which was based on scientific methods and aesthetic experiments’ (Klütsch, 2007b, p. 424). When scrutinised, however, this claim seems rather simplistic. The fact that Noll and Nees were scientists (engineers is perhaps more appropriate) does not equate to a ‘bridging’ between the two separate cultures. Sometimes, in fact, the opposite is true: Bense wished to make art into a science and, with that, create a new, rational art form. If anything his methods seem intended to alienate artists and not, as Klütsch’s reading suggests, to bring the vocabularies of art and science closer to one another. Two different processes are at work here. First there is how people today frame that old debate, as simply being an attempt to unite the discourses of two different fields. Second, arising from this is the misrepresentation of Snow’s idea, which, really, proposed neither a union nor a common understanding. Snow’s lecture was more about the superior morality of the scientific culture, more about the inevitability of science, and more about the perceived lack of recognition coming from the ‘traditional culture’ than, simply, a call for greater understanding. It is important to remember, for example, that Bense’s information aesthetic predates Snow’s lecture. Since Bense’s work was the product of his long engagement with concrete art, how could we attribute it to Snow’s provocations? We simply cannot. Here is where I believe the wide influence of rational formalism is most clearly seen. It was rational formalism, and not cybernetics or the ‘two cultures’ debate, themselves products of a faith in rational, axiomatic, formalistic proposals, that characterised the development of the early rationale of computer art. Computer art, as much as cybernetics or the ‘debate’, was a product of a moral discourse that credited rational formalism as the main episteme for truth. It was this superior moral

121 I highly recommend Collini’s (2000) and Ortolano’s (2008) works as guides in comprehending the (English) context of Snow’s work. Again, because Snow’s lecture would be pivotal to AST in general, I will not discuss it in this section.
authority of a particular understanding of science that was claimed by these artists. Denouncing the ‘literary intellectuals’, Snow, like Augusto de Campos at the beginning of this conclusion, paints a picture of a conflict, between new and old traditions, between modern and traditional views of the world, between those who advance and those whose hold us back. Perhaps more importantly, Snow addresses the lack of recognition by those in the intellectual pole who, invariably, could not comprehend the changes and possibilities of this new world.

122 Professing a confidence typical of post-war technocrats and rational formalists alike – since in many ways the first is the product of the second – Snow argues that: ‘Literary intellectuals at one pole – at the other scientists, and as the most representative, the physical scientists. Between the two a gulf of mutual incomprehension – sometimes (particularly among the young) hostility and dislike, but most of all lack of understanding […] Non-scientists tend to think of scientists as brash and boastful. They hear Mr T. S. Eliot, who just for these illustrations we can take as an archetypal figure, saying about his attempts to revive verse-drama that we can hope for very little […] That is the tone, restricted and constrained, with which literary intellectuals are at home: it is the subdued voice of their culture. Then they hear a much louder voice, that of another archetypal figure, Rutherford, trumpeting: “This is the heroic age of science! This is the Elizabethan age!” […] What is hard for the literary intellectuals to understand, imaginatively or intellectually, is that he was absolutely right’ (Snow, 2000, pp. 3–5).
Chapter 3: From computer art to AST

The previous chapter was dedicated mainly to the contextual (geopolitical) and discursive (rational formalism) aspects of computer art. I have described and explained the impact of exogenous factors responsible for the development of an artistic form but we have not seen, as yet, the results of the 1965 computer artists’ claims to the status of art. We have just scratched the surface of these developments, of positioning computer art and later AST within art. If the highly pervasive effects of technological optimism allowed computer art to emerge, what would happen when that tide changed? In other words, if the technophilia of the 1950s and early 1960s allowed it to be in the first place, what would happen to computer art in the increasingly technophobic late 1960s and 1970s? The picture emerging from computer art’s public and critical response, we shall see, is a mixed one. On the one hand artistic developments stemming from technophilia definitely failed to be included in the larger artistic debates of the time. The art world was simply too distrustful of computer art’s achievements to consider them part of its canon. On the other hand, however, this very dismissal provided its members, true believers in the (good) use of technology and science, with the opportunity to rally the field’s troops into dedicated and specialised institutions that, over time, would become more and more detached from the art world. Computer art and, right afterwards, ‘art and technology’ attempts, perhaps best exemplified by the organisation Experiments in Art and Technology (E.A.T.), may have failed to stir the art world to their cause. This failure, however, had a silver lining since this very dismissal only reinforced these practitioners’ belief that the larger artistic world did not comprehend the scope of technological change happening in that period (and indeed today). This chapter, finally, deals with the emergence of the AST field as proposed by this thesis: a relatively autonomous artistic world, born out of the technophilic culture of the 1950s and early 1960s, that matured in
the technophobic late 1960s and 1970s and, in many ways, proposes a different art altogether from anything that came before.

The years following 1965 were of great importance for computer art and consequentially AST. It seemed at the time that, given the frenetic attention given to the newly developed artistic world and some record-breaking exhibitions, the ideas proposed by early practitioners were indeed resonating with both publics and artists themselves. An increasing number of exhibitions, publications and meetings dedicated exclusively to computer art marked the apogee of the field but also, paradoxically, its increasing dismissal by the larger artistic field. This paradox, of increasing growth but also of increasing criticism, was crucial for the later development of AST as an independent and detached field of artistic practice. Consequentially, this should be part of the effort of this chapter: to recognise not only the rationale for this criticism but also the structural effects of it in the field of AST itself. In order to achieve this objective, I shall review some key events following the fated year of 1965 and, moreover, link those events and criticisms of them to the larger trends both in the cultural sphere in general and within the artistic world of the period in particular. As noted, artistic practices do not evolve within a vacuum and are, undoubtedly, connected to the world at large. We should not forget, then, that, despite some old conceptions regarding the ‘uniqueness’ of computer, digital, electronic, new media or technological art, the AST world as a whole was not only affected by larger cultural and material trends but also made possible – in its present form – by these exogenous events. That is not to say that this discussion will forget the endogenous factors inherent to the art world itself. These are also crucial in that they both informed the criticism aimed at computer art and informed the discourse of theoreticians in favour – via a legitimising discourse – of computer art and its eventual consequence, the AST field. By ‘endogenous’ I mean, of course, new artistic discourses, resources (institutionalisation) and practices that, according to the supporters of AST, attempted to position it within the artistic canon – something that, despite this wishful thinking, did not
happen. The reader might think, within this perspective, that the effort of these theorists, artists and institutions was, and still is, then, useless! Since according to this narrative AST never achieved full recognition, as its supporters claimed it should, why even bother? The question of legitimacy, however, is never a straightforward problem. Despite still sitting at the fringes of contemporary art, the very fact that it persists, that it is still going after more than fifty years, is in itself a sign that, for some at least, technophilic discourse and artistic practice not only resonate but also are connected in an important way. Their divorce, material and discursive, as we shall see, evolved not from a grudge between AST enthusiasts and frustrated mainstream art world participants (only). It was also a matter of institutionalisation, of new structures being created in order to accommodate a cultural product that, despite having supporters, did not find a home within established artistic structures. Not only their discourses were different: materials, methods and, eventually, internal criticism also diverged from larger artistic debates. This distancing, evolving from the very situations created by computer art itself, gave rise to the problem of legitimacy still central to many voices within the field. Unfortunately for those active today, their inherited field cannot easily be changed.

The criticisms of computer art (and subsequently AST) then were so varied that it is difficult to demonstrate all of the propositions. In fact, these varied criticisms and the inability of computer art to be accepted have, ironically, informed much of the historical narratives of the field today: that it is soulless; that it is mathematically rigid; that it anthropomorphises machines; that its scientific propositions are useless; that it has a utopian and naïve tendency; that it is socially disengaged; etc.\textsuperscript{123} As we shall see, the

\textsuperscript{123} To my knowledge Taylor (2004) is undoubtedly the historian who has best mapped those criticisms and, as he remarks, they were not only put forwards by outsiders but also by members of the computer art world itself. While Akbar (2008) provides a compelling case in regard to a more ‘ontological’ rationale, her text is rather focused on its own arguments, whereas Grant (2004) provides a wider view of the
pattern of these anti-discourses, in the same fashion as exemplified by studies of countermovements, are not only ongoing but also proportional to the attention raised by the prodiscourse group (computer art and AST world members). Hence, the more attention AST gained, the more it was criticised. The reader must remember, however, that when I speak of a movement I am using a different definition from that of art historians, who, inevitably, search for patterns in both discourses and aesthetics in order to define a movement of some sort. An important distinction must be made with regard to Taylor’s approach or even characterisation regarding the development of computer art. For him, as an art historian, following Nick Lambert’s suggestion, it is difficult to characterise computer art’s position as a movement because:

Since its inception, the term has been employed in a variety of contexts. As the computer became the new experimental medium, it was employed within a constellation of practices, including visual arts, film, choreography, poetry and music. The term ‘computer art’ has over time denoted different artistic practices [...] This has led commentators, with vastly different perspectives, to define computer art’s essential character in relation to their artistic goals. The multiple definitions mirror the various practices. (Taylor, 2004, p. 7)

problem. Given the novelty of these systematic approaches, I am certain that over time the subject will become ever more clear. I should also name Shanken (2001), Rosen (2011b) and Franco (2013b) as good references. As the chapter develops I will look at some of these individual criticisms according to this thesis’ own narrative.

124 This assertion is constructed from the work of Meyer and Staggenborg (1996). However, differently from classic social movements, which in essence fight over broader social changes, art worlds seem to defend the artistic status of highly specialised cultural products, exemplified for example in studies of cinema (Baumann, 2007b), jazz (Lopes, 2002) or, yet, impressionism (White and White, 1993). Consequently, conflict for art worlds and their movements are different from the face-to-face, heated and/or broader debates stemming from ‘normal’ social movements. As such, a ‘counter-computer art’ is not to be found as an organised effort but, rather, developed as a criticism directed at the new field and made by established figures of the art world. For a more in-depth discussion of my method, as well as of the similarities between artistic and social movements, refer to Chapter 1 and Baumann (2007a).
Following my previous assertion that, in computer art history, the lowest common denominator for the field is its material and not its art historical or theoretical configuration, we may assert that the same can be said of AST. Furthermore, my definition of ‘movement’, following the sociological field that studies the broader phenomenon of social movements, requires only collective and organised action whereas agreement between its members can be very weak. Perhaps better summarised by those interested in the impact of external factors affecting cultural fields, this perspective can also be seen as concerned with how ‘the symbolic elements of culture are shaped by the systems within which they are created, distributed, evaluated, taught, and preserved’ (Peterson and Anand, 2004, p. 311). Therefore, the very debate over definition within computer art, regarding its unity, particularity or otherwise, seems indicative of not only theoretical tension between its members but also the creation of a group of people interested in this discussion in the first place. Moreover, if the channels where discussion is held (journals, institutions, books…) and the sites of exhibitions and meetings (specialist festivals, museums, university departments…) are the same for all conflicting denominations, how can we divide the field? The answer, for us, is that we should not\textsuperscript{125}.

Having said that, we also need to remind ourselves that, by 1968, two different and sometimes competing discourses had emerged. Both, in a sense, were attempting to direct the future of the field. Despite sharing many of the institutional settings available to discourses, despite this internal conflict never being realised directly and despite both discourses being disregarded by the larger artistic community, both were preoccupied with defining differently the aims of computer art and this was highly dependent on context. On the one hand we have an ‘experimentalist’ discourse, originating from an Anglo-American context and much less interested in rigidly defining the broad

\textsuperscript{125} Refer to Chapter 1 for a better discussion of the definition of ‘movement’. 

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developments in computer art. This discourse answered C. P. Snow’s call for action (both for and against it) and, as such, it had a broad appeal beyond the artist–technologist type. This broad interplay between artist, scientist and engineer is in essence what would define the AST world for years to come. On the other hand, however, we have a discourse that called for a strict definition of computer art, originating from the discussions instigated by its concrete art context, which we may label as ‘purist’. This discourse was not as interested in the collaboration between artists and scientists as such but, instead, aimed to reform art and society, following the calls for a completely rational artistic practice, which antagonised not only the ‘romanticism’ of art but also its market. By the beginning of the next decade, following the devastating effects of late 1960s’ technophobia and antitechnocratic sentiment, one of these propositions, the experimentalist one, would have become dominant within the field and, in turn, would also inform the development and rationale behind future institutions created exclusively for it.

### 3.1 The cultural turn: From utopia to dystopia

On December 2, 1964, just before noon, more than five thousand students streamed into an open-air plaza in front of the University of California at Berkeley’s Sproul Hall. As they sat down on the pavement, one of their leaders, Mario Savio, stepped up to a microphone. With the towering gray columns of Sproul behind him, he tried to articulate what he and his audience had mobilized to fight. The university, he shouted, was an ‘autocracy.’ Its Board of Regents was a ‘Board of Directors,’ and its president, Clark Kerr, was a ‘manager.’ Extending the corporate analogy, he argued that the faculty were little more than ‘employees’ and the students, ‘raw material.’ But, shouted Savio, ‘we’re a bunch of raw material that don’t mean […] to be made into any product, don’t mean to end up being bought by some clients of the university […] We’re human beings.’ With that, he uttered three sentences that would come to define not only the Free Speech Movement at Berkeley, but the countercultural militancy of the 1960s across America and much of Europe as well: ‘There’s a time when the operation of the machine becomes so odious, makes you so sick at heart, that you can’t take part, you can’t even tacitly take part. And you’ve got to put your bodies upon the gears and upon the wheels, upon the levers, upon all the apparatus, and you’ve got to make it stop. And you’ve got to indicate to the people who run it, to the
people who own it, that unless you’re free, the machine will be prevented from working at all.’ (Turner, 2006, p. 1)

Turner, in this beautifully crafted paragraph, not only opens his book tracing the development of what some may call the ‘Californian ideology’ (Barbrook and Cameron, 1996)126 but also perfectly describes the mood of many in the counter-culture: machines not only were spectres of a failed social order but ‘also referred to a social world that had become increasingly organized around information and information technologies’ (Turner, 2006, pp. 11–12). With that in mind, it is important to stress that when I reviewed the reasons that made it possible for computer art to emerge – that is, Cold War politics, industrial and policy changes and the growth of rational formalist discourse – I did not mean to paint a static and inflexible portrait of society. Those events narrated in the previous chapters in fact predated computer art’s first public appearance127, and those appearances, especially in regard to rational formalism, could in fact be seen as the epitome of those dramatic events in the artistic field. The general mood of those preceding years was of an optimistic kind, especially in the US, and an attitude towards

126 We should note that, despite their similarities, Turner does not agree with Barbrook and Camoron’s narrative of the origin of the Californian ideology: ‘this ubiquitous set of beliefs did not in fact grow out of the legacy of the New Left, as Barbrook and Cameron suggested. Rather, a close look at Wired’s first and most influential five years suggests that the magazine’s vision of the digital horizon emerged in large part from its intellectual and interpersonal affiliations with Kevin Kelly and the Whole Earth network and, through them, from the New Communalist embrace of the politics of consciousness’ (Turner, 2006, pp. 208–209). As for the Californian ideology itself, this ‘heterogeneous orthodoxy for the coming information age’, created by ‘a loose alliance of writers, hackers, capitalists and artists from the West Coast of the USA’, ‘promiscuously combines the free-wheeling spirit of the hippies and the entrepreneurial zeal of the yuppies’ (Barbrook and Cameron, 1996, pp. 44–45).

127 We had, obviously, computer art being produced before 1965. When I refer to a ‘public appearance’ I mean in the context of an artistic exhibition. Before that it was technical, small publications such as Computers and Automation that were responsible for showing the first works of computer art.
the future saw not only an American hegemony in the West as naturally arising from the end of the war but also an ontological change in the view of both society and policy, as exemplified by the rise of rational choice theories and their influence on policy, as controllable, predictable and, hence, harmonious. Resting on the assumption of technoscientific optimism lay a deterministic belief in ‘exponential technological growth’ (Krier and Gillette, 1985, p. 405). Perhaps better exemplified by the adoption of and certainty in Moore’s Law (National Research Council, 1999, p. 26), then and now (Ceruzzi, 2003), as a way of predicting the development and cost of integrated circuits within a chip, this optimistic attitude held strong for most of the 1950s and a great part of the 1960s as well. In the historiographical literature, this belief is usually attached to the attitudes and ideals of a liberal class in the American elites – attitudes and ideals that, nevertheless, were also adopted later by their allies. As previously seen, it comes as no surprise that many in the computing industry were part of this same liberal consensus that ruled American policy both at home and abroad. It is important to stress that optimism in the 1950s was also tied to the broader economic situation of the US and its allies’ economies. There was huge growth not only in absolute GDP but also in GDP per capita, which reflected the colossal growth in consumer expenditure over the period of 1950–1973, in both the US and other Western economies (Jones and Zeitlin, 2008, pp. 404–407). Under American hegemonic influence, the prosperity of its allies would function as a deterrent to communist sentiment and, following a rational formalist logic, ‘American

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128 The term ‘liberal’ itself has been a matter of debate. Similarly, the narrative of the 1960s in relation to conservatism and the emergence of radicalism is also a focus of intense historical debate. However, this text adopts the classification ‘liberal’ in the sense of non-isolationist, technologically progressive and strong industrial and social policies, in the form of renewed welfare capitalism and social policies as adopted by President Johnson in his Great Society. The common point to those narratives, however, is the importance of international conflict and internal unrest in the 1960s. For a much better take on this historical politics see Heale (2005).
opinion generally viewed the transition to a society of abundance as a problem of engineering, not of politics’ (Maier, 1977, p. 615). This exported social engineering in the form of foreign aid, monetary reorganisation (Maier, 1977) or even modernisation theory for third world countries (Bockman, 2006) can also be seen in the rise of rationalistic social sciences sustaining the American consensus and against the communist lure, which for a period resulted in actual economic growth. Despite some disputes within economic scholarship over the reasons and details of Western Europe’s economic growth post-war, principally focused on Germany’s miracle, the fact remains that, especially during the 1950s and in general, a massive economic recovery occurred (Sohmen, 1960; Dumke, 1990; Reichel, 2002; Temin, 2002; Vonyó, 2008). This, it seems, helped to propel optimism to a new high and, in truth, who could blame those who were optimistic? North America had come out of the war intact; its hegemony was clear for all to see; people were witnessing rapid technological development, rising living standards and increasing consumption… there was even a glamorous space race!

Western Europe and Japan, on the other hand, despite coming out the war devastated, in time also experienced huge economic development, anchored in both the Marshall Plan and nationalistic policies both in industry and science. This prosperity,

129 For more on the history of rationality within the social sciences, regarding its intellectual forebears – Hayek, Popper and Schumpeter – see the prologue of Amadea’s (2003) *Rationalizing Capitalism Democracy*. See also Maier (1977) for a more general historical account of American policies. And, one could also consult Erickson (2010) for a more general study of the mathematical assumptions of policymakers.

130 Since most of these narratives have been seen in the previous chapters, I shall contain my enthusiasm for them and only provide some references that may previously have been left out. For a history of post-war optimism in Britain and Japan, respectively see Hennessy (2007) and Forsberg (2000). For a general history of science policy in the European theatre, see Krige (2006); for a focused perspective on a single country, West Germany, consult Beyler and Low (2003). It is important to remember when talking about economic policy that West Germany was quite an anomaly since, differently from most of the US’s
allied with the perceived communist threat, was not only responsible for the large liberal, anti-communist consensus in American policy but also shaped the public opinion at home and abroad. There was a clear idea within American minds not only that the US was both better developed and more educated but also that the Soviet Union was more militarily belligerent, a sentiment shared by its Western allies (Quester, 1978). It was under this cloud of optimism and perceived foreign threat that computer art first developed. We need to remind ourselves of Nake’s commentaries in relation to Bense’s rationalism (alluring since it provided a way out of the 1930s and 1940s emotional excesses) and Noll’s embrace of computing as a way of mimicking human behaviour (as in his Mondrian experiments) in order to picture this scenario. Although without outright support from their respective employees, early practitioners could only develop these unusual ideas because they were, after all, within the American hegemonic sphere: the computers were American; aid money came from America; scientific communities developed on the western side of the Iron Curtain and under the protection of NATO. Despite the importance of local contexts, which informed the framing of those new products, such as in the case of cybernetics, early computer art was a Western

allies, it was a radical non-interventionist government and, despite American liberal rhetoric, even more so than the US. For a variety of articles concerned with the economic history of Germany and Japan in the post-war period, focused on businesses, see Kipping et al. (2003). Also note Forsberg (2000) for an economic and political history of Japan’s post-war growth. Finally, for an overview of European developments, see the enormous work of Judt (2005). Common to all these narratives is a story of riches and incredible growth, which, in a sense, was also part of the US strategy of Soviet containment, as we previously saw.

131 That Western characteristic is true only of 1965 and before. From the late 1960s non-Westerners and people from non-aligned countries would join the fore. Although they were few in number, if compared to the central countries of the Western alliance, the reader should recall the Computer Technique Group in Japan; the works of the Spanish artists coming out of the University of Madrid (Alés, 2000), still living under General Franco; the work of Waldemar Cordeiro in Brazil; and also Vladimir Bonacic in the former non-
phenomenon that simultaneously developed on both sides of the Atlantic. Had the Soviet Union been able to free itself from social realism or its early campaign against cybernetics, perhaps it would also have figured within this beginning. Who else on the planet would have the resources to ‘play’ with computers if not people involved in institutions with a reasonable amount of resources? In time, as seen with Cybernetic Serendipity, E.A.T. and many of the artist-in-residence programs that sprang up after the mid-1960s (subjects to be discussed next), companies would support those practices. For a time, computer art really seemed to incorporate (in the minds of its adopters) and embody the possibilities of new technological development and scientific knowledge. This material backing had, however, to be interpreted in a way that could justify computer art: this was the beginning of the ‘end of historical chatter’ of Bense’s pro-rational and formalist narrative; the exploration of computing possibilities of Reichardt’s Cybernetic Serendipity; the anti-capitalist and humanistic vision of Meštrović’s Tendencije; the computer as the logical continuation of Waldemar Cordeiro’s concretism etc. It was not only computer art, as one might expect, that was influenced by this worldview. Goodyear, for example, reminds us that the larger art world was also infected by this technophilia:

In response to the Soviet threat, American education emphasized science and technology, while influential theorists such as C.P. Snow, Reyner Banham and Marshall McLuhan stressed the need for interconnection between art, science and technology. In 1967, engineer Billy Klüver, co-founder of Experiments in Art and Technology (E.A.T.), argued that ‘the new interface between artists and engineers…has not developed only out of the historical relationship between art and technology. It has rather been born out of the direction and the nature of contemporary art itself.’ Klüver’s observation fits with the responses by artists Dan Flavin, Robert Morris and Allan Kaprow to a 1966 questionnaire circulated by art historian and critic Barbara Rose to assess the ‘Sensibility of the Sixties’ […] Such opinions were consistent with viewpoints expressed by several pop
artists in the decade [...] The drive to combine art with new technology inspired numerous exhibitions. These included: The Machine as Seen at the End of the Machine Age, at the New York Museum of Modern Art in 1968, held with Some More Beginnings, at the Brooklyn Museum of Art, Cybernetic Serendipity, at the Corcoran in Washington, D.C., in 1969; Software Information Technology, at the Jewish Museum in New York in 1970, and Explorations at the Smithsonian the same year. (Goodyear, 2008, p. 169)

Developments more associated with the larger AST world, for example, were also intoxicated by this pervasive optimism. This dream of a technophilic and rationally controlled world indeed was contagious and, as Turner remembers, not only did E.A.T. have over six thousands members and seventy-eight corporate sponsors by 1969 but also for

the members of E.A.T., as for the computer designers, game theorists, and war planners of the Pentagon in that era, cybernetics mapped the world as it was and should be: an information system that transcended the limits of biology and technology, simultaneously freeing individuals and integrating social groups. It was a system ostensibly without politics. It was in many ways an ideal technocracy watched over by engineers and managed through communication machines. (Turner, 2014, p. 71)

The faith in a stable, self-regulated technocratic order can also be seen in the public perception at the time. From 1950 to 1960 the chief preoccupation of the American public was international conflict and defence (Hibbs, 1979). In fact, 1960 is the most extreme example of preoccupation with the communist threat since it not only marks the peak of this trend but also marks the lowest point in the concern of public opinion towards internal politics and social problems. According to one meta-study, (fantastically) almost no interviewees regard social problems or the economy as problematic, whereas almost all of those regarded the international conflict as the main problem (Hibbs, 1979, p. 706).

It is as if the external conflict not only created the conditions for the belief in rational control and closed world narratives, such as the one described by Edwards (1996), but also created the conditions for utopian beliefs, based on the idea that the US had in fact reached a kind of progress unmatched by any other country in the world or in history. What else could explain the perception that there were no internal problems? It seems to me, however, that as truthful as it is that the general mood was optimistic, the numbers
collected by the Gallup poll and other sources in the same paper (Hibbs, 1979) were not really representative of the whole public or political spectrum. What is common to all the exhibitions described by Goodyear and also the ones seen over this chapter is that, as early as the mid-1950s, cracks started to emerge within the optimistic, technophilic, rational formalistic, liberal American-led consensus of the world and these were, in fact, becoming public. Despite this glimmering and naïve optimism, social problems were still present, perhaps no more so in segregated, white-dominant and sexist American post-war society.132

Examples of this growing tension, both in cultural productions and in society itself, are not rare. Racial discrimination, hitherto ignored by the majority of the (white) public, not only became visible but its proponents and adversaries also became more vocal (Tyson, 1998). Literature, in the form of dystopian narratives, highlighted the

132 As Turner elsewhere reminds us: ‘Gender boundaries stiffened, racial tensions slipped from public discussion, and leaders and citizens alike came to dread a vague but seemingly pervasive Communist menace. As Paul Edwards has demonstrated, computers played a central role as both tools and symbols in this period. In Washington, government planners used computers to model the possible effects of nuclear holocaust; in North Dakota, Alaska, and elsewhere, air force generals used computers to track potential attacks on the US. In both cases, the planet was transformed into a closed informational system for purposes of military command and control. Cognitive psychologists in turn began to imagine that the brain was a form of digital hardware and its actions a form of software, that thinking was a type of computing and memory simply a matter of data retrieval. Together, such analogies supported what Edwards has called a “closed world discourse.” Within this discourse, the mind of the individual man and the command centers of America’s nuclear defence establishment both seemed to be mechanized tools of management and control. Both seemed devoted to maintaining firm boundaries—national in the case of the military, masculine in the case of individual military leaders. The world in which they lived and worked seemed to be dominated by large, bureaucratic organizations. Like their leaders and like the information machines upon which they depended, these organizations seemed to many to be closed, unfeeling systems’ (Turner, 2006, p. 171).
abnormality and insanity of a rigidly rational and bureaucratic world\textsuperscript{133}, numbing capitalism, the perils of control and standardisation; as Moylan describes:

By the 1950s, [science fiction] texts such as Frederik Pohl and C. M. Kornbluth’s \textit{Space Merchants} and Kurt Vonnegut’s \textit{Player Piano} shifted dystopia’s fascination with questions of state power into an interrogation of the economic and cultural sphere shaped by the postwar partnership of a revived capitalism (spreading by way of its commodification systems into all aspects of daily life) and the new imperial power of the United States (eliminating opposition not only by the lure of the good life of suburbia and consumer goods but also by the weapons of loyalty oaths and anti-communist witch-hunts). In this conjuncture, dystopia again proved adequate to the task of catching not only the extent of the human and ecological devastation brought by the latest configuration of capitalism and imperialism but also of finding the seeds of opposition within the tendencies and latencies of that existing social system. (Moylan, 2000, p. xvi)

Computer art might have emerged among the optimistic and technophilic sense of utopian control arising from the end of the war but it did not come into the public and the art world until much later, only after 1965, and initially in only small doses. It was only with shows such as \textit{Cybernetic Serendipity}, which attracted a lot of popular and press attention, and with \textit{Tendencije 4}, which tried to reconcile and create a space for computers within an already established and large artistic framework, that computer art really became a subject worthy of attention for external participants. The problem for those internal to the movement was that by 1968 public mood had already changed, spurred not only by increasing protests around the Western world but also by the dramatic development of the Vietnam War and worsening economic conditions\textsuperscript{134}. Computer art

\textsuperscript{133} Booker, for example, traces this disenchantment with utopianism in both the literature and cinema of the ‘long fifties’. Invoking Joseph Heller’s novel \textit{Catch-22} as a paradigmatic example of this process, the absurd military bureaucracy of the same novel ‘stands in for all of the forces that sought to enforce normality, routine and regimentation in American society in the 1950s’ (Booker, 2002, p. 33).

\textsuperscript{134} These worsening conditions were not only present in the US. Europe, too, had been deconstructing the narrative of infinite material progress: ‘Even before the effervescence of the Sixties had subsided, the unique circumstances that made it possible had passed forever. Within three years of the end of
relied on that rational formalist, optimistic and naïve discourse in order to legitimise itself. It did indeed appear to be riding under the veil of such discourses, but, unfortunately for those in the field, material development in the form of widespread computing technology was a little too late. Its patrons, the massive tech companies of the Western world and academia, in a very short space of time became known not for their capacity to shape a bright new future but, instead, for being an integral part of the military–industrial complex that so much embodied American imperialism and a disenfranchising capitalist rationality. As Mario Savio, the student leader mentioned on the first page of this section, summarised the feeling, people felt like ‘little more than an IBM card’ (in Turner, 2006, p. 2). The effects of the cultural turn on AST varied but, in effect, changed the rationale of some groups and events, towards an anti-capitalistic discourse, concerned with the dehumanising effects of technocracy in society, while at the same time preserving some of its scientism – that is, the aim of quantifying and rationalising all aspects of human experience, including art. Over the course of this chapter I shall review some of the changes provoked by this technophobic and pessimistic turn that, invariably, resulted in many people abandoning the field by the beginning of the 1970s.

The most prosperous decade in recorded history, the post-war economic boom was over. Western Europe’s “thirty glorious years” gave way to an age of monetary inflation and declining growth rates, accompanied by widespread unemployment and social discontent. Most of the radicals of the Sixties, like their followers, abandoned “the Revolution” and worried instead about their job prospects. A few opted for violent confrontation; the damage they wrought – and the response their actions elicited from the authorities – led to much nervous talk of the “ungovernable” condition of Western societies. Such anxieties proved overwrought: under stress, the institutions of Western Europe showed more resilience than many observers had feared. But there was to be no return to the optimism – or the illusions – of the first post-war decades” (Judt, 2005, p. 453).
3.1.1 Experimentalism: *Cybernetic Serendipity* and E.A.T.

The newly formed computer art field, developing firstly from the earlier 1965 exhibitions and, after, from a cohort of publications and exhibitions following that year (and some, like the computer art contest in *Computers and Automation*, even predating it), would achieve its biggest exhibition some three years later, this time in London. *Cybernetic Serendipity* (1968) (e.g. Fig. 12, 13), held at the Institute of Contemporary Arts (ICA), with Jasia Reichardt as its curator, was perhaps the best example of an exhibition that symbolised the dynamic between supporters and critics, grabbing attention and consequentially criticism, mirroring movement and counter-movement dynamics. Predominant in the historical accounts of the field today and since, this exhibition, even for today’s standards, not only was heavily financed but was also a great success among the general public. The first of its kind in the UK, *Cybernetic Serendipity* ran from 2 August to 30 October 1968. Over the course of only seven weeks it ‘packed in 40,000 London art lovers, schoolboys, mathematicians and Chelsea old-age pensioners, and from admissions alone […] all but recouped its $45,000 cost’ (*Time*, 1968). In total, more than

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It is important to remind the reader that I am not interested in mapping all exhibitions, events and publications dedicated to computer art or AST over this period. Apart from the references given so far, this work has also been done (in different contexts) by edited works and articles such as Franke (1985), Dietrich (1986), Kac (1986), Giloth and Pocock-Williams (1990), Shanken (2001), Lovejoy (2004), Taylor (2004), Mason (2008), Oberquelle and Beckmann (2008), Brown *et al.* (2009), Douglas (2009), Nake (2009), Kane (2010) and Rosen (2011a). In a sense, however, since there is no single unified overview of those first years, all those collections must be read in order to avoid overlooking a specific context or artist. Japan, for example, is notoriously absent from this list. To my knowledge no complete study has been done so far of the works of the Computer Technique Group. I am sure that in the next few years this list will only increase, with up to now hidden contexts and artists becoming included.
60,000 people visited the ICA (Reichardt, 1968a). The exhibition’s intention was, as described by its name, to make chance discoveries using cybernetic devices, or, as the *Daily Mail* exuberantly wrote at the time, ‘to use computers to find unexpected joys in life and art’ (in Usselmann, 2003, p. 389). If there was one blockbuster exhibition within computer art’s early history, this certainly was it. Strikingly different from its 1965 predecessors, in size, staging and scope, this show seemed to herald a bright future for the contested art practice.

If computer and tech companies some years earlier were wary of being attached to something as unproductive and detached from its products as art, over *Cybernetic Serendipity* there was certainly a change of mood in this respect. Despite the ICA initially having financial problems, according to Reichardt, the exhibition went ahead with the help of the well-connected Sir Herbert Read (the ICA’s president) and Sir Roland Penrose (the ICA’s chairman) (Reichardt, 2009, p. 77). In addition, while over time a number of collaborators joined in, following a public announcement in 1966, it seems that, without the financial backing of IBM, the show would not have gone ahead (MacGregor, 2009, p. 85). While the 1965 events were mostly an academic or experimental affair, held in an academic environment/experimental gallery and allowed (but not supported) by Siemens and AT&T’s Bell Labs, *Cybernetic Serendipity* was held at the same space as IBM (which provided computers, money and a whole section on the history of computing), Westinghouse, Calcomp, Bell Telephone Labs, the US Air Force, the US State Department, General Motors and Boeing (these last two closing the exhibition with two separate presentations) (MacGregor, 2009; Reichardt, 1968b). In time, many corporations would house artist-in-residence programs\(^{36}\), publish texts about computer art (sometimes referred to as ‘computer graphics’, in order to highlight its

\(^{36}\) Examples of artists within industries can be seen in Harris (1999), Candy and Edmonds (2002), Shanken (2005), Eleey (2007) and Turner (2014).
practical aspects)\textsuperscript{137} and, as this exhibition shows, directly support the idea that computers could make art.

According to Reichardt, ‘some 350 people were involved in making the exhibition possible, 700 press invitations were sent out, 3000 people attended the private views […] lectures were given twice a week between August 8 and October 17’ (Reichardt, 2009, p. 78). Participants included John Cage, the Computer Technique Group, Charles Csuri, Roger Dainton, Edward Ihnatowicz, Kenneth Knowlton, Bruce Lacey, Frank Malina, Gustav Metzger, Edwin Morgan, Frieder Nake, Nicholas Negroponte, Lowell Nesbitt, A. Michael Noll, Nam June Paik, Charles Pask, James Seawright, Jean Tinguely, Tsai Wen Ying, John H. Whitney, Iannis Xenakis and Peter Zinovieff (MacGregor, 2009; Reichardt, 1968b). Works shown ranged from prints (such as the ones made in 1965) to poetry, music, film, sculpture, installations and paintings. So huge was the scope of the show it is indeed difficult to exhaust or narrow it. There was a sense that the popular press at the time had a generally positive reaction to it (Reichardt, 2009, p. 80; Usselmann, 2003, p. 390) and it was not only reported in the UK but also internationally. Despite these positive reviews, some ambivalence can also be found. In the review for the \textit{New York Times}, for example, despite claiming the show to a ‘mind-stretching experiment’, its reviewer also affirms that ‘no one is rushing in to claim that the results are great art – not quite yet anyway – but like children with a new toy, they (the artists) are falling over themselves to demonstrate the possibilities that are opened up’ (Thompson, 1968). Independent art historian Rainer Usselmann has, so far, best mapped those criticisms:

\begin{quote}
\textsuperscript{137} Among others we have Siemens publishing Georg Nees’ thesis and IBM France publishing a survey of computer graphics (Franke, 1985, pp. 107–110).
\end{quote}
Mario Amaya, in the Financial Times, pondered: ‘I am left with the sneaking suspicion that much of this exhibition has little to do with art as such. In fact, the show seems to be telling us more about what art is not, rather than what it could be’. More to the point, Michael Shepard in the Sunday Telegraph found that ‘this exhibition … serves to show up … a desolation to be seen in art generally – that we haven’t the faintest idea these days what art is for or about’. Robert Melville from the New Statesman went even further: ‘The winking lights, the flickering television screens and the squawks from the music machines are signaling the end of abstract art; when machines can do it, it will not be worth doing.’ (Usselmann, 2003, p. 391)

Categorising the works mostly under the banner of ‘fun experiments’, these reviews do not critically engage the subject in the same way a normal review would do. The works, after all, were just experiments, not worthy of serious artistic consideration. There were some who, like Wiener himself\(^{138}\), saw danger in blind acceptance of cybernetics and its precepts:

Could it be that the ICA’s ‘happy accidents’ flourished so well because they were staged in an atmosphere of breathtaking naïveté? Only a few lone voices seem to acknowledge the more serious and inevitably unhappy accidents that litter the history of cybernetics. ‘Do not be fooled,’ cautioned Michael McNay of the Guardian in a rare critical review of the exhibition: ‘Norbert Wiener … knew better. He published the first treatise on the new science not very long after the holocausts of Hiroshima and Nagasaki, yet he felt able to predict for cybernetics a destiny as fateful as for the atom.’ (Usselmann, 2003, p. 391)

The questions raised were not only against the perceived technological obsession and corporate propaganda. Much was said about the naïve\(^{139}\) way in which AST artists employed their technology. After all, it was military technology developed during a nuclear arms race and designed for conflict rather than art. According to critics, none of the works presented at the ICA posed a serious question to the social context in which those technologies were created. The first lines of a review in Time magazine sum up the

\(^{138}\) This affirmation is a nod to his highly precautionary book God and Golem, Inc. (Wiener, 1964).

\(^{139}\) Unsurprisingly, this was the same argument used by Leavis in order to rebuke C. P. Snow’s ‘two cultures’ claims (Collini, 2000), a topic to be introduced shortly.
general mood: ‘Can computers create? Maybe not, but many of their programmers have a lot of fun trying to make them behave as if they could’ (*Time*, 1968). This ambiguity towards computers in art can also be seen among staunch supporters. Reichardt in 1971, for example, wrote that perhaps ‘computer art may not be art in any sense’ (in Salah, 2008, p. 84), which should have sounded like a real blow to any intention by computer artists to be seen as such. This defensive mood, as if taking a precautious position, guarding oneself against future and certain attacks, is also seen in a special edition of the magazine *Studio International*, which solely covered the exhibition and is even today seen (wrongly) as the catalogue for *Cybernetic Serendipity*. In it Reichardt affirms that ‘the computer is only a tool which, at the moment, still seems far removed from those polemic preoccupations which concern art’ (Reichardt, 1968b, p. 71). Why, similarly to Bense and Ness at that first public exhibition, was Reichardt so reluctant to call the products worthy artistic endeavours? It is worth noting that Reichardt, similarly to Bense, was originally involved with concrete art. In one of those moments that seem to be just a coincidence, Bense, visiting Reichardt’s concrete art exhibition (*Between Poetry and Painting*) in London in 1965, and asked what her plans were for afterwards, to which she replied, none. ‘Look into computers, he said’ (Reichardt, 2009, p. 77). So she did, and three year later we had *Cybernetic Serendipity*. The relationship between Reichardt and Bense, however, does not explain the former’s reluctance in relation to the very subject of her exhibition. We know, for example, that Bense’s reluctance resulted from a political stance (not wanting to alienate his peers), a theoretical perspective (the information and generative art concepts) and institutional factors (Siemens’ reluctance). Reichardt, as far as we know, did not have any constraints. Her position, in fact, seems closer to the more naïve approach proposed by Noll at the Howard Wise Gallery. Although still having political and institutional constraints (because of Julesz and Bell Labs), the second 1965 exhibition, Noll’s, was also defined as ‘experimental’ and not the embodiment of an already defined theory of art (Bense’s informational theory). For Reichardt the exhibition
worked as a forum, a space where creativity could be shown away from the art and where the possibilities of the digital computer could be explored without necessarily worrying about ‘art’ itself:

The fact that the exhibition was approachable on a number of levels was most fortunate because it meant that it could be enjoyed by the layman without simultaneously seeming offensively simplistic to the experts. Since no claims were made that the various manifestations aimed at art, there was virtually no discussion as to whether this was or was not an art exhibition. Surprisingly many adults and certainly all children found the question ‘Is it art or not?’ irrelevant […] Both the exhibition and the lectures which dealt with the main theme of Cybernetic Serendipity were designed to dispel some of those prejudices which caused many intelligent people to believe that the computer is a threat to those whose intellectual abilities and creative powers may no longer be in demand as their role is gradually taken over by the artificial intelligence machines. The exhibition demonstrated the possibilities and limitations inherent in the uses of computers. (Reichardt, 1968a, p. 176)

Reichardt’s experiment, of seeing what people could do with that new technology, as a way of dispelling prejudices towards the computer, similarly to the 1965 exhibitions, usually is framed as a response to C. P. Snow’s ‘two cultures’ lecture (Snow, 2000 [1959]). According to some commentators, today ‘the “two cultures” figures in accounts of popular science, public policy, the sociology of knowledge, postwar British history, intellectual history – and much else besides’ (Ortolano, 2008, p. 144). So, it is fair to question again, as done in the previous chapter, how good this frame is? If in the previous chapter we saw that the 1965 exhibitions could not be thought of as responses to

\[^{140}\] Although at the time Reichardt seemed to emphasize the experimental character of these artworks, today she strongly denies such an uncertainty in relation to the denomination of that exhibition as ‘art’. Although admitting some uncertainty, she recently claimed that she ‘opted for the word art and stood by it as firmly as possible’ (Reichardt, 2009, p. 71). Perhaps previous claims regarding the nature of the show as an experiment were related more to the fact that Reichardt was unsure about the quality of the attempts and not so much about their status as art. In other words, it was not that she did not believe those products to be art but that, instead, she doubted their quality. This same ambiguity is seen, for example, in her 1968 Studio International essay ‘Computer Art’ (1968a).
Snow’s lecture, this time around the relationship between the two events seems more valid. In a sense Reichardt, by proposing to dispel the prejudices towards the computer, was simply reflecting Snow’s belief that the ruling class valued ‘traditional culture’ instead of the natural sciences by way of prejudice. Again, it must be stressed, Snow was not interested in bringing the two cultures together for the sake of the artistic or humanities community. According to Collini (2000), Snow’s lecture was primarily a conversation regarding the English context of classes, which, from his point of view, had a biased attitude against the natural sciences and in favour of the humanities. For him, following a centuries-old debate between the two, only the humanities were considered worthy by the elite. Hence,

He saw science as the great hope in a world which the traditional elites had mismanaged and led into economic depression and to the brink of a second devastating war. He also saw it as the one true meritocracy, in which sheer ability could overcome social disadvantages to obtain its true reward. And, in more parochial terms, the young Snow developed an antipathy to ‘literary intellectuals’, especially to what he identified as their snobbish and nostalgic social attitudes, which was never to leave him. (Collini, 2000, p. xxiii)

If we can say that Snow’s call was based on his optimistic attitude towards science, I believe the same can be said of Reichardt’s project. As she herself pointed out at the time, Cybernetic Serendipity was ‘prematurely optimistic’ (Reichardt, 1968b, p. 5). Optimistic about what then? I believe there is evidence to comprehend this optimism in two ways. Firstly, as Reichardt suggests over and over again, she believed that new technology, and in particular the computer, could somehow be used as a way to liberate and expand the tools available to artists. Even if the results of Cybernetic Serendipity or previous computer attempts were not all that revolutionary, she asserted that, in due time, a true great computer art would appear (Reichardt, 1968b). Secondly, and perhaps not as clear as the first point, Reichardt perceived technology and science as neutral entities. In other words, despite the turning tide of technophobia, Reichardt, because she believed in the inherited power of computing technology and science, thought its subject to be value-
free and disinterested development. Commenting on the reception of the exhibition, she wrote: ‘what computers do is help people to respond to things: this comment by John Gormley of The Tablet was extremely relevant. In the context of the exhibition the computer is seen as a neutral tool, so much so that only man’s intentional endeavour brings about some result’ (Reichardt, 1968a, p. 177).

In hindsight, Reichardt’s assertion that the computer was value free and neutral was very naïve. Affected by the technophilia of her peers, it was perhaps impossible for her to realise how merciless the computer was coming to be perceived in the eyes of not only the artistic community but also the general public. Every AST action, by the end of the 1960s, would be scrutinised (Goodyear, 2008). The fact that major players of the military–industrial complex were present at Cybernetic Serendipity did not help her case. She portrays these artists and Cybernetic Serendipity itself as heroic but, for an increasing share of the population, they were anything but. Here is where, ironically, the criticism directed towards Snow and Cybernetic Serendipity converges. As interesting as the wish to frame AST within the two cultures debate is the lack of commentaries regarding the Leavis–Snow controversy (Gerhardi, 1962; Collini, 2000, 2013; Edgerton, 2005; Ortolano, 2005, 2008). As important as Snow’s lecture was the counter-reaction to it. Frank Raymond Leavis, a prominent if blunt literary critic based in Cambridge, was already due to retire from his post as reader when Snow first published his lecture, in 1962. Known for his ferocious humanist convictions, which dismissed, for example, the works of H. G. Wells (Collini, 2000) as technocratic141, Leavis, according to Collini, found in Snow the personification of everything that was evil142 (Collini, 2000):

141 Collini informs us that in 1932, as a reviewer of Well’s latest book, The Work, Wealth, and Happines of Mankind, ‘Leavis also rehearsed the same refrain about the limitations of the technocratic vision of human well-being: “the efficiency of the machinery becomes the ultimate value, and this seems to us to mean something very different from expanding and richer human life” [and in the same publication, while
That Snow’s novels enjoyed, in the late 1940s and 1950s, a considerable réclame in the London literary world was, in Leavis’s eyes, further damning evidence of their meretriciousness. And that world, the world of ‘literary London’, of smart cocktail parties, of reviews in the Sunday papers, of the latest ‘view’ propounded in the New Statesman or on the BBC’s Third Programme, was a world in which Snow had come to move easily and with increasing fame. But Snow was also a technocrat, a spokesman for what Leavis regarded as the ‘technologico-Benthamite’ reduction of human experience to the quantifiable, the measurable, the manageable. And Snow had blundered across one of the most sensitive terrains in twentieth-century English culture: the assessment of the human consequences of the Industrial Revolution. (Collini, 2000, p. xxxiii)

Moreover, as Collini continues:

Leavis treated Snow’s fame as a symptom, a ‘portent’, of how contemporary society had largely lost the ability to frame anything like an adequate description of the values which could give life a meaning. The language of ‘prosperity’ and ‘rising standards of living’ had come to fill this void, and Snow was the prophet of the consumer society. Leavis was particularly incensed that Snow, who appeared unshakably confident of the benefits of industrialisation, should have dismissed as ‘Luddites’ those nineteenth-century authors who had raised doubts about the human cost of the Industrial Revolution. (Collini, 2000, p. xxxiv)

In a vicious lecture in 1962, also published later as an article, Leavis not only discredited Snow’s claims on literary terms, by criticising his novels, but also attacked his sense of moral superiority, which invariably placed the technocratic vision above all else. In other words, Leavis denounced Snow’s naïveté, for believing that the material revolutions of the present and past were somehow improving the human condition. An attack on the scientism of both Snow and his supporters, Leavis’ lecture in a way anticipated the arguments that would be used against computer art and AST. The latter’s

attacking another writer he states that:] “He believes with implicit faith that [science] will settle all our problems for us. In short, he lives still in the age of H.G. Wells” (Leavis in Collini, 2000). For more on this subject, see Edgerton (2005 and Ortolano (2005).

142 An adjective also directed towards Wells (Paul Nurse in Bragg, 2013). For a more Leavis-centred narrative, see Ortolano (2008).
‘technological determinism’ and ‘naïve teleology’, which posited the newly emerged field as the ‘culmination or end point of art’s technological evolution […] like society’ (Taylor, 2004, p. 245), similarly to Snow’s propositions, would immensely suffer into the late 1960s. Not only were the discourses for and against AST mirrored by the Leavis–Snow controversy but the careers of both Snow and AST itself suffered similar consequences. In his personal life, for example, Snow, having previously been part of Wilson’s Labour government as minister of technology and knighted in the 1950s, experienced various disillusionments as the 1960s turned into the 1970s. Wilson’s government lost its lustre, Snow’s novels lost their audience, and that 1960s optimism was replaced by a gloomy sense of despair […] The significance of this story is not merely a matter of one man’s dashed hopes, but rather the way that it tracks (and thus enables us to track) the rise and fall of the broader social attitudes to which his reputation had been tied. (Ortolano, 2008, p. 145)

It is unsurprisingly that we can use the Leavis–Snow controversy as a proxy of computer art’s and AST’s eventual fate. It, despite being as far away from the visual arts as it could be, nevertheless reproduced the larger debates being played out in England and elsewhere – that is, the argument that science and technology in post-war societies was a morally superior endeavour to the ‘literary cultures’ since it promoted material progress. Wishing to amend the situation, part of Snow’s diagnosis for this British bias towards ‘intellectual luddites’ was found in the educational British system, which, Snow believed, ought to be reformed towards an universal and scientific orientation. This constant call for reform,

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143 One of the most pressing calls for Snow was the reformation of the educational system in Britain. In his lecture, he declared: ‘Why aren’t we coping with the scientific revolution? Why are other countries doing better? […] In some ways, as I said before, the Russians and Americans are both more actively dissatisfied with theirs than we are: that is, they are taking more drastic steps to change it […] The differences between the three systems [UK, US and USSR] are revelatory. We teach, of course, a far smaller proportion of our children up to the age of eighteen: and we take a far smaller proportion even of those we do teach up to
manifested as a wish to change the institutions of the state, for Edgerton (2005), characterised the technocratic movements that Snow represented. This critique of institutions, a current and ever-present narrative within British (and perhaps other nations)´declinism´, espouses the view that ´the relative decline of Britain was due to British failings [and] almost always took those failings to be ones which more, and more powerful, technocrats would have avoided´ (Edgerton, 2005, p. 187). In their efforts to achieve their intentions, of elevating science above all else, Edgerton (2005) places technocrats such as Snow and many others under the banner of anti-historians. These anti-historic strategies, embodiments of the technocratic culture of the time, both in the UK and abroad, ´involve[d] a gross distortion of the historical record by denying the strength of technocracy, and overestimating the significance of opposition to [it]´ (Edgerton, 2005, p. 188). Snow, by affirming that science was, in effect, subjugated to elites concerned more with intellectualism (of the literary kind), at once erased the importance of science in Britain and reinforced the idea that science ought to have a central position within government and indeed society. The pervasiveness of technocratic ideals, for both the left and right, before the cultural turn of the late 1960s, for Edgerton (2005), is attributed to those ideals´malleability since ´both the left and right were very nationalistic about technology´ (Edgerton, 2005, p. 200). Mirroring the adoption of cybernetics, which, as we saw repeatedly in Chapter 1, was adapted in order to accommodate national narratives, technocracy in Britain, and by extension Cybernetic Serendipity and reactions to it, must be read not only as an art historical phenomenon but also as a cultural national one that, nevertheless, was intertwined with the anti-

the level of a university degree. The old pattern of training a small élite has never been broken, though it has been slightly bent´ (Snow, 2012, p. 34).
technocratic and technophobic feeling that had emerged by the end of the 1960s throughout the Western world.

It is important to note that Leavis, for one, did not oppose science per se (Collini, 2000; Ortolano, 2005). What he attacked was the moral pretension of technocratic discourses. He believed that technocrats were interfering with what he considered human affairs – that is to say, with life\textsuperscript{144}. The emphasis on science and materialism, for him, was then a symptom of a larger malaise, which affected all modern existence and which, as his answers to Snow demonstrate, must be ferociously attacked. Ironically, two years before Cybernetic Serendipity and at the heart of the US military–industrial complex, another experimental event would invert the logic behind Snow’s calls and, in a way, would concur with Leavis (although I believe he would have completely dismissed this link). Founded by two Bell Labs employees (Billy Klüver and Fred Waldhauer) and two established artists (Robert Rauschenberg and Robert Whitman), this time around the experiment would not be centred on computer-generated pictures or artist–engineers with deep technical knowledge. Instead the proposal was something rather different: to bring artists and engineers together in order to collaborate. At first sight this may have seemed a realisation of Snow’s call – that finally someone had realised that artists ought to be taught the benefits of industrialisation and science. It could also be assumed, because Klüver’s and Rauschenberg’s project attempted to bring both groups together, artists and technocrats, that this was an experiment in Cybernetic Serendipity’s terms – that is to say, an experiment willing to show the possibilities of new technologies and, consequentially, ‘designed to dispel some of those prejudices which caused many intelligent people to believe that the computer is a threat to those whose intellectual abilities and creative

\textsuperscript{144} Ortolano (2005), reading Leavis, characterises his use of ‘life’ as denoting a human creative and spontaneous act. This good and proper human life, then, was what was being diminished by Snow’s technocratic ideals of material progress.
powers may no longer be in demand as their role is gradually taken over by the artificial intelligence machines’ (Reichardt, 1968a, p. 176). Truth be told, none of the above characteristics, after some examination, seem to fit this 1966 development. Experiments in Art and Technology, or simply E.A.T., was a group that certainly made an impact not only within the infant AST but also in the arts in general (albeit very briefly). E.A.T. in fact had developed from an earlier experimental exhibition, 9 Evenings: Theatre and Engineering\(^\text{145}\) (e.g. Fig. 14, 15, 16, 17), which was held at the 69th Regiment Armory in New York in October 1966\(^\text{146}\). E.A.T.’s goal from the beginning, as Klüver, a career engineer at Bell Labs and now seen as E.A.T.’s driving force (Goodyear, 2004) summarises, ‘was to provide new materials for artists in the form of technology’ (in Candy and Edmonds, 2002, p. 8). This simple task, however, hid some very unusual intentions. 9 Evenings, differently from the first shows of 1965, received a vast amount of attention and, in a way, can be seen as a precursor to Cybernetic Serendipity: some of the artists present there were also present at Cybernetic Serendipity\(^\text{147}\). Moreover, like Cybernetic Serendipity, the show attracted a big crowd: ‘The main breakthrough in Nine Evenings was scale. Everybody in New York was there. Practically every artist […] and about 10,000 spectators saw it’ (Klüver in Candy and Edmonds, 2002, p. 9). Despite this

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\(^{145}\) There are some good references for this show and the organization itself. However, their rather recent publication and the fact that many are PhD theses reinforces my view that E.A.T. and 9 Evenings: Theatre and Engineering are becoming major landmarks in the construction of the AST canon. Shanken (2001), Candy and Edmonds (2002), Goodyear (2004), Taylor (2004), Dyson (2009) and Turner (2014) provide good overviews of E.A.T. and Klüver himself. Although Klüver’s and E.A.T.’s archives seem very well organised, via the Daniel Langlois Foundation for Art, Science, and Technology and the Getty institute, I have not had the resources to check them personally. For some insights into this archive, though positively biased, consult Oppenheimer’s (2011) PhD thesis and the foundations’ own websites.

\(^{146}\) E.A.T. itself would be formed right after this exhibition (Klüver, 2000).

\(^{147}\) The most illustrious example being John Cage, who had also published in the Studio International special covering Cybernetic Serendipity (Reichardt, 1968b).
similarity, something very noticeable differentiated 9 Evenings from Cybernetic Serendipity and from the 1965 exhibitions. It did not contain computer artists per se – that is, no artist had the command of technology, computing or otherwise, necessary to produce the performances and artworks shown on that occasion. Neither did it contain computer plotter drawings such as the ones done by Nake, Nees and Noll. It was primarily a combination of established artists performing live art and not, as previously shown, computer graphics hanging on a wall. Such was the effort to bring those two separate groups together that, according to Shanken, the artists, the dancers and the composers\textsuperscript{148} ‘benefited from 8500 engineering hours (worth an estimated $150,000) provided mostly by Klüver and his colleagues at Bell Laboratories’ (Shanken, 2001, p. 78). An expensive experiment indeed! The lack of artist–engineers is even more noticeable when we think of Klüver’s intentions. He was not, as one might expect, promoting the use of computers or new technologies in art only. In fact the computer itself was seen as a peripheral concern in E.A.T. (Franke, 1985; also in Taylor, 2004, p. 43)\textsuperscript{149}. 9 Evenings, like Cybernetic Serendipity two years later, was not purely an aesthetic experiment either. Obviously that is not to say that there were not aesthetic results. The fact that there were artworks resulting from these experiments points to consequential aesthetic results. What I want to point out is that any aesthetic production was primarily the result of a discourse and not its final objective. Regarding possible artistic merits, Reichardt, for example, was surprisingly dismissive; for her, Cybernetic Serendipity dealt with ‘possibilities rather than achievements, and in this sense it is


\textsuperscript{149} Nevertheless, as Klüver remarked earlier in that year, the computer was ‘the great initiator of all this technological soul searching’ (in Turner, 2008, p. 18).
prematurely optimistic [as] heroic claims\textsuperscript{150} cannot be made because computers have so far neither revolutionizes music, nor art, nor poetry, in the same way that they have revolutionized science’ (Reichardt, 1968b, p. 5). Likewise E.A.T., while not necessarily dismissing aesthetic results, was first and foremost interested in a specific kind of experiment that, as we shall see, was quite different from the one proposed by Cybernetic Serendipity. As Lovejoy remarks, ‘Aesthetically and technically, Nine Evenings was less than anticipated, but it proved that collaborations between artists and engineers were possible’ (Lovejoy, 2004, p. 69).

If we can say that 9 Evenings was not attempting the use of computers or new technologies \textit{per se} and neither was it interested in aesthetic results only, was it simply trying to put artists and engineers together with no further ambition than the collaboration itself? Was the collaboration alone what characterised the experiment? Shanken begins his discussion of E.A.T. by pointing to one of John Cage’s statements that, as he rightly points out, ‘exemplifies some of the prevalent attitudes held by artists toward art and technology in the 1960s’ (Shanken, 2001, p. 79).\textsuperscript{151} From Cage’s point of view ‘the artist was the progenitor of a revolutionary heritage who, through collaborations between artists and engineers, would transfer this revolutionary element to the technical servants of

\textsuperscript{150} We should note that the negation of heroism here is from an artistic point of view. Reichardt and the \textit{Studio International} special portray the show as heroic in the sense that it is far fetched, visionary.

\textsuperscript{151} Full quote: ‘I want to remove the notion of the separation between the artist and the engineer. I think that the engineer is separate from other people simply because of his very highly specialized knowledge. If the artist can become aware of the technology, and if the engineer can become aware of the fact that the show must go on, then I think that we can expect not only interesting art, but we may just very well expect an interesting change in the social order. The most important aspect of this is the position of the engineer as a possible revolutionary figure. And it may very well come [to pass] as a result of the artists and engineers collaborating. Because the artists, for years now, have been the repositories of revolutionary thought. Whereas the engineers, in their recent history, have been employees of the economic life. But in relating to the artists, they become related to a revolutionary factor’ (Cage in Shanken, 2001, p. 79).
commerce and industry’ (in Shanken, 2001, p. 79). Believing in the artist’s capacity to change the social order, Cage then typified the growing anxiety of the late 1960s. This anxiety, a product of both the further development of the Cold War and growing social unrest, created an environment that mobilised artists across many different contexts. Although this narrative has so far focused on the organisational discourses – that is to say, the rationales and objectives of those who organised either Cybernetic Serendipity or 9 Evenings – it must not be forgotten that all the individuals involved had their own personal reasons for participating in these events. Turner (2008), for example, explores the rationale for artists in the US wishing to participate in E.A.T.:

For almost 20 years, newspapers and magazines had been filled with the suggestion that if humans admitted their fundamental likeness to information processors, if they turned over even a portion of their work to those machines, they would be deprived of their independence and exiled from the social world of the factory. But over the course of 9 Evenings, some 10,000 audience members glimpsed a world in which artists shared their creative agency with an assortment of devices, procedures, programs and communities [...] together, artists and engineers made visible a world in which giving some portion of one’s autonomy over to electronic devices for communication and control resulted in the creation of new experiences – experiences not of humiliation and defeat, but of playful agency in and among probabilistic systems. (Turner, 2008, p. 18)

For Turner, then, one of the reasons behind the artists’ engagement with E.A.T. was an attempt to construct a ‘collaborative social style specifically opposed to the hierarchies of the automated factory’ (which Turner names ‘Romantic automatism’) (Turner, 2008, p. 6). This attempt, against a social order if we use Cage’s terms, is far from the rational formalist discourse celebrated some years earlier. Here the situation is inverted – that is, Snow’s postulate is inverted. According to this new discourse the scientist, in order to be revolutionary, must change. It is not the arts that ought to learn from the sciences but, instead, it is the sciences that ought to learn from the arts. This complete reversal of attitude becomes even more shocking if, for example, proclaimed by
someone from the technocratic world itself\textsuperscript{152}. Although affirming that ‘art cannot contribute anything to science’ (Klüver in Goodyear, 2004, p. 626), Klüver himself ‘argued that art could redefine the goals of engineering, while technology could expand the possibilities of art’ (Klüver in Goodyear, 2004, p. 627). In an interview from 1995 with Garnet Hertz, Klüver does not allow any space for misinterpretation\textsuperscript{153} (my emphasis):

\begin{quote}
H: I have a quote here… ‘Klüver saw many parallels between contemporary art and science, both of which were concerned basically with the investigation of life… a vision of American technological genius humanized and made wiser by the imaginative perception of artists…’ Does that accurately describe your goal?

K: Well, it could be said better than that… The way I see it is that artists provide non-artists – engineers or whomever – a certain number of things which non-artists do not possess. The engineer expands his vision and gets involved with problems which are not the kind of rational problems that come up in his daily routine. And the engineer becomes committed because it becomes a fascinating technological problem that nobody else would have raised. \textbf{If the engineer gets involved with the kinds of questions that an artist would raise, then the activities of the engineer go closer towards that of humanity…} Now, this is all sort of philosophical – in practice, it has to do with doing it.

H: So, is technology a transparent medium that artists should be able to use… there’s not really a moral side to technology?

K: \textbf{Well, no. The artists have shaped technology. They have helped make technology more human. They automatically will because they’re artists.} That’s by definition. If they do something it automatically comes out human. There’s no way you can come out and say that if art is the driving force in a technological situation then it will come out with destructive ideas. That’s not possible. But what happens, of course, is that the artist widens the vision of the engineer.
\end{quote}

\textsuperscript{152} It is important to stress that, following Turner (2008), the automated and self-regulated utopia of cybernetics was still present. What had changed, from the points of view of the opposing sides of the two cultures, was who should change: instead of the humanities moving closer to the sciences, Klüver was proposing the opposite.

\textsuperscript{153} A point that both Shanken (2001) and Goodyear (2004) also affirm but that they learned via their personal communications with Klüver.
H: And so artists can provide a conscience or humanizing element to the technology?

K: Yes, that’s what I mean … but that’s saying it too much. There might be other consciousness that comes from other sources than art. I think there is a huge consciousness inside technology that hasn’t been tapped. (Hertz and Klüver in Candy and Edmonds, 2002, p. 9)

Just the fact that Klüver did not seem to comprehend technology as a morally neutral entity would alone posit E.A.T. in diametrical opposition to Reichardt’s technological assumption (of neutrality). That, however, is only half the story. This interview, conducted decades later, directly contradict his own position back in 1968 where, in true rational formalist fashion, he proposed an axiomatic structure for technology, stating that ‘technology is neutral. It possesses no inherent values, value judgments, teleological direction, or normative goals. It is a tool’ (Klüver in Dyson, 2009). Moreover, although E.A.T. and Klüver do seem to oppose the social order they also – albeit for varying reasons – collaborated with the military–industrial complex. This dilemma, of wishing for social change and at the same time collaborating with the status quo, was seen in many corners. As Shanken puts it: ‘this dilemma plagues the political consequences of art and technology in general. For how can an artist use technology in a way that does not aestheticise it or otherwise reify the elitist social relations of technocracy?’ (Shanken, 2001, p. 100). E.A.T. was certainly not alone in this and between 1965 and 1971 a huge number of responses were given to the topic of the current situation of artists operating under an increasingly technical society and/or the continuously evolving (or decaying according to the opposite view) world order. The experimentalist exhibitions of early

154 A similar problem can be seen over MIT’s GRAV. For more, consult Wisnioski (2013).

155 Shanken reminds us that, in the US alone, between 1966 and 1972, there were ‘nine evenings: theatre and engineering; Software, Information Technology: Its New Meaning for Art; The Machine as Seen at the End of the Mechanical Age; Cybernetic Serendipity; Art and Technology; Some More Beginnings; and
AST, arriving shortly after the computer art exhibitions of 1965, may have either sided with Snow’s or Leavis’ arguments but, in the end, they all used in some way or another the very same architecture established by the military–industrial complex. By wishing to reform either the artist, the artist’s practices, or society and science via the structure central to the Cold War era, these exhibitions were neither defining an artistic movement (with specific stylistic criteria) nor a cohesive discourse, via a central theoretical authority. Although promoting two different solutions, both E.A.T. and Cybernetic Serendipity in this context were then acting according to a perceived cultural problem (the increasing centrality of the technosciences and their precepts) and not, as we may expect from a classically defined artistic movement, an aesthetic proposition.

Following this increased contestation, between those who seemed to profess the technocratic principles of a new society and those opposed to it, between the status quo and the counter culture, Dyson (2009) sees the rhetoric of E.A.T. developing ‘according to its quickly changing context’. Following this observation she divides E.A.T. ‘rhetoric’ into three stages. Firstly, as she notes, ‘Klüver emphasized the transformative potential not only of art and science, but of culture as a whole, through collaborations between artists and engineers’ (Dyson, 2009). This is what this thesis dubs the experimentalist discourse of E.A.T., its raison d’entre, not as an aesthetic experiment but as a social one. Second in her division we find the stage where E.A.T. ‘foregrounds the ethical, environmental and social aspects of technological change while focusing on the individual’ where ‘Klüver repeated technology’s main post-war promise to increase the

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Magic Theatre. They took place at such prestige institutions as The Museum of Modern Art, New York; The San Francisco Museum of Modern Art; The Los Angeles County Museum of Art; the Institute of Contemporary Art, Boston; the Chicago Museum of Contemporary Art; the Corcoran Gallery; The Walker Art Center; the Brooklyn Museum of Art; the William Rockhill Nelson Gallery; and the Jewish Museum’ (2011, p. 76). On top of this list we should add the Artist Placement Group in the UK (Bishop, 2012, chapter 6) and New Tendencies, in the old Yugoslavia, my next subject.
amount of leisure time’ while at the same time he ‘channelled the traumas produced by massive technological change into the pursuit of happiness’ (Dyson, 2009). Finally, Dyson identifies E.A.T.’s involvement with the ideals of what she calls ‘technological democracy’, which in many ways resembles Turner’s (2008, 2014) perception of the same movement\[^{156}\], where E.A.T. becomes ‘involved in humanitarian, environmental, educational, media communications and third world development projects’ (Dyson, 2009). While making these distinctions, between the different phases of E.A.T.’s discourse, Dyson rightly acknowledges the difficulty in discerning what was ‘written only for the eyes of corporations liable to sponsor his projects, or whether they are expressions of deeply held beliefs, or tools for constructing an overarching philosophy’ (Dyson, 2009). This difficulty, I believe, aligned with the fact that only a few years separate Dyson’s ‘rhetoric’ phases, seems to indicate a diffuse discourse rather than an all-encompassing philosophy. Not only are the references cited by her separated by only a few years, between 1967 and 1970, but also some of the ‘phases’ she indicates overlap within the same year. How can she, then, divide so neatly the discourse of E.A.T.? While there seems to have been a development of its emphasis, from hazily defined social experiments to technological democracy (or as Turner would see it a technocratic form of government), E.A.T. was always interested in an undefined potential art that nevertheless emphasised a strong social engagement that, for some at least, would propose a new direction for art. This development hence does not speak of an artistic movement that possesses X, Y or Z aesthetic qualities. Similarly to the proposition of *Cybernetic Serendipity* of a new direction, where aesthetics is secondary to the experiment itself, E.A.T. would reimagine not only society but also the artist’s position. E.A.T. may have changed its tone and emphasis over time but its intention remained the same: social and

\[^{156}\] Although she describes Turner’s ideas in relation to the utopia of these projects, Dyson misses his emphasis on the technocratic, decentralised and cybernetics-led aspects of this new democracy.
artistic reform via an experiment focused on the transformative (positive) aspects of technology. As Rauschenberg declared: ‘it is obvious that we live in a technical society, where it is the technologist who plays the key role and the artist who remains isolated on the periphery. As such, the artist’s days are numbered unless we can adapt to the technical framework of his time’ (in Dyson, 2009).

The difficulty arising from the study of such events is characteristic of an attempt to give form to something that is in itself formless. If I had proposed to define an AST movement, in the art historical tradition, my mission would have been pointless. Again, similarly to the developments seen in Chapter 1, the material, cultural and political context are what should be analysed. It is only by understanding their engagement with technology and science, and both their vocal and silent support for it, that we can construct a minimally cohesive set of patristic practices. Without such support any attempt would be fruitless since, as the literature of the field portrays, each individual event proposed a different solution to the situation emerging from the material and cultural contexts of the late 1960s.

In time, however, each of these experiments would dramatically fail. Their failure, exemplified by their non-insertion into the artistic canon, a measure of artistic legitimacy, only reinforced the picture of a growing dissatisfaction with the paradoxical dilemma faced by proponents of AST. Despite distancing herself from these ‘preoccupations which concern art’ (MacGregor, 2009, p. 91), Reichardt, for example, would not escape, as computer art pioneer Paul Brown latter realised, the ‘kiss of death of computer art’ (Brown, 1996; also in Taylor, 2004, p. 3). In fact, ‘so endemic was the cynicism towards computer art that Reichardt’s career was thwarted when she received negative treatment from the art establishment after her involvement with computer art and her curatorial role in Cybernetic Serendipity’ (Taylor, 2004, p. 134; see also Fernández, 2008). Even as late as 2008, in Art Journal (College Art Association), a central publication within the traditional contemporary art world, an article highlights that
‘scholars writing about curatorial work consistently exclude *Cybernetic Serendipity*’ (Fernández, 2008, p. 7). One might be tempted to relate this terrible fate only to *Cybernetic Serendipity*’s naïve conformism but, as E.A.T.’s (vague) politics show, that was far from the truth. Jack Burnham, a curator and critic for *Art Forum* at the time, responsible for the disastrous 1970 *Software* exhibition\(^\text{157}\) held at the Jewish Museum, might seem a strong advocate for AST but, ironically, he later recalled *Nine Evenings* with a hilarious but bitter quote from a theatre critic stating that it ‘was not so much an experiment in theatre and engineering as it was an experiment in sociology, since it would take a particularly perverse audience to sit through and endure anything so feeble’ (Burnham, 1980, p. 203). Yet, for E.A.T., this sarcastic criticism was surely not the worst to come. E.A.T. kept growing and by 1968 it ‘had over six thousand members’ while by 1969 it ‘had found seventy-eight corporate sponsors, including IBM, Xerox, Atlantic

\(^{157}\) As Shanken posits: ‘It must be noted that in many respects *Software* was a disaster. The DEC PDP-8 Time Share Computer that controlled many of the works did not function for the first month of the exhibition due to problems with, ironically enough, the software […] The show went greatly over budget, which put the Jewish Museum in a precarious position financially. The Jewish Theological Seminary procured funds to save the foundering institution, but dictated a radical shift in the museum’s mission, which precipitated Karl Katz’s dismissal as its director and its demise as a leading exhibition space for experimental art. The show was scheduled to travel to the Smithsonian Institution, but that venue was cancelled […] Like *Nine Evenings* before it, and many subsequent exhibitions, the failure of the technology to work contributed to increasing public disappointment and impatience with Art and Technology. While works of art have always been more or less successful according to some set of criteria, the idea of the art simply “not working” was unfamiliar to audiences. Moreover, given the technological accomplishments of the period – such as putting a human being on the moon – the failure of technology to function in artistic contexts made artists appear to be amateurs dabbling unsuccessfully with materials better left to engineers’ (Shanken, 2001, pp. 119–120). In a very honest text (and usually within AST), Burnham himself would later recall the various problems: the lack of art world support, the technical and financial difficulties, the conservatism of the pictures and artworks, all leading to him abandoning any pretension to artistic exhibition and instead focusing on an ‘educational, viewer interactive’ show (Burnham, 1980, p. 207).
Richfield, and Schlumberger’ with each spending over ‘$1,000 a year to subscribe to the E.A.T. newsletter and to gain access to its list of artists and engineers’ (Turner, 2014, p. 71). Such was the confidence of (and in) E.A.T. that in 1970 it presented a highly ambitious project that, in time, proved to be its downfall: the Pepsi Pavilion at the 1970 International Exhibition in Osaka (Fig. 18). Turner (2014). The exhibition related E.A.T. to Turner’s broader research into the appropriation of cybernetic discourse by the counter-culture, reminding us that for PepsiCo executives E.A.T. presented a great marketing opportunity: ‘even as they worked with the artistic styles of the counterculture, they sought out the leaders of corporate America. This was just the sort of cross-cultural fusion Pepsi’s executives were looking for. After all, they too were seeking to attach the products of mainstream American mass production – in this case, soda pop rather than engineered devices – to the legitimating cool of the counterculture’ (Turner, 2014, p. 71).

Not only was E.A.T. proposing a new social order, in tune with the changing time, differently from other artistic groups, which may have caused problems, but also E.A.T’s emphasis on collaboration, technology, and creativity aped the interdisciplinary ideology of the Cold War military research world. Its model of individual agency and collective coordination brought to life the cybernetic ideals of Norbert Wiener. For the members of E.A.T., as for the computer designers, game theorists, and war planners of the Pentagon in that era, cybernetics mapped the world as it was and should be: an information system that transcended the limits of biology and technology, simultaneously freeing individuals and integrating social groups. It was a system ostensibly without politics. It was in many ways an ideal technocracy watched over by engineers and managed through communication machines. (Turner, 2014, p. 71)

E.A.T.’s conundrum, of aiming at social change by fantastically distancing itself from traditional politics158, in time, would catch it out. With the exhibition highly over

158 That is not to say, of course, that E.A.T. did not have its own politics.
budget and after many delays, one month after the opening Pepsi fired E.A.T.\textsuperscript{159}. That seemed to be a sign of times to come. One critic, commenting on one of the art and technology programs at Expo’70, claimed that during the term of the project ‘there occurred the My Lai massacre, the Chicago Democratic Convention riots, the assassinations of Martin Luther King and Robert Kennedy, the invasion of Cambodia, the student killings at Kent and Jackson State. While these convulsions were taking place, inflaming the radicalism of our youth and polarizing the country, the American artists did not hesitate to freeload at the trough of that techno-fascism that had inspired them’ (Kozloff in Lee, 2004, p. 24)\textsuperscript{160}. By 1972 E.A.T.’s membership would have halved and, as Burnham notes:

Outside New York City, artist members of E.A.T. began to grumble that they were merely statistical fodder for E.A.T.’s grant proposals and that most of their serious requests to E.A.T. were simply ignored or bypassed with form letters. Once the word penetrated the art world that E.A.T. was an ‘elitist’ organization, simply catering to the needs of its own staff and a few favoured big-time artists in the New York area, its national demise was insured. (Burnham, 1980, p. 204)

\textsuperscript{159} While for Burnham that was the reason for E.A.T. being fired, for Turner the motifs are clouded and not as clear as they seem.

\textsuperscript{160} Taylor reminds us of another fantastic example of this visceral reaction: ‘In 1971, Max Kozloff in his Art Forum piece \textit{Multimillion Dollar Art Boondoggle}, gave what Burnham describes as the “most vicious, inflammatory, and irrational attack ever written on the art and technology phenomenon. Kozoff depicted the artists involved in the “lavishly funded” A&T project as “fledgling technocrats, acting out mad science fiction fantasies,” while the more sophisticated artists he envisaged as cynical opportunists’ (Taylor, 2004, pp. 100–101).
3.2 Revolutionaries: New Tendencies

Another exhibition with computers at the forefront would take place in 1968, this time in Zagreb, at the time part of non-aligned Yugoslavia and, hence, a seemingly strategic place bypassing the Iron Curtain and positioning itself neither with the West nor with the communist bloc. Also plagued by internal criticism, heavily under the influence of rational formalist discourse and having developed from concrete-art-like discourse and containing works by the usual suspects (Bense, Nake, Ness and Noll), the exhibition Tendencije 4, despite the most obvious connection (the use of computers), was a very, very different exhibition from its Anglo-American counterparts. First and foremost this was an event that developed within an already established artistic movement: New Tendencies\textsuperscript{161}. A pan-European network of mostly young, male and politically concerned artists with an abstract and concrete-oriented artistic production, New Tendencies would attempt to bring together artists from various countries into a set of events known as New Tendencies. It is important to note, however, that this is not to say that before New Tendencies there was a close and communicative community of pan-European constructivist-oriented artists. Pretty much the opposite is true. Although their aesthetics indicate otherwise, they were mostly unaware of each other and due credit should be

\textsuperscript{161} The history of this movement, conceptualised as the last avant-garde (Rosen, 2011b, p. 25) in a very modernistic fashion, is incredibly well documented in one of the most consistent and complete books ever written about the world of computer art. Tracing not only the origins of the group but also its development, via an assorted collection of letters, essays and photos from most participants, Rosen’s work is indeed – and sadly – the one book that appears close to a complete overview of any movement in computer art to date. A Little-Known Story (published by ZKM) is undoubtedly the primary source for anyone interested in these developments. Hence, I will not attempt to detail the group’s development and will, instead, focus on some interesting documents and discussions from its fourth exhibition, Tendencije 4, where the computer was, rather abrasively, adopted.
given to New Tendencies: it was only in Zagreb that a more or less cohesive network was formed. The artists themselves were surprised to find not only that there were many similar concrete-oriented developments at the time but also that they were grouped so well in Zagreb (Denegri, 2011, pp. 20–21)\textsuperscript{162}.

It is difficult to overstate the importance of the context of these meetings. These were artists who lived under the ‘spirit of resurging optimism spreading through the ranks of the young generation of artists that developed in the consolidated social situation of renewed Europe’ (Denegri, 2011, p. 21). Fiercely opposed to abstract expressionism (Rosen, 2011b, p. 27) and its romantic individualism, New Tendencies was a group that quickly developed as an organisation, supporting a series of events over the course of the years and, as an artistic movement, proposing a politicised anti-capitalist discourse and abstract, rational artistic practice. This internal change, culminating in the entrance of the computer as a subject and support in 1968, reflected an internal dispute over how to frame the production of so many artists and groups into a single narrative\textsuperscript{163}.

A character already seen in this thesis, Almir Mavignier, instigated the first exhibition, in 1961\textsuperscript{164}. The story is told in detail by Mavignier himself and Matko

\textsuperscript{162} One of the participants, and a member of the Italian Gruppo N, Manfredo Massironi, described the impact of such a surprise: ‘This exhibition, the response which was quite limited among critics, was of exceptional significance for the artists, above all because it provided an opportunity for meetings between many artists from diverse parts of Europe who, not being personally acquainted, could witness for themselves the striking affinity of their works. Although they were not aware of what, in fact connected them, it was for them a moment of great enthusiasm’ (in Denegri, 2011, p. 21).

\textsuperscript{163} So much for the camaraderie describe by Massironi in the previous footnote!

Meštrović in Denegri (2011) and Rosen (2011a). In short, as previously highlighted, New Tendencies happened as a result of a chance encounter. Mavignier, having then just completed his studies at Ulm (under Bense’s tutelage), while visiting some friends in Zagreb, accidentally met Meštrović, an art historian who is regarded as the ideologue of the movement on an international level (Denegri, 2011, p. 24). Meštrović, impressed by his new friend’s academic pedigree, and Mavignier, impressed by Meštrović’s knowledge, concurred with each other about the lack of any single and distinctive movement appearing in the recently closed Venice Biennale (1960). Questioned at a symposium as to whether he knew of any hitherto unknown movement, Mavignier responded that ‘to get wind of still unknown movements, one has to go to artists’ studios and get acquainted with artists who are experimenting with new ideas and new materials – artists like […] François Morellet, Gruppo N, Enrico Castellani, Heinz Mack, Otto Piene’ (in Denegri, 2011, p. 20). In order to confirm his own opinion, Mavignier, chosen as curator for this first New Tendencies event, proposed an exhibition with the same name (Denegri, 2011)\(^{165}\) (e.g. Fig. 19, 20, 21, 22, 23, 24, 25, 26, 27).

The second (1964–1965) and third (1965) exhibitions, although maintaining the abstract, patterned and geometric compositions common to the first show, were marked by an intense internal debate and, eventually, a reorientation. Manfredo Massironi, for example, who some years earlier had celebrated the unexpected similarity between many different artists identified by Mavignier (in Denegri, 2011, p. 21), on the occasion of the

\(^{165}\) There is a curious omission in Mavignier’s list: no Brazilian is mentioned. In the letters he wrote to Meštrović, however, he is clear that for ‘those who live in Brazil […] the invitation should be made through the Museu de Art Moderna in Rio de Janeiro, who will pay the costs of shipping canvases’ (Mavignier, 2011, p. 60). The reason why there is no Brazilian apart from Mavignier, for me, then, is an unsolved mystery.
second exhibition declared that it had ‘first and foremost, a rigorous selection of participants’ that reflected the ‘difficult search for a common ground of understanding in order to create a large unitary international movement’ (in Denegri, 2011, p. 22). Following a series of encounters and meetings to which not all participants of the first exhibition were invited, the movement seemed to crystallise its intentions over social reform. Meštrović, for example, wrote that ‘the danger of going astray and deflecting energies is always present; the prism of social contradiction keeps refracting them and deflecting them from the only effective way – penetration of social structures. The breaking down of social barriers, mental rigidity, routine schemes and all resistances of non-reorganised production conditions […] comprise the historical necessity of art and no means are superfluous to it in performing this task’ (in Denegri, 2011, p. 22). Yet, two years later, he would plainly state that within the movement ‘a crisis broke out’ (in Denegri, 2011, p. 22). Within this increasingly politicised atmosphere the movement became ‘exceedingly activist, expansionist, and in some individual theoretical positions even extremely doctrinaire’ (Denegri, 2011, p. 23).

Denegri (2011) reminds us that Meštrović, being the most vocal and militant of all the members, increasingly moved New Tendencies towards the scientisation of art. His texts, widely applauded by the activist members of the movement, called for an art that demanded ‘to debunk the dominant influence of the art market, which speculated with art, treating it contradictorily both as a myth and as commodity’ (in Denegri, 2011, p. 25). Subjectivism, irrationality and mystification of art, under this discourse, became synonyms for capitalist art market manipulations and commodification: only rationality could help New Tendencies achieve the objective of a new art. For New Tendencies’ members, following a Bauhausian rationale of art and industry, art should not only adopt new industrial materials but also be democratised. The romanticism of the author, for them, was seen as a myth that should also be combated. The personal discourses calling for this new pure and revolutionary art proliferated. As early as the first exhibition,
Meštrović, for example, heroically called for a ‘new beginning’, ‘to rise straight up into a clearing’ and spoke of the impossibility of a ‘fresh start without total purging’ (Meštrović, 2011a, p. 68). Others concurred. Castellani said that they were not ‘interested in expressing subjective reactions’; Le Parc commented that whoever ‘makes art becomes aware of the flagrant contraction in his social position’; Morellet declared that New Tendencies was ‘at the eve of a revolution in the arts that is as great as the revolution that exists in science’; Piene declared that the most meaningful art is the one with ‘purity of light, pure colour’ etc. (all in Adrian et al., 2011, p. 82). Unsurprisingly, given these new clear programmatic intentions, the exhibition that was originally called New Tendencies, in plural, became New Tendency, in the singular, from its second edition onwards. Despite these short examples, nowhere was the radical disposition of New Tendency – thereafter named in the singular – more clearly expressed as in the catalogue of its second exhibition, in 1963. In a prophetic essay Meštrović, by then a more influential figure within the group than Mavignier, summed up all the concerns expressed by its individual members and, at the same time, created a framework for the new New Tendency. ‘No other text was distributed as widely within the framework of the New Tendencies as this essay’, which reappeared many times with translations in ‘Croatian, French, Italian and German’ (Rosen, 2011a, p. 114). Given its importance, a long quote is necessary (my emphasis):

How should we then comprehend and understand that social problems cannot be solved without ideological clarification, that is, without acceleration of inevitable historical processes and, that scientific discoveries are, in a historical sense, not truly efficient or valid until they become the common property of society, that in all this art is a necessary and accessory fact of human moral awareness […]

How, by schematically defining our historical situation as [a] phase in which the classical formations of capitalist society are being dismembered and dissolved by an inner revolution of the productive forces, which are increasingly and against their will coming closer to understanding the inevitable process of socialization as the world’s historical perspective and to understanding the ideological implications of this process within the problem of alienation as impairing comprehension of the real expression of this period, no matter whether the alienation originated in the prevailing laws of commodity value or
from a privileged position within the state apparatus, how should we then comprehend, resolve, and implement the fundamental social problem: equal distribution of all material and spiritual goods?

First of all we should understand that this a necessity, not just theoretical […] This necessity should finally be recognized also in all insights of science into nature and the world, which sooner or later will become the transformation and organization model for human society and its inner structure.

However, it is science with all its successes that demonstrates how estranged it is from man, as representative of its kind, and how alienated one human can become from another […] Humans have permitted science to free itself of their control, and also to free itself of self-control; they have thus relinquished the possibility to acquire power over themselves and science. For this reason we must not neglect science, but make the vast experience contained in it our own.

Currently, most is achieved by objectifying this experience by turning into technical and industrial systems and production practice […] At the same time this hinders the realization of possible human values and the general historical process of humanization of the world […]

Art has a sense even when its pure expressiveness in the form of the ethical sense of extreme human confrontation with the insoluble […] it has a markedly constructive sense especially when it is expressed as a positive attempt at understanding historical realities and the laws of transformation and existence of the world and society […] Art is the first to sense a new time within time […] And, finally, who can deny that art is the first to point to what is decaying […]

At the beginning of the century there were thinkers, ‘ideologists of formal rationalism’. Whom we could call prophets of the modern art […] They saw, for example, that the machine is not something we can ignore; that its logic is not only valid for bankers and captain of industry, and that it would be fatal if it were only adopted by them […] Misuse turned their ideas into utopias; they had to capitulate before political reality […] At that point, innate human nature screamed in a primal and painful way, frantically seeking an echo in the wastes and hollow lap of matter […]

The New Tendencies emerged spontaneously in this climate that was first felt by Old Europe. A positive relationship towards scientific insights is a tradition of pioneers of modern architecture, of Neoplasticists, of Bauhaus followers. Although this tradition had not lived to the full, it stayed alive […]

On this level, logically, the very notion of art must undergo a decisive change and be erased as such, while art should be subjected to necessary scientization. (Meštrović, 2011b, pp. 114–117)

Whether or not artists in the early twentieth century seemed inclined to celebrate science and technology, Meštrović makes the case for a more restrained

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166 Such celebration, as we know, is usually accompanied by its denouncing. In introducing the early modernism and its interaction with the material changes of the period, in the now classical Art in Theory (2003), Harrison and Wood remind us that ‘however different they may have been, the variant responses of depression and exhilaration are two sides of the same coin’ (Harrison and Wood, 2003, p. 129).
relationship with science/technology. For him, a particular science that does not take part in his revolution is not an ‘efficient or valid’ science. Although paralleling Klüver’s (late) discourse, in calling for a ‘humanization’ of the scientific field or by highlighting that science freed ‘itself of control’, Meštrović here goes even further in his intentions. He proposes science and technology as means of achieving a revolution, in Marxist terms\(^{167}\), against the capitalist order and for the ‘distribution of all materials and spiritual goods’. Meštrović’s argument, in fact, anticipates the mood of the 1970s within the field. The idea that technology dehumanises us, however, can be traced back to the alienating aspects of Fordist capitalism, as understood by Marxist criticism, in the image of the assembly line, for example, and similarly used by Leavis against Snow’s calls (as seen in the previous section). Philosophers such as Flusser (2007), definitely not a Marxist define the technology of the industrial revolution as adapting humans to its need. The tools that preceded this revolution (e.g. a hammer) were extensions of the human. Conversely, the machines of the industrial revolution, especially in productive spaces such as the factory, were of a different and new kind of cosmology: in the factory, the human was fulfilling the will of the machine and not otherwise. Despite not referring directly to the factory or to the assembly line, Meštrović does refers to the alienating aspects of capitalism and the perceived fact that technology had freed itself, which, I believe, frames the problem of technology (and science) within the idea that it must be brought back under control\(^{168}\). Meštrović in fact is giving a diagnostic of the situation as he sees it. In other words, he is framing the development of technology in a negative light, in that he perceives the increasing autonomy of science as detrimental to a ‘humanization of the world’.

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\(^{167}\) Morellet and Molnár (2011[1963]), for example, further emphasise the revolutionary aspects of abstract art by asserting that it ‘does not appear to us to contradict the principles of dialectical materialism. Quite the contrary; by its historicity, as least, it is an excellent illustration of that philosophy’ (2011, p. 138).

\(^{168}\) The perception that there is a dehumanising effect of technology is a huge topic that unfortunate cannot be dealt with here. For a very brief contemporary and introduction, see Haslam (2006).
prognosis proposed by him, also very clear, is simple: artists and art ought to take control back. If one did not answer his call, he warns, the result would be fatal. Meštrović in this text is then playing a double game. Similarly to others in the field before him, and similarly to others in the field today, he is both picturing a problem and offering a solution. What distances him from his contemporaries, however, is that he does not frame computing technology, or science/technology, within the realm of possibilities, of experiments. For him it is not, as Bense proposes, a matter of changing art. Also differently from Noll or Reichardt, it is not a matter of experimenting with new possibilities. Actually, it is all the above but even more: it is about changing society, art and science. If those other two intentions, of changing art and experimenting with technology, had had an appeal, had resonated with a certain public up to the late 1960s, we can say that Meštrović is radicalising even more these previous experimentalist claims. In the light of rational formalistic optimism, the simple ideas of changing art and experimenting with technology were not only possible but also inevitable. After all, in the minds of their proponents, cybernetics, linguistic, game theory etc. had moved towards this objective, towards scientisation. For Meštrović, however, there was not a speck of optimism – perhaps only a light at the end of the tunnel. If for the optimistic trend of formalism the social world in general was not a concern, for Meštrović the opposite was true. His ‘fundamental social problem’, clearly, was both the end game and the higher motivation in his aesthetic concerns. This fundamental problem, however, was kept as if dormant during the long 1950s. The exaltation of human rational capabilities embodied in the new discoveries and products of the post-war era seemed to herald a new age, a

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169 Both the diagnosis and prognosis of perceived problems are a central feature of the mobilisation of social movements. It is via these discursive techniques that movements mobilise and retain their members, and act via those members (Benford and Snow, 2000; Snow, 2004, 2008; Benford, 2013). Likewise, a discourse’s resonance – that is to say, its capacity to mobilise social actors – can be thought of as an aspect of its (and its speakers’) legitimacy.
technocratic one, full of promises that, at the time, appeared to be dawning. This revolutionary discourse, which ironically later in the decade would be branded as reactionary, can then be seen in a table produced by Morellet and Molnár (2011 [1963], p. 139) where they oppose the characteristics proper to ‘progressive’ and ‘reactionary’ tendencies: a ‘confidence in rationality and logic as fundamentals’ against ‘trust in the irrational’; a ‘confidence in progress’ against a ‘denial of progress’; ‘scientific research’ against ‘works of art designed to be private property of a wealthy class’; the ‘use of modern industrial materials’ against the ‘use of precious or traditional’ ones; and a belief ‘in experimental art’ against ‘the unique, unchangeable, and non-controllable work of art’. This naïve optimism, clearly, one day had to end, and so it did. Discourses such as that of Umbro Apollonio, secretary general of the Venice Biennale, professing that ‘anyone who thinks that technology can separate us from transcendental art, or that the machine will eventually come to dominate and overpower us merely shows that they have not understood the intrinsic meaning of the historical changes we are going through’ (Apollonio, 2011, p. 116), would become less and less commonplace.

Fatefully, despite this revolutionary call, New Tendency members eventually were led to a period of fame and art market success that caused an inevitable existential crisis within the movement. Denegri tell us that ‘between June and October 1963, parallel to the second exhibition of the New Tendencies in Zagreb, the IV Biennale Internazionale d’Arte was held in San Marino’. At this event, organised by Giulio Carlo Argan, Pierre Restany and Vicente Aguilera-Cerni, ‘the participants of the Zagreb exhibition – the ZERO group and Gruppo N – carried off most of the top awards’ (Denegri, 2011, p. 23). It was not long before these awards resulted in more specific results. Now New Tendency was ‘involved in […] international art affairs’, in 1965 the ‘American market did not ignore it: in 1965, William Seitz organised for the MoMa The Responsive Eye, which, according to Massironi, amounted to a ‘first class funeral’ (in Denegri, 2011). How could the revolutionaries of some years back get involved in such a
commercial show? From the point of view of the movement’s own discourse, there were many glaring problems. Firstly, its politics were completely stripped out. According to Galimberti (2012, p. 81), Gruppo N, for example, which was associated with ‘the most innovative group of Marxist thinkers in 1960s Italy, the operaisti (workerists), which featured figures such as Antonio Negri’, was integrated into another movement, the op art, which discursively did not have anything in common with New Tendency\textsuperscript{170}. Moreover the exhibition, ‘which amounted to the first contemporary art blockbuster’, saw the work of its artists being ‘applied to dresses, plates, carpets, fashion magazines, album covers and concert stage sets’, while ‘the critics and the public ignored the fact that these, now popularized works, had once been created as a means to reconstruct the value system of the art world’ (Rosen, 2011b, p. 27). Worse still, as Galimberti (2012, p. 81) tells us, the curator would state that ‘impersonal fabrication is [here] extended to anonymity of authorship and almost to socialism’, then immediately reassuring his Cold War audience by proclaiming that ‘these artists are not revolutionaries; they aspire to full cooperation with the modern world’ (in Galimberti, 2012, p. 81). Sell-outs, collaborators and capitalists: that is how they would have felt. This and their participation in the Venice Biennale and \textit{documenta III} caused artists to wonder whether they had ‘simply ended up in the production of works of art’ (Rosen, 2011b, p. 28).

\textsuperscript{170}In this example we can see the limits of stylistic and aesthetic readings of formalist art history, which, by missing the discursive aspects of artists, tend to posit different and opposed groups under the same umbrella.
3.2.1 Purists: *Tendencije 4*

It was this crisis of confidence, more than its own righteous discourse, that led New Tendencies towards the computer. The exhibition following the rather uncertain *Nova Tendencije 3* (1965), *Tendencije 4*[^171], initially scheduled for 1967 (following the biannual format since its first edition), did not happen. The organisation of the movement, which seemed to have dispersed by 18 December 1967, via the actions of its Yugoslavian hosts, seemed to reach a new term: ‘computer art’ (Rosen, 2011a). The new event was renamed *Tendencije 4: Computers and Visual Research* (e.g. Fig. 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43) and from then on a new figure would emerge as the discursive head of this event: Abraham A. Moles. Note that, like the exhibitions of 1965, ‘art’ is conspicuously missing from the title. The reason, this time, was certainly a theoretical one and not an institutional constraint since this exhibition, more than any previous New Tendency one, was completely focused on the scientisation of art. Another important difference, as we can see, is the lack of the adjective ‘new’ (*nova*) from the title. That, as we shall see, reflected the organiser’s certainty that the computer was not a new, future development but, instead, that it was the actual, present state of the art – despite the rarity of computers at the time. Some explanation is necessary. Moles, together with Bense, can

[^171]: *Tendencije 4*, similarly to previous New Tendencies events, was not confined to a single exhibition but consisted of many interconnected events. Its main exhibition, which would open only in 1969, was mostly defined and fought over, however, over its colloquies and symposiums. Moreover, apart from the event itself, there was the introduction of a magazine, *bit international*, where many of the presentations conducted in these meetings were published. These magazines and their articles are the major components that make up the historical documents concerning New Tendencies and its involvement with the computer. Understandably, Rosen’s incredible book (2011) draws heavily from *bit international*. For a comprehensive timeline of these developments, refer to Klütsch (2005), Fritz (2008a, 2008b, 2011b) and Rosen and Scholl (2011).
be considered one of the fathers of information aesthetics and its attempts at quantifying aesthetic phenomena. Although they differed in their methods, they can be said to have been attempting the same result albeit via different means.\textsuperscript{172} In fact, it could be argued that ‘the fourth Tendencies exhibition (1968/69) was marked by a further penetration of the idea of a theory of information and exact aesthetics’ (Fritz in Klütsch, 2005). Moreover, ‘the artistic use of computers was a “last try” of the Tendencies movement to synchronize its goals as the “scientification of art” and “bettering the society” and [the] historical movement of 1968’ (Fritz in Klütsch, 2005). Moles, like Bense, was an academic, and he held the chair of social psychology of communication at Strasbourg University. Naturally, the fourth event then had a colloquy in which Moles presented his ideas for the future of New Tendencies. In his new role as mentor, for him the goal of \textit{Tendencije 4} was clear: ‘to establish the bases of the new orientation in artistic development’ (Moles, 2011b, p. 263). Acknowledging the previous successes of New Tendencies, of creating a network of similarly oriented artists, he affirmed that, nevertheless, ‘a further step is necessary’ (Moles, 2011b, p. 263). Differently from Meštrović’s prophetic rhetoric, his rationale was simple and direct: ‘This is to take into account and come to terms with the technological revolution in the field of art’ (Moles, 2011b, p. 263). This preoccupation with science and technology, as he rightly posits, was a central concern within New Tendencies. Moreover, for him, it was also attached to another topic dear to New Tendencies: the ‘relationship between art and society’, which, within the spectre of technological development, was seen as part of a ‘sociocultural evolution’ (Moles, 2011b, p. 263). Perhaps in a nod to experimentalist Anglo-American developments in computer art, Moles denounced what he saw as a common misunderstanding in the ‘modern art’, between trial and experiment. A trial, in his

\textsuperscript{172} A complete study on Moles’ and Bense’s methods is offered by Klütsch (2007a).
conception, is a failed, small part of a long, rigorous experiment. Consequentially, for Moles a true experiment is not a free-for-all game, and instead must be based on systematization, exploration of the range of possibilities [where] it differs essentially from the mere trial, from this multiplicity of trials that we have witnessed over the past […] in which no serious analysis was made of the reasons for which something was good or bad […] Experimentation is study, study in the field of possibilities, defined by constraining laws or by an algorithm, which is to say, by a succession of intellectual steps toward the achievement of a definite goal. (Moles, 2011b, p. 264).

Here, Moles sweeps aside all work that is not, in essence, computable, algorithmic. Moreover, regarding his conception of the correct, good art, and by extension a good experiment, a clear objective – his ‘definite goal’ – must be stated in advance. Although the exhibition also presented works that were not made with computers, the emphasis on scientisation and strictly defined experimentation put forward the computer artists as central figures in this new reorientation. Moles, like Bense before him, saw the computer as heralding a new era not just for society but for humans as well. This transformation, credited to the rise of the ‘machine’, presents a new revolution ‘more important than the mechanized revolution that inspired Karl Marx, a revolution of automation, of artificial thought, of symbiosis with machines, of mastery of communications’ (Moles, 2011b, p. 264). This ontological transformation, a direct product of cybernetics’ dissolution of borders, between human and machine, between human and other entities, as seen by Hayles (1999)\textsuperscript{173}, would reaffirm the secondary character of the artist. The artist, no longer manipulating matter (Moles, 2011b, p. 265), becomes an operator (in Flusser’s terms), a manipulator of abstract symbols with the machine, the computer, responsible for the experiment in itself. This, for Moles, ‘brings out the role of machine-based art as

\textsuperscript{173} This new ontology, of the posthuman, is the subject of the conclusion of this chapter.
successor to geometric art’ (Moles, 2011b, p. 264)\textsuperscript{174}. Hence, ‘through these criteria, which the New Tendency has brought to the fore, a new form of artwork is emerging’ (Moles, 2011b, p. 264).

Throughout his presentation Moles does not, however, dwell on the nature of his objective. Since all good art ought to have a ‘definite goal’, what is this goal? Is it just the experiment in itself, or is it something else? Despite affirming that New Tendencies, as a movement, had ‘brought out the essential values of contemporary art, such as rigor of execution, construction of significant form, and appropriateness of means to ends’ (Moles, 2011b, p. 263), he warns that this ‘form’ ‘insist[s] upon having its own criteria’ (Moles, 2011b). Apart from the obvious answer, that the definite goal was good art as described by Moles (rigorous, significant and appropriate), resulting then in a circular \textit{ad infinitum} answer, I believe that the problem may be clarified by looking at the first edition of \textit{bit international}, also from 1968. It is in these other documents that I believe we can find the way out of New Tendencies’ own criteria. \textit{Bit international} was published by the organisers/hosts of New Tendencies, the Galerije grade Zagreba. According to its editors, in a suggestive editorial titled ‘Why Bit Appears’, \textit{bit international}’s \textit{raison d’entrec} was ‘to present information theory, exact aesthetics, design, mass media, visual communication, and related subjects’ (Basicevic and Picelj, 2011, p. 294). Given its wish for an exact aesthetics, this first edition was consequentially focused, unsurprisingly, on the work of both Bense and Moles. Bense, who had not participated in that first colloquy where Moles specified his plans for the future of New Tendencies, republished a text (originally printed in 1966) where he specified the objectiveness of his exact aesthetics. According to him, when one ‘speaks of modern aesthetics’, one speaks of ‘mathematical and empirical procedures’ that, ‘unlike classical

\textsuperscript{174} Similar interpretations of these events have been put forward by Klütsch (2005) and Fritz (2008a).
aesthetics’, rest not on a philosophical but on a ‘methodological concept’, which, as we saw in the previous chapter, ‘is oriented on objective rather than subjective problems’ (Bense, 2011, p. 296). Birkhoff’s mathematical measurement of aesthetics considered this objective and aimed to quantify aesthetic value via a formula where the (good) aesthetic measurement (M) is derived from the ratio between order (O) and complexity (C), resulting in the function M=O/C. Following this formula, Bense attempted to reach objectivity via a formalisation that could give a definite result, a definite answer, that explains artistic worthiness. As Klütsch readily realises, however, Bense could not ‘explain why very low values for O or C would be considered high aesthetic values’ (Klütsch, 2012, p. 68). Moles, who also used Birkhoff’s mathematical measurement of aesthetics, albeit in a different form, according to Klütsch, also reached a similar impasse. We can conclusively say that, given the lack of explanation for a particular judgement of worthiness, both methods aimed at an objective that, in fact, it was impossible to achieve. Despite both authors arguing in bit international about the objective of art (Moles’ ‘definite goal’), and despite both pursuing an exact aesthetic measurement that theoretically would be objective, neither could provide an explanation of their own exercise. The incapacity to provide an explanation for a supposedly good artwork, as demonstrated by Klütsch, is even more problematic since:

whereas Bense adhered to the original equation, M=O/C, Moles modified the formula into M=OxC, with drastic implications. If you take low order (O) and low complexity (C), for Bense the measurement (M) can still be high, but with Moles’s modification it would be at a minimum. If both values C and O are high, Bense gets a comparatively low measurement (M), while Moles gets a maximum. (Klütsch, 2012, p. 68)

Despite the formula’s shortcomings, both authors, playing with the authoritative discourse of science and rational formalism, were constantly adamant regarding their formulas’ propositions. In that same publication Bense, for example, continued to argue for a generative aesthetics, as seen in the previous chapter, while Moles called for a
permutational art (Bense, 2011; Moles, 2011a). For the purposes of this research it is relatively unimportant to scrutinise their position. Instead, given the comparative endeavour of this thesis, it is better to understand how these formalist discourses were translated into New Tendencies and, in turn, comprehend how this new orientation for New Tendencies compares, for example, with the propositions of Cybernetic Serendipity or E.A.T. Consequently, as we saw in the previous section, if the Anglo-American discourses of computer art/AST had not gone through a process of elimination – that is to say, of demarcation between new and old practices, of attempting to demonstrate the good and the bad in artistic production, an exercise primarily focused not on a scientific effort as it was determined by both Bense and Moles but, instead, an exercise that defined a pure, new and good way of producing art – the propositions raised by the different strands of information aesthetics presented at Tendencije 4 were attempting exactly this: separation. That is not to say, obviously, that Anglo-American propositions were not attempting to define a group of cohesive artistic methods; they had, after all, the computer as their lowest common denominator. The idea of experimentation (for example), expressed in both Cybernetic Serendipity and Tendencije 4, traces a strong line between these two groups. While both advocated the use of computers, they did so for different reasons. Another example of Tendencije 4's restrictive, purist approach to an idea of a new art can be seen in the reaction of previous New Tendencies members. Moles’ assertions, as one can expect, given their displacement of the traditional artist and their advocacy of (unrigorous) trial and error, were not readily accepted by the previous New Tendencies members. As Rosen (2011b, p. 29) reminds us, ‘the burden of the task of reviving the movement was perhaps perceived by the organizers, but not by the guests’, who, in effect, only vaguely knew of previous New Tendencies activities. During the colloquy some voices raised objections towards this new orientation. Artists who had previously argued for a reorientation regarding the position of the artist, swept along by the logical extensions of their own ideas, were now surpassed by the invited artist–
scientists, saw themselves in a precarious position. If one could not program, if one did not partake in that new art process, what would remain?

In the first colloquy Alberto Biasi, co-founder of Gruppo N and an active participant in old New Tendencies gatherings, stated very clearly his opposition to the computational developments of New Tendencies. In this lecture, titled ‘Situation 1967’, he described what he believed was a sectarian split within New Tendencies, between those who believed art should educate, those who believed art should be formalist (in the sense of only referring to itself, without an expressive meaning) and those who saw art as a ‘continuous evolution of phenomena’ (resulting in kinetic art). The split, according to his narrative, was being resolved back in 1965 when, before Tendencije 4, abruptly, the movement ‘virtually ceased to exist’ (Biasi, 2011, p. 268). The culprit for this sudden disbandment was ‘both economic circumstances and, above all, […] a common lack of determination to prevent individualistic divergences’ (Biasi, 2011, p. 268). According to Biasi:

Yugoslav friends who had initiated the movement and who lived under a socialist economic system, had not foreseen the realistic issues of individuals survival besetting their Western friends would create all kinds of motives for competition among artists living in countries with a capitalist economic structure […] There was a desire that traditional theories of art should be replaced by a mode of understanding and working that would be more in line with new scientific thinking about nature and human life […] These words might also seem the express the opinion of many of my Western friends who took part in the previous New Tendencies exhibitions. We certainly cannot fail to take your program into account, but at the same time, we must also consider the situation of the capitalist economic world […] Everyone has seen that the consequence of increased mechanization is increased exploitation of man by man. Increased automation has not diminished man’s exertions or given him greater freedom at work. On the contrary, it is used to rationalize exploitation. Artists cannot remain indifferent to these conditions […] Perhaps for all these reasons artists from the previous New Tendencies exhibitions have not come to Zagreb. (Biasi, 2011, pp. 268–269)

Biasi’s lecture denounces two problems within the movement, problems that in a sense were taken as subject by the New Tendencies and its new orientation towards computing tech. The exaltation of ‘scientific trends’, despite being directed initially at the
‘inconsistency of previous metaphysical systems’ (and an objective they all shared), also put an emphasis on the processes used by the capitalist system, which, according to Biasi, was responsible in the case of Western artists for both their hardship and their commodification. What was initially a split in the movement then became a split between those who applauded the exploitative scientific developments and those previous participants who were ‘disillusioned’ (Biasi, 2011, pp. 268–269). True artists, for him, could ‘not remain indifferent to these opinions’. Nake, one of the participants of that first colloquy, seemed to take this as a rather personal attack – of all people, it was strange that he went against Biasi (since Nake too was very politicised and left oriented). Surprisingly, it seems that he saw himself as both the target of Biasi’s critiques and an avatar of the scientific establishment. The colloquy was his first participation within the movement as he was ‘appointed’ by Bense as a representative of the production being made in Stuttgart whereas Bense went to the ICA to help Reichardt prepare for Cybernetic Serendipity.175 Perplexed by Biasi’s assertion that no artist could support technological development, he spoke back:

Mr. Biasi has told us that there are no artists here today. That is not quite right, and yet perhaps the following is symptomatic: Here at the speaker’s desk it is mainly scientists or scholars who make an appearance, or at best artists like Kurd Alsleben who work primarily as scientists. This seems to me to be a problem of the Tendencies. On the one hand, artists are at a loss as to how to proceed, and on the other, there are scientists who are making efforts to penetrate art. Mr. Biasi has broached a special problem of the artists: the problem of automation. This problem is not, however, the artists’ problem alone […] It is senseless to make private declarations here. If we want to do that, I could talk about how we stood in front of the gates of factories, how we demonstrated, held tech-ins, built barricades […] Therefore, I would now like to say something that we won’t perhaps like to hear. We shouldn’t demonize automatia. Computers exist, and we would be making a great mistake if we ran away from them. I think it would be much better if we brought as many ‘leftists’ as possible together with computers

175 This information is available in Nake’s interview with Poltronieri. However, according to Marc Adrian (in Medosch, 2012, p. 163), Bense was worried that Yugoslavian authorities would arrest him on charges of fleeing the German Democratic Republic.
Therefore, we must in the first place go and work on computers – but then not make the same mistakes as do those on the ‘right’. We must, for example, stick to the following program: rationality in the service of humankind. The problem of Tendencije 4 appears to be the following: Should the Tendencies make the attempt to bring together artists and scientists? Should the Tendencies make the attempt to bring about a symbiosis between discursive and intuitive thought? I continue to think that this makes sense; but I don’t know whether further discussion will yield other results […] I could envisage the following: The exhibition in May of next year will be approximately as planned – but, for example, only those scientists and artists will be admitted who are committed to a certain social idea […] The London exhibition Cybernetic Serendipity addresses mainly the individual’s instinct to play. Why shouldn’t the Zagreb Tendencies address the social consciousness? I think the discussion has been opened. (Nake, 2011b, pp. 270–271)

Nake’s answer shows that the adoption of the computer within New Tendencies was far from a tranquil affair and instead quite the opposite was true: there was certainly a tension between the old and the new, computer-oriented members, as well as the orientation towards a further scientisation of the artistic practice. It was not only the political aspects that divided the old and new guard. From a practical point of view, how could the previous artists, with no previous knowledge of digital computing, adapt themselves to this new reality? In fact, as we have seen, tensions already existed as early as 1965 between the old members of the movement, and, according to some, there was actually the end of New Tendencies as a program, consequentially giving birth to the Tendency. According to Medosch, ‘a gap was discovered between the artist’s desire to

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176 Armin Medosch (2012) in his PhD thesis, in a sense, does a disservice to this debate. Despite offering a comprehensive historical account of New Tendencies and presenting a series of interviews with many responsible for the New Tendencies events, he slips in his assertions that computer artists and Tendencije 4 were merely replicating the discourse supported by the military–industrial complex. By expanding on Martin’s *Organizational Complex* (2005), he finds that artists such as Noll merely ‘carried within themselves the logic of corporate research which primarily demonstrated possibilities of technology’ (Medosch, 2012, p. 172). That may be true in the case of architecture; after all, architects are commissioned applied artists who, ultimately, must comply with their employer’s wish. People like Noll or Ness were indeed interested in the possibilities of this new medium but they were not mere automatons following
conduct research and their actual capacity to do so, between a programme oriented towards the most advanced level of industrial production and the actual level of technical execution of artworks’ (Medosch, 2012, p. 153). This drift, between intention and actual production, allied with the fact that most of the social intentions were being absorbed by simple participation in the art market, was ‘fatal’ for the first participants. Signs of tension were everywhere, even before Tendencije 4: not only were patterns produced by the members being sold in the high street but also Le Parc, for example, ‘accepted the first prize at the Biennale of Venice in 1966 in the painting category as an individual, and not as a member of GRAV’ (Denegri in Medosch, 2012, p. 154), his previous group. Computers only added a new problematic layer in an already uneasy partnership. Jerko Ješa Denegri, another vocal and influential art critic within the movement and the Zagreb scene, found incomprehensible that Nake could affirm the use of rationality in the service of human kind since ‘never before had the world been so shaken in its scientifically based institutional constraints. This smacks to me of a kind of institutional determinism that, by now, should be regarded as both outdated and misleading. In Noll’s case, to simply state that the corporation he worked at ‘had an institutional interest in giving its products the appearance of something benevolent and humanistic’ is not only simplistic but also plainly wrong because, as we have seen, there was a strong resistance both in AT&T (because of its monopolistic position) and Siemens to early computer art. That situation changed, of course, with the free publicity of Cybernetic Serendipity – which even then had problems raising cash. In another misleading proposition, with regard to the ‘growing availability’ of software (Medosch, 2012, p. 175) being used by those artists, Medosch temporarily seems to forget that the works of pioneers were, in many circumstances, written from scratch – that is to say, there were no software or graphical packages as we know today – something that Medosch himself acknowledges later on (Medosch, 2012, p. 179). It seems that Medosch is more interested in his own politics than research since, for him, the use of software was a ‘specific version of commodity fetishism’ (Medosch, 2012, p. 176). Moreover, as we will see later in this text, participants in Zagreb and elsewhere were not ‘blind to the role of the military’ (Medosch, 2012, p. 176). Instead a colorful debate emerged in Zagreb and elsewhere, with artists such as Cordeiro and Csuri making clearly antiwar work and others abandoning AST altogether.
rationalism’ (Denegri in Medosch, 2012, p. 187). He was, clearly, reflecting on the protests of 1968 particularly and on the tumultuous late 1960s in general. Over the course of the years the discourse within the Zagreb meeting and exhibitions would change towards a more critical one, rather than the blindly optimistic discourse of the mid-1960s, which emphasised the novelty of the movement. The broader changes in society, away from the capacity of art world members to influence it in any way, once again would dictate the way computer art would be seen. If New Tendencies’ initial discourse was aimed at the formalisation of artistic theory, via information aesthetics, or the simple exploration of technology by its artists, as in *Cybernetic Serendipity*, in time those ideas would be antagonistic to the art world in general, which, affected by the protest wave of the late 1960s and by international conflicts, would also turn against a rational formalist discourse that represented the old, overtly capitalist, seemingly technocratic, American hegemonic order. The computer, in this picture, would become a symbol of this old, oppressive technocratic order and, consequentially, became something that should be contested. Even in the US, ‘as Americans lost confidence in this premise, as their optimism about the future became tinged with pessimism, the foundations of society’s support for science – and scientists’ faith in themselves – eroded’ (Smith, 1990, p. 77).

That the attack of Biasi seems focused on the computer itself is by no means unexpected. Rosen’s remarks on this topic are revealing since, as she demonstrates, ‘information aesthetics, as defined by Bense and Moles, was not introduced to the New Tendencies initially as a theoretical operating manual for computer [but instead] it has been spread among artists’ circles without direct reference to the computer since the end of the 1950s’ (Rosen, 2011b, p. 31). Likewise, the ideas previously professed by Bense and Moles, ‘of precision, unambiguousness, objectivity, and intersubjectivity with the natural sciences’, reverberated with the original New Tendencies’ calls for ‘demystification and transparency’ (Rosen, 2011b, p. 31). Moreover a central aspect of information aesthetics, of programmability, was well received by New Tendencies
members. Rosen highlights that Morellet, for example, ‘insisted that the pictorial element should be based on controllable elements, whereby systematic progress would be made by following a program’ (in Rosen, 2011b, p. 33) while Mavignier ‘emphasized that the programmed permutation, which he mechanically elaborated precisely after having set the program, led to results about which he would have otherwise remained ignorant’ (Rosen, 2011b, p. 33). Albeit working on a very simple form of ‘program’, these attempts are, in essence, similar to an algorithmic progression.

Despite the similarities between previous New Tendencies processes and information aesthetics, the fact that the computer came to represent all that was wrong with the status quo led computer art to an increasingly precarious position within New Tendencies. The problem of the computer within the movement had two components. The first one, as described above, focused on the image of the computer as a proxy of technocratic capitalism. The second problem, much more mundane, was based on the premise that artists were not, in fact, that much interested in the computer itself. The reason for this detachment is also twofold: not only were computers incredibly rare to come by, given their cost and complexity at the time, but they were also incredibly complex to operate. ‘In effect, only very few New Tendencies artists were so dissatisfied with merely imitating programming “mimetically”, that they actually decided to use the computer as a tool by establishing collaborations with engineers [and yet] fewer in fact learned to program an electronic computing machine themselves’ (Weibel, 2011, p. 47).

It has been argued, for example, that only one artist, Vladimir Bonačić, (temporarily) embodied Cordeiro’s claim that computer art would replace concrete art – yet even he doubted information aesthetics (Fritz, 2011b). Although some would continue to profess the moral superiority of a scientifically oriented art (as in Snow’s calls (Horvat-Pintaric, 2011b).

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177 Thanks to YouTube we can actually see Mavignier demonstrating this kind of ‘program’ today (Galanternick, 2010).
2011[1969]) or the pervasiveness of the computer in society and New Tendencies’ positive relation to it (following Moles’ call (Putar, 2011a)) or yet the possibilities of the technology as envisaged respectively by Nake and Nees (Kelemen, 2011), by the end of the 1960s a change had already occurred. Questions began to appear so frequently that one would be tempted to doubt the whole reorientation towards the computer. Umberto Eco, for example, previously an imposing figure with his *arte programmata*, now would assert that ‘the experiments in aesthetics performed with electronic devices [were] enormously valuable, but not for the future of art’ (Eco, 2011[1969], p. 416). Others raised the question of the discrepancy ‘between the possibilities of programming and the possibilities of realizing program’ (Gerstner, 2011, p. 419). Some, like Metzger, as will be seen in further detail later on, denounced the idea that technology is neutral and called for its responsible use (Metzger, 2011[1969]). Others would even be willing to directly contradict and point to the shortcomings of information aesthetics (Hlavacek, 2011[1969]) or, yet, demonstrate an ‘extreme’ scepticism in relation to it while, at the same time, declaring computer art to be ‘dead end’ (Benthall, 2011[1971], p. 465). Of all objections, however, one certainly surpassed the others. The problem with this objection, in fact a presentation given at a New Tendencies colloquy held in June 1971 and titled *Art and Computers 71*, was not so much its message but its messenger, Nake. Bluntly titled ‘There Should Be No Computer Art’, this presentation, which Nake did not even deliver himself but instead relied on Jonathan Benthall of the Computer Art Society in London to do it, marked, I argue, the end of computer art’s first wave, which lasted from 1965 until 1971. It was roughly from 1971 that the context of attempts at AST, including computer art, would become more and more contested by the artistic world and by the field’s own members. Nake’s text only added to the growing impression that computer art was on the wrong side of the debate, between protesters and governments. If Nake, who some years

178 This source, in fact, it is surprisingly vicious and coherent in its attacks.
earlier had rashly condemned Biasi’s comments, had now become a vocal critic, despite being one of the three pioneers to kick start computer art back in 1965, what was left for other enthusiasts? This text, which will be discussed in more detail in Section 3.3, also highlighted internal fractures within the group. Some months later, in October of that same year, Nake’s presentation would be published in the Computer Arts Society newsletter, PAGE, which was edited by none other than Gustav Metzger, an artist whose staunchly anti-war discourse was nevertheless concerned with the (humanistic) appropriation of technology and science before ‘the entire globe could be wiped out by nuclear, biological, and other weapons’ (Metzger, 2011, p. 422). This backlash, anchored in the increasingly pessimistic and technophobic cultural field of the 1970s and 1980s, would inevitably not only distance those enthusiasts of Snow’s proposal but also anyone willing to merge new technologies or scientific methods into artistic production. As a result, previous and new members who believed in the ideas developed during that earlier period would become more and more isolated. Eventually, as a result of the creation of institutions that could accommodate their artistic and intellectual aspirations, this distance led the group to a situation of relative independence from the larger art world.

### 3.3 Internal conflict and people abandoning the field

Nake’s fiery pseudo-presentation in Zagreb, as previously mentioned, was also published in the Computer Arts Society (CAS) bulletin, PAGE, at the time edited by Gustav Metzger. Before we proceed into Nake’s objections, some context is necessary.  

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179 Not much has been written regarding the foundation and functioning of CAS itself. PAGE, its bulletin/newsletter, is certainly the best source from which to reconstruct the events of the society and its
Brought to life by an informal meeting at the 68th Congress of the International Federation for Information Processing, by participants mostly interested in using computers for musical composition, the society was formed right after _Cybernetic Serendipity_, in March 1969. It was _Cybernetic Serendipity_ that, according to Sutcliffe, ‘helped the CAS to extend its membership, especially among people in the arts’ (2009, p. 181). In order to mark its official introduction, an exhibition, _Event One_, held at the Royal College of Art, was agreed (Lansdown _et al._, 1969; Sutcliffe, 2009, p. 180). That event, like many others in this field, was not particularly well received and, as expected, ‘the art press largely ignored CAS’ (Sutcliffe, 2009, p. 181). Although the tide against computers had already fully turned, and despite the silence from the artistic world, ‘by April 1970 there were 254 members in the United Kingdom and 123 overseas members from sixteen countries, almost half of them from the United States’ (Sutcliffe, 2009, p. 178). The reason for that, argues Sutcliff, ‘was that CAS filled an emerging need, and there was no similar international group’ (Sutcliffe, 2009, p. 178). That, as we know from E.A.T.’s example and AST in general, is just half-truth. Whereas CAS had over 300 members, E.A.T. had, by 1969, ‘over 2,000 artist members as well as 2,000 engineer members willing to work with artists’ (Klüver, 2000). One may argue that the members. Apart from _PAGE_ there is also a number of good articles edited into _White Heat Cold Logic_ (Brown _et al._, 2009), including Ford (2009), Mallen (2009), Sutcliffe (2009) and Swade (2009), which guide us through the anecdotes and motifs of people who were involved in CAS’s early history. This narrative is based on these recollections. Additionally, we can find a lot of information, including most of _PAGE_’s editions, on the CAS’s website (www.computer-arts-society.com) and at the CACHe project, hosted by Birkbeck University (www.bbk.ac.uk/hosted/cache/archive).

According to Sutcliffe, the _Guardian_ largely misrepresented the exhibition by calling it a ‘theatrical outrage’ and ‘a day of programmed japes’. Also according to him, the same newspaper published a response letter from Sutcliffe himself in which he affirmed that _Event One_’s ‘immediate aim [was] to show something of the possible creative uses of computers in a number of arts’ (Sutcliffe, 2009, p. 181).
corporate support explains the discrepancy between the two organisations; after all E.A.T., via Klüver’s industrial links and pragmatic leadership (Dyson, 2009), was indeed very well supported whereas CAS had a much lower profile. That may well be a reason but, as Sutcliffe posits, the reason for this gap lies deep within the proposals of both endeavours. On the one hand E.A.T., from its idea of proposing a link between artists and engineers, had not asked for a deeper engagement with technology or science; it would enable artists to work alongside engineers but the artist would not need to learn the principles behind the chosen technique. That was what the partnership aimed at, since each element, artist and technologist, would contribute their own expertise. On the other hand, CAS, since it was actually much more defined, as a computer society, demanded deeper knowledge from its participants. It would cater, as Sutcliffe proposed, to ‘an emerging need’ – that is, the know-how, the capacity and the support to work with computers. It is easy to forget how difficult it was to get your hands on a computer; needless to say, the skill necessary to work with one was scarcer still. George Mallen, CAS’s first treasurer, for example, records CAS ‘running Sunday morning programming session at Telcomp’s office in London for artists’ (Mallen, 2009, p. 193). Even today, when computers are ubiquitous and programming techniques widely available and much simpler, I cannot envisage many artists participating in such sessions.

181 It is interesting to note Sutcliffe’s (2009, p. 181) explanation regarding the financial backing of ICL (International Computers Limited) in terms of the benefits it caused the company. According to him its head of communication ‘saw computer arts as good publicity’ because it gave the company ‘a human face to an industry that many people saw as threatening’. Dyson (2009) also attempts to explain the support of E.A.T.’s tech companies in similar terms, whereas for Turner (2014) Pepsico got involved with E.A.T. because of its relationship with the counter-culture.

182 Its initial booklet (Lansdown et al., 1969), for example, clearly states as CAS’s ‘first major task’ the ‘mutual education of artists and computer scientists’. Although CAS stressed that ‘there is no need for an
People like Nake represented this kind of artist–programmer, who was (and still is) a rarity within artistic circles. CAS in a sense, because of its close links with the British Computer Society, nurtured this kind of artist engaged with computing and not simply with ‘new technology’, as E.A.T. would do it. Moreover, differently from E.A.T.’s relationship with big artistic names of the time (initially mostly from New York), CAS was not so judgemental in relation to artistic merit. Sutcliffe, for example, affirms that ‘general philosophy in the CAS was to not be judgemental; aesthetics was a word never to be used’ (2009, p. 182). That lack of artistic pedigree, together with the highly demanding computational techniques\textsuperscript{183}, certainly did not help CAS to achieve the kind of popularity that E.A.T. initially had with artists. Its initial booklet (Lansdown et al., 1969), for example, to my knowledge the first material to be published by CAS and where the society was first publically presented, was not composed or signed by artists or people central to the artistic world and had only Reichardt, curator of \textit{Cybernetic Serendipity}, as an art world proxy. The names and their institutional affiliations were John Lansdown (Ian Fraser and Associates), George Mallen (System Research Limited), Alan Mayne (Creative Enterprises Limited), Robert Parslow (Brunel University), Ian Pickering (Architectural Association), Jasia Reichardt (Institute of Contemporary Arts), Beverley Rowe (London University) and Alan Sutcliffe (International Computers Limited).

\textsuperscript{183} Herbert Franke, whose 1971 (reprinted in 1985) book can be seen as one of the first comprehensible publications on the field, in its preface for the first edition highlights that ‘computer art is hindered by a difficulty unknown in other art forms: its practice requires a certain elementary mathematical and technical knowledge’ (Franke, 1985, p. x). It is important to note that Franke and his translator, Metzger, were also CAS members.
Despite all of the achievements attributed to CAS\(^{184}\), it can be argued that Nake’s debate within PAGE, as well as Metzger’s involvement as its editor, were CAS’s most meaningful contributions to the field from a historiographical point of view. There are two reasons for this argument. First, given the importance of CAS for computer art practitioners, and given Nake’s position as a central figure in the newly formed field, since he was one of the three original artists to have exhibitions in 1965, his proclamation against computer art can be seen as a heavy blow for new and late entrants to the field, including CAS itself. The response that it generated (soon to be discussed), today and then, reflects the importance of both the statement and Nake’s position in the field. Second, Metzger’s participation and eventual desertion, which could be seen superficially as a mere curiosity or coincidence, is not only indicative of his wish to engage computers in order to humanise technology (to be discussed next, and similar to Meštrović’s initial position) but is also a reflection of the growing discomfort generated by the union of computers and art.

That both Metzger’s and Nake’s criticisms converge is, nevertheless, surprising. Metzger, for one, was never really interested in computer graphics. He was not interested in programming, nor in its graphical output. Later he would reaffirm this position by stating that he ‘did not see the point of making very crude lines on a bit of paper – which was the computer art of the time’ (Metzger in Ford, 2009, p. 166). For him the computer was the future but not in its present, late 1960s, form (Ford, 2009, p. 166). He would envisage the computer as an ‘integral element’ (Ford, 2009, p. 165) in his practice of auto-destructive art\(^{185}\) but, differently from Nake, who emphasised the computer and its

\(^{184}\) As seen, for example, in Mallen (2009) and Sutcliffe (2009).

\(^{185}\) Notoriously, his involvement with technoscientific methods (and particularly chemistry) can be seen as early as 1960, in his now infamous acid paintings (Wilson, 2008). In a manifesto written a year later he would state that ‘Auto-destructive art and auto-creative art aim at the integration of art with the advances
code, mathematical rigour and algorithmic practice were not what Metzger thought interesting. According to Ford (2009, p. 165), Metzger saw the computer as a possible link, via the artist, between ‘art, technology and society’ (Ford, 2009, p. 165). He would then, via the computer, ‘re-channel the destructive potential of the computer’ (Ford, 2009, p. 165) since, for him, the computer was more than a merely innocent and neutral tool: ‘Today death is fed into, processed and administered by the computers’ (Metzger in Ford, 2009, p. 165). It is indeed ‘impossible to isolate his practice as an artist from his engagement in different kinds of political activism’ (Wilson, 2008, p. 177). Unlike Metzger’s constant anti-war campaign and highly politicised artistic practice, Nake, as previously seen, was never overtly vocal regarding his own political beliefs. The emphasis in his early work, similarly to Bense’s or Nees’s work, is always placed on rationality and/or technical discussions. The first signs (at least in the literature) of Nake’s politics emerged out of his debate with Biasi at Tendencije 4. Yet, of science and technology’ (in Wilson, 2008, p. 187). As Wilson (2008, p. 189) posits: ‘In the following few years, his recognition of an auto-creative art within auto-destructive art, allied to the position he had adopted as an artist who produces no objects, led him to an increasingly close identification with science whereby his view of the studio as laboratory became actual.’ Moreover, Metzger’s earlier involvement with the Signals group, which stated that it catered ‘for all those who believe passionately in the co-relation of the arts and Art’s imaginative integration with technology, science, architecture and our entire environment’ (Wilson, 2008, p. 191), is further evidence of his interest in technoscientific subjects.

186 Despite this, for Nake, Bense’s rationality had a political aspect since it encapsulated the German post-war attitude, which would contrast with the manipulation of euphoria and emotions perpetuated by the Nazi regime. This point was only expressed in his interview with Poltronieri (Nake, 2013) and has never been stated in writing.

187 We should remember that at this debate (Biasi, 2011; Nake, 2011b) Nake stressed, like Metzger, the necessity to engage with technology. For him ‘we should not demonize automata’ since ‘computers exist and we would be making a great mistake if we ran way from them’ (Nake, 2011b, pp. 270–271). When perceiving that Biasi attacked his leftist credentials, Nake reminded his opponent that he ‘could talk about
notwithstanding their artistic differences, both Nake’s and Metzger’s politics would eventually converge. Even before the famous ‘There Should Be No Computer Art’ (Nake, 1971), cracks seem to have emerged between those members of CAS who uncritically supported the computer and those who, like Metzger and Nake, grew wary of it. In a very short notice published in May 1970 in *PAGE*, more than one year before the ‘There Should Be No Computer Art’ text and presentation, Nake publically announced:

**STATEMENT TO PAGE**

I stop exhibiting for the present (last exhibition, in form of a retrospective, with H de Vries at the Swart Gallery, Amsterdam).

Reason: it looks as if the capitalist art market is trying to get hold of computer productions. This would mean a distraction from visual research.

Exhibiting in universities etc., is different as it helps to communicate communications is essential to research.

The actual production in artistic computer graphics is repeating itself to a great extent. Really good ideas haven’t shown up for quite a while.


It is important to read this letter in the context of *PAGE* itself. During its initial editions, one could barely notice any political interest from its editor (Metzger). The first two issues, *PAGE* 1 and 2188 (Fig. 44, 45), were bulletins in the literal sense; they contained nothing more than a few announcements and a repetitive text regarding the society itself. Similar to CAS’s initial leaflet in 1969, both editions mostly talked about the society itself and only added some very few remarks regarding courses, meetings, publications and workshops. However, from its fourth edition (Fig. 46), in August 1969, things changed. Firstly, *PAGE*’s design became more free and less like an advert from a social club. If we did not know better, it would have seemed that Metzger had only become editor then. Some editions, like the ones from November 1969 and July 1971, were

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how we stood in front of gates of factories, how we demonstrated, held teach-ins, built barricades, printed and distributed leaflets’ (Nake, 2011b, p. 270).

188 *PAGE* issue 3 is missing from both the CACHe and the CAS archives.
beautifully designed yet ostentatiously unhewn. Secondly, the content of PAGE, still mostly dedicated to announcements and calls for exhibitions and events, had nevertheless acquired some longer, rather opinionated texts. The first longer article featured in PAGE 4, signed by the artist and founder of the Artist Placement Group (APG), John Latham (1969), discussed, for example, the motifs and workings of his group. PAGE 5 (Fig. 47) had a Wittgensteinian review of Noll’s writings along with a section dedicated to publications received; PAGE 6 explored the computer music of the time (Mathews, 1970) and reviewed the 1969 Association for Computing Machinery (ACM) computer art,

189 In it he stressed that ‘there was a situation where the financial structure virtually controlled the forms of art, that is into “painting”, “theatre” and so on. It had done so because collection of cash required it in those forms. The shop, the gallery market, box office and doors, these devices all led to a belief that there was such a thing. Now, the artists’ decision to make something interesting happen regardless of whether it could pay off – always a key element – has becomes part of the facts of life, an essential in the structures of a total, in contrast to a purely monetary economy’ (Latham, 1969). Ironically, in 1972 Metzger would turn increasingly critical of APG for ‘trying to steer two mutually opposed groups together into dialogue (young artists and powerful corporations)’ (Bishop, 2012, p. 170). Bishop in fact is right on target when she places APG into ‘a familiar tendency during the late ’60s. Early APG documents reference examples in Europe as comparative models: in France, the Groupe Recherche d’Art Visuel, who were sponsored by industrialists interested in the exploitation of techniques and visual phenomena; in Holland, the Philips electricity company worked directly with an artist to make robot art; in Italy, competitions were sponsored by Esso and Pirelli; while in Britain, various sculptors were working in new materials that demanded close collaboration with steelworks (Eduardo Paolozzi), nickel laboratories (John Hosking) and glass fibre manufacturers (Phillip King). In the US, Experiments in Art and Technology (E.A.T.), set up in 1966 by the Bell Labs scientist Billy Klüver in collaboration with Robert Rauschenberg, aimed to bring science to the service of artistic innovation, while on the West coast in the same year, curator Maurice Tuchman established the Art and Technology programme at LACMA’ (Bishop, 2012, p. 166). For more on Latham and APG see Shanken (2001) and Bishop (2012).

190 Which, in its digital version at least, is unfortunately too damaged to be read properly.
Music & Film Festival (Burnham, 1970a)\(^{191}\). PAGE 7 had an article that both presented a computer artwork and called into question, from the point of view of an art professor, the necessity of artists engaging in and learning programming (Nash and Williams, 1970).

It was only in May 1970, in PAGE 8, more than a year after the first edition was published, that Metzger published Nake’s statement. That edition of PAGE is particularly interesting not only because of Nake’s first sign of dissatisfaction with the field he helped to create but also because of some other small notes scattered here and there. At first sight the first small note, besides Nake’s statement, does not seem to relate to that personal take on the field. That would be wrong. The editor in fact seems aware of this connection. This small note described CAS’s participation in an event that just had happened, the Computer Graphics 70 international symposium, held at Brunel University between 13 and 16 April 1970. According to the specialised press the event would concentrate ‘on the various applications of graphic systems’; furthermore, ‘firms participating in the exhibits are expected to demonstrate and discuss fully interactive graphic display, alphanumeric display terminals, hard-copy plotting and automatic drafting machines [etc.]’ (Computer World, 1970, p. 46). Moreover, according to the same article and a quoted survey, Computer Graphics 70 (CG70) was responding to a ‘strong delegate interest in applications’ and, hence,

the provisional program schedule includes the following: Computer Graphics Comes of Age, Economic and Other Fundamental Issues Facing Computer Graphics, management information systems, computer-aided design, hospital information and monitoring systems, computer-aided instruction, architectural applications, new hardware display techniques, data structures and remote displays, graphics languages, computer-generated animation, text processing, and pattern recognition. (Computer World, 1970, p. 46).

\(^{191}\) Note that the author, Burnham, was the curator of the troubled Software exhibition previously mentioned. Following his relatively positive review of the ACM show, since it was plagued by some technical difficulties, a problem too common then and now in this kind of show, Burnham also talks about his own exhibition.
Despite the myriad subjects, the small article did not contain a single reference to CAS’s activities. It seems, retrospectively, odd for artists so socially concerned to exhibit in such an environment. At the same time, who would believe that engineers would be interested in the crude plotted graphics produced by many members of CAS? Nevertheless, in Metzger’s words, ‘according to the lady in charge of the Press Room at CG70, there was a greater demand for off-prints of papers by members of the Computer Arts Society than any others’ (Metzger, 1970a). The attentive reader may then question: Where is the connection between CG70 and Nake’s statement? CG70 after all, despite being narrated by Metzger as a success, seems more similar to a trade show where companies could showcase their technology, CAS’s participation just an out-of-the-ordinary situation that, invariably, seemed exiting to bored delegates. The connection between CG70 and Nake’s statement, I believe, is clear: Nake did not sign the statement from Stuttgart or Montreal (where he had been working alongside Leslie Mezei) but instead from London. More surprising still is that the statement is dated exactly on same day as the last day of the symposium, 16 April 1970. Not only that but Nake was also one of CAS’s international members present at CG70 (Metzger, 1970a). Hence we can infer that Nake’s statement was written on his way back to London from Uxbridge, on his way home to Brunel University or even right before the end of the symposium itself. Perhaps following Metzger’s enthusiasm for the CAS session at CG70, which, despite involving members of industry, was held in an academic environment, Nake decided to abandon what he termed as the ‘capitalist art market’ (Nake, 1970). It seems that the academic world where he presented had become more engaging for him since, in his view, ‘the actual production in artistic computer graphics is repeating itself to a great extent. Really good ideas haven’t shown up for quite a while’ (Nake, 1970).
Despite claiming he would halt his artistic activities and instead would focus on ‘visual research’\(^{192}\) (Nake, 1970), Nake would participate in one last exhibition in June of that same year and this time it was a big one: the 35\(^{th}\) Venice Biennale. It seems that, since the statement for *PAGE* was written some forty days before the Biennale’s opening and assuming that, given the complexity of such exhibitions, Nake would have been engaged with it way before his statement in April, his statement can be seen as addressing the fact that computer art would heavily feature in that same event. In 1970 the Biennale\(^{193}\), arguably the central event in the art world calendar, was not a simple, business-as-usual event. First and foremost the 1970 show was an answer to the 1968 protests that had troubled its previous iteration. Answering calls for a ‘democratisation of art’, this Biennale attempted ‘an exhibition entirely devoted to “experimental art” and included a large selection of early computer art [that] st[ood] between the apolitical shows organized in English-speaking countries […] and the more politically driven shows organized in the Eastern European block, in particular Zagreb’ (Franco, 2013b, p. 120). Franco stresses that the Biennale’s proposals did not, however, manage to dispel attendees’ discomfort at the computers within its settings\(^{194}\). She summarises the problem:

\[^{192}\text{Not coincidentally the subtitle for the first *Tendencije 4* colloquium.}\]
\[^{193}\text{Francesca Franco has dedicated a whole thesis to this subject. It was reprinted as short articles in Franco (2013a, 2013b).}\]
\[^{194}\text{As Franco posits: ‘In presenting the experimental show the organizers, especially Apollonio, demonstrated a defensive attitude […] To confer the experimental show academic recognition, Apollonio invited a number of internationally renowned scholars to contribute to the exhibition catalog. These included German philosopher Max Bense and Swiss art historian René Berger. Most of the Italian contributors to the 1970 Venice Biennale’s general catalog demonstrated a cautious and sometimes fatalist attitude toward the relationship between art and technology’ (Franco, 2013b, p. 125).}\]
On the one hand, computer-generated art was considered by most of the contributors as a positive alternative to the dominance of technology over humankind and to consumerism – in other words, a new way to express the vital function of art in society. On the other hand, this positive attitude seemed to coincide exactly with the emergence of the first symptoms of the problem related to the commercialization of computer art. (Franco, 2013b, p. 128)

More important for us is the fact that, as noted by Franco (2013b), Nake was not alone in seeing the increasing commercialisation (in the Venetian context) of computer art. Another computer art pioneer would lambast the field in January of that same year. Haruki Tsuchiya, of the Computer Technique Group in Japan, would publish a letter in which he stated that: ‘This may be an exaggeration, but I say that computer art is a revolt against the whole of technology […] Today, new relationships between engineers and artists are expected for computer art. It has become a thing of the past for me’ (Tsuchiya in Franco, 2013b, p. 129). Even in PAGE 8 itself, Metzger, in another small note, this time regarding the upcoming Biennale and its computer involvement, sarcastically introduced the exhibition by questioning the reader and recalling the previous problems faced by the Biennale: ‘Remember the cops; the rioting students the protesting artists in 1968? Well, the Venice Biennale will open its doors for the 35th time around 25 June this year’ (Metzger, 1970b).

From PAGE 8 onwards the tension between internal critics, eager to point to the shortfalls of computer art both as an artistic practice and as a moral problem, and internal supporters, who pointed out that using computers in the arts was an experiment and that we ought to engage technology in order to humanise it, would only become more apparent. Moreover, as seen in Tsuchiya’s example and in the discussion above of New

195 Another way to rephrase this dichotomy would be to posit both extremes on a spectrum where, on one end, people perceived technology (and science) as value-free (i.e. mere tools whose good or bad uses are determined by humans), and, on the other end, those who argued that computers and their industry were
Tendencies, the growing questioning was not only seen among previously politicised artists such as Metzger (UK) or a disgruntled German pioneer (Nake). For example, the next PAGE, issue number 9, edited by the CAS’s Dutch branch, CACHe, announced a colloquium self-explanatorily named ‘Creative Expressions of a Society Conflict’; contained a coded game named *Netherlands in 2 Minuten* in which the reader deciphers a message in Dutch highlighting contemporary problems (apartheid, babies, computers); and reprinted a comment by a ‘Philips computer man’ that declared that ‘the use of computers may delay the fall of a police state by one century’, a pessimistic sentence to which the editors added, ‘By how much may it advance its rise?’ (Geurts and Meertens, 1970). Over the course of the following editions a certain ironic attitude regarding the main focal point, the computer, would coexist alongside unabashedly positive articles. In *PAGE* 11, for example, one year before Nake’s controversial article, Metzger published another long piece titled ‘Social Responsibility and the Computer Professional: The Rise of an Idea in America Part 1’ (Metzger, 1970c). Metzger, drawing on his previous preoccupation with nuclear disarmament, attempted a quantitative study of the pages of the *Journal of the ACM*, the journal *Communications of the ACM* and the magazine *Computers and Automation* (Metzger, 1970c). In this article his objective was to trace the number of times the computing industry appeared in those publications in relation to the creation of weapons of mass destruction and other ethical issues. From 1955 to 1970 he counted the instances of such discussions in the pages, months, editions and years of those publications in order to demonstrate the development and increase of ethical issues within the industry itself. His intention was not only to trace this increase but also to

nothing but charged with intentionality, and had been since prior to the tools themselves, and hence were inherently bad for society both as proxies of a capitalist system and tools for mass murder.
‘enable the movement to make further progress’ (Metzger, 1970c). It is important to remember that Metzger never seemed an easy fit for CAS. Although publishing in Reichardt’s collection (Reichardt, 1968b) and participating in the exhibition, he had previously criticised *Cybernetic Serendipity*. In the same article where he criticised *Cybernetic Serendipity*, he would also call for ‘E.A.T. to refuse to collaborate with firms producing napalm and bombs for Vietnam. (Of course, practically any technically advanced industry in the big nations contributes directly or indirectly to war preparations – here is the central and irresoluble dilemma of technological art)’ (Metzger, 1969a, p. 108, italics in the original).

If Metzger’s ‘central and irresoluble dilemma’, a moral one, was what troubled him, Nake would focus his criticism on the artistic merit of computer art as well as the morality of art itself. In *PAGE* 18 (Fig. 48), when he published the lecture given by Benthall in his place at one of the New Tendencies colloquies, Nake would describe

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196 Tellingly, as Ford highlights (Ford, 2009, p. 173), there was never a Part 2 of this text. Moreover, also noteworthy was the fact that it was distributed at CG70, which, in turn, was attended by ‘key representatives of the military–industrial complex: General motors, Lockheed Georgia, Mobil Oil Corporation, Royal Navy, Ford Motor Company, Space Flight Center, Boeing, Sperry Rand and Unilever’ (Ford, 2009, p. 169).

197 Metzger’s condemnation, also highlighted by Ford (2009) and used as the title for his informative text ‘Technological Kindergarten’, is pretty straightforward: ‘We are faced by this prospect – whilst more and more scientists are investigating the threats that science and technology pose for society, artists are being led into a technological kindergarten’ (Metzger, 1969a, p. 108, italics in the original).

198 The differences between the version of the lecture that is transcribed in *A Little-Known Story* (Rosen, 2011a, pp. 466–468) and the *PAGE* version are minimal. The whole content and the central idea, that computer art was artistically useless and that art itself was corrupt, are intact. The lecture was given in June 1971 and the *PAGE* article was published in October of the same year. Since *PAGE* did not have numbered pages, I will refer to the transcript, which should make it easier for readers to check references and direct quotes.
the field of computer art as an emergent one, highlighting the change from the small 1965 exhibitions into the larger 1968 ones. He remembers that, since then, ‘Art magazines are full of articles, exhibitions are held everywhere, seminars are offered by art schools, books are published, portfolios are sold’ (Nake, 1971, p. 466). As for the artists themselves, he notes that either they ‘surrender to the pressures of the new techniques or laugh at the results’ while being ‘humiliated by the attitude of scientists when they attempt to communicate with them’ (Nake, 1971, p. 466). In this context, he posits that ‘debate centers around the question “Is it art?” [and hence] the discussions is heated, often extremely ignorant and biased, shows virtually no progress, and is highly repetitive, although […] the little knowledge of computers that one needs was published several years ago’ (Nake, 1971, p. 466). Also remembering he has seen it all, being one of the initiators of the field, he straightforwardly remarks that he found it ‘easy to admit that computer art did not contribute to the advancement of art, if we judge advancement by comparing the computer’s products to all existing works of art’ (Nake, 1971, p. 466). For him ‘the repertoire of results of aesthetic behaviour has not been changed by […] computers’, and, despite some ‘new interesting methods’, computer art amounted to nothing more than a fashion (Nake, 1971, pp. 466–467). Returning to the motif seen in his previous note in PAGE 8, he blames the artistic system via the figure of the art dealer and sees computer art as:

emerging from some accident, blossoming for a while, subject matter for shallow “philosophical” reasoning based on prejudice and misunderstanding as well as euphoric overestimation, vanishing into nowhere to make way for the next fashion. The big machinery, still shrouded in mystical clouds, is used to frighten artists and to convince the public that its products are good and beautiful. Quite frankly, I find this use of the computer ridiculous. (Nake, 1971, p. 467)

Given that artists, emphasising the concept of ‘real’ artists, were sometimes comprehending and accomplishing ways to bypass the traditional artistic system, Nake particularly found it odd that ‘outsiders from technology’ would step in to attempt to
rescue the world of art ‘with new methods of creation, old results, and by surrendering to
the given “laws of the market” in a naïve and ignorant manner’ (Nake, 1971, p. 467). Questions such as ‘Is a computer creative?’ or ‘Is a computer an artist?’, which as we
know have accompanied computer art from its beginning, were not ‘deemed serious
questions, period’ (Nake, 1971, p. 467). In fact, given the problematic state of the world,
Nake saw those questions as ‘irrelevant’ (Nake, 1971, p. 467). Because of its irrelevance,
he believed that there was no need for art anymore and, in particular, there was ‘no need
for computer art’ (Nake, 1971, p. 467). Going back to the New Tendencies concern of
research, or artistic investigation, as in the subtitle of the first Tendencije 4 colloquium,
Nake thus found that this research ‘should be directed by the need of the people’ and not,
as in the traditional artistic setting, ‘for the rich and the ruling’ (Nake, 1971, p. 467).
Nake’s criticism, albeit different in emphasis from Metzger’s usual critique, definitely
seems to have touched **PAGE**’s editor. Although it was not in itself a novelty, Metzger’s
design dedicated ample space to ‘There Should Be No Computer Art’; it ran
uninterrupted for the whole first page, interrupted only by a picture of another artist,
Gottfried Jäger, holding one of his own prints (of unknown origin to the editor). In this
picture Jäger’s print covers most of his body, leaving only his barefoot feet and face; a
cheeky caption for the photo questioned the reader: ‘The Emperor hath clothes?’ (Fig.
48).

Metzger, despite his constant questioning and criticism, was never (at least as far
as the literature is concerned) told off. In fact CAS seemed to regard him as a kind of
moral compass, someone who would provide its ‘social conscience’ (Mallen, 1972a), as
if there was a need for someone external to computers to think over the social issues that
‘insiders’ would disregard. If Metzger, himself considered the moral compass of CAS,
was never clearly contradicted, the same cannot be said of Nake’s positioning. For at least
a year after ‘There Should Be No Computer Art’ was published, letters would still be
published answering his criticism. To my knowledge, no other commentary in the early field reverberated as much, as long and as publically as this one. Two months after its publication, in PAGE 19, which was not edited by Metzger but rather by the CAS chairman, Alan Sutcliffe, himself (Sutcliffe, 1971), a rather direct and antagonistic answer was given to Nake. Written by John Lansdown, at the time secretary of CAS, ‘Computer Graphics ≠ Computer Art’ attempted to counter each of Nake’s arguments regarding computer art but, nevertheless, steered away from the moral issues of art itself, ironically the central point of Nake’s discussion. Lansdown began his reply by remembering the importance of Nake’s position. According to him, ‘no-one who takes an interest in the aims and objections of the CAS can afford to ignore anything that Frieder Nake says. His note in PAGE 18 is an important personal statement which has to be taken into account by anyone who devotes any part of his life to the “creative” use of computers’ (Lansdown, 1971). Yet, according to him (italics in the original):

Nake has fallen into the same trap which ensnares so many writers on the subject: that of equating computer art with computer graphics […] If this were not so he could not make the statement that ‘the repertoire of results of aesthetic behaviour has not been changed by the use of computers’. This may be the case in graphics: it is certainly not the case in the rest of the field […] The work of computer-composers not to say Metzger’s as yet unrealized ‘Five screens with computer’ should not be ignored in this context. In every case ‘the repertoire of results of aesthetic behaviour’ has certainly been changed by the use of computers […]

199 People would criticize and partially support him in PAGE 19, 21, 22, 24, 25, 26 and 27. Some of these will be seen shortly. The discussion, usually in detriment to Nake’s position, was followed by attacks from John Lansdown (CAS secretary and founder), Alan Sutcliffe (CAS president and founder), John H. Whitney (artist/animator and first IBM in-residence artist) among others.

200 I suspect, following Lansdown’s tentative title and arguments, which in effect distanced the plotted graphics of early practitioners from those interactive objects discussed by him as the true form of computer art, that Herbert Franke’s seminal 1971 book Computer Graphics – Computer Art was its influence. The difference between the symbols (≠ and –) does not seem to be a mere coincidence since in PAGE 20 Franke would also partake in the discussion generated by Nake’s text.
However, unlike the graphicists to whom the output is of prime importance, many of the ‘Proceduralists’ of which I count myself a member, feel that, in computer art more than any other, the object is the process. We see the computer as a device for performing procedures and this is not quite the same as Bense’s ‘Art as a model for art’. (Lansdown, 1971)

Lansdown, by providing examples of computer art that do not have a graphical output, dismisses Nake’s arguments regarding the non-contribution of computers for artistic means. What he is trying to show is that, differently from Nake’s assumptions, there were indeed new aesthetic possibilities only made possible by the computer. As we have seen, despite also being critical of computer art, Metzger’s attack was allowed, even supported, since it did not claim the end of computer art. Nake’s position, however, was much more directed at the field itself. It claimed not only that computer art did not contribute aesthetically to art but also that, by serving the usual art market or its business-as-usual model, it had become a concept that should simply cease to be. This view was obviously bound to clash with members of CAS; they, after all, argued for a computer art. Lansdown in the same article, for example, dismissed the idea that British computer artists were interested in graphics. Without pointing at Nake’s German heritage, via Bense’s and Nees’ emphasis on graphical output, Sutcliffe recalled a CAS exhibition dedicated to graphics where he noted that there were no British artists involved. At the risk of alienating CAS’s international element, Lansdown affirmed that: ‘We in Britain seem less concerned with graphics than with music and works for performance’ (Lansdown, 1971).

As important as Lansdown’s arguments are, it is also important to note the absence of any argument against Nake’s moral criticism, which was directed at art itself and not at computer art only. Over the following issues of PAGE, replies were also focused on the definition of computer art instead of being discussions of art itself. What should have been a discussion of the position of the artist became instead a discussion of who was an (computer) artist, about who produced interesting works and about what computer art should be. In PAGE 20, for example, in an indirect contribution to the
discussion (since he did not name Lansdown or Nake directly), Herbert W. Franke, artist, scientist, writer and the first historian of computer art, would highlight the dangers of ‘artificially created boundaries’ between computer art and other ‘areas’ (Franke, 1972). In PAGE 22, the first issue made by CASUS, the American branch of CAS, its ‘U.S. Chairman of Visual Arts’, Gary William Smith also pitched in on the conversation. ‘Having recently become involved in the creation of computer assisted art’, he agreed with Nake’s statement that ‘there should be no computer art’ (Smith, 1972). His reason for this, however, was not related to Nake’s moral arguments. For Smith, the artist should take the blame for being commodified since ‘if an artist produces work of sufficient strength and integrity, no art dealer can turn it into a shallow fashion’ (Smith, 1972). Moreover, his problem with the label ‘computer art’ was a problem of someone ‘involved with art nearly all [his] life’ (Smith, 1972): computer art, for him, was just art; the prefix ‘computer’ should not negate it being subject to the same ‘rigorous standards’ as non-computer-assisted art (Smith, 1972). In PAGE 24, another artist, John H. Whitney, who was an IBM artist in residence by then, asserted that:

the computer is quite useless as a tool for that kind of art which must exist as a static image […] Smith, Nake, Maurice Tuchman and many others, including editors of engineering oriented computer trade journals, are entranced with the ‘real’ artist syndrome: If only a real artist could use the computer – we’d have real art. (Whitney, 1972)

Sometime before these criticisms Nake himself had replied directly to Lansdown’s commentaries. As early as PAGE 21 he tried to clarify his arguments by backtracking on some of his assertions regarding the changes to the ‘repertoire of results of aesthetic behaviour’ (Nake, 1972) – that is, new forms of aesthetics being created

\[\text{201}\text{ He described Nake as being the ‘somewhat […] great old man of computer assisted art’ (Smith, 1972).}\]
because of the computer. Nake’s mea culpa, since for him these changes were never significant, only served the purpose of reinforcing his main argument that ‘the results of computer art should be re-interpreted’; that computer art aesthetics should bring ‘art back to the world’; that ‘traditional’ art (its system) was ‘tied with the bourgeois class’ etc. (Nake, 1972). Sarcastically titling this answer ‘Technocratic Dadaists’, Nake affirmed, that, if his call were not answered, the computer artists would:

deny and replace the traditional ways of artistic production and see this as a revolutionary step; but, in effect, they only create a new artistic style – nothing more. The Dadaists were bourgeois; they honestly believed in their revolution; they ended up with just another style whose products can be sold and assigned a place in bourgeois art history. (Nake, 1972)

As we have seen above, Nake’s clarification fell on deaf ears. The field that he had inaugurated together with Bense, Nees and Noll had moved on. By 1971 it had become chaotic and heterogeneous, as more and more people flocked into the field, each proposing a different view, understanding and definition of that strange artistic production. Not only was there a larger trend towards engagement with technology in particular and science at large, as seen in the US, but also gone were the days when Bense or Moles, for example, would be seen as central theoretical figures by European participants. Moreover, in culture at large, the optimistic, naïve and utopian attitude towards technology, which invariably had been responsible for the 1965 events in the first place, had all but vanished. Rosen reminds us that Bense’s theories were created against a background of ‘unconditional acceptance of the way of life of western industrial states after the Second World War as technical existence’ (Rosen, 2011b, p. 31). At the end of the 1960s, however, this very same assumption was being questioned not only within the field of computer art but also by civil society at large, and in this context Bense’s

provocation of bourgeois post-war culture by mathematical aesthetics had lost its edge in the politicized atmosphere of 1968/1969. The clash between Joseph Beuys and Max Bense during a panel discussion in Düsseldorf in 1970 was the
visibly spectacular finale to the project of a rational, mathematically oriented aesthetics that had sought to demystify art and the artists. (Rosen, 2011b, p. 39)

Not only there were internal cracks within the movement, given the different ideas proposed by new members, but outside pressure also affected its internal configuration. The examples provided here are but a few. There is nothing, however, that better illustrates the disappointment of a great part of the AST field than the mass demobilisation that followed the end of the 1960s. Metzger, who never managed to finish his Five screens project, abandoned PAGE in November 1972 in its twenty-sixth issue. After that, as Ford highlights, ‘the subsequent issues of PAGE veered away from overtly political issues’ (Ford, 2009, p. 173 note 28). Nake would abandon the field until 1984, returning only after the collapse of the Soviet Union; during that time, he would hide his past involvement with computer art (Nake, 2013, 1h 48min). Nees would continue to develop his work as an engineer rather than as an artist (Nake, 2013). Noll, despite saying that ‘in the early 1960’s the digital computer offered great hope’ (Noll, 1970, p. 10), would in 1970 affirm, remembering 9 Evenings, that ‘artists could not cope with technology’ (Noll, 1970, p. 13) and that ‘unfortunately, science and technology have become exploitable commodities used as artistic gimmicks’ (Noll, 1970, p. 12); he later went back to academic and engineering work, as shown by his own website (Noll, 2015) and by Nake’s recollections (Nake, 2013). Mezei, an important figure in the North American scene, would by the late 1970s completely abandon academia and the computer in order to dedicate himself to becoming a multi-faith minister (Nake, 2005b). For Mezei: ‘Computer Art, as many new endeavors, [had] reached a plateau of stagnation after an exhilarating start full of promise […] In any case no exciting new ideas and results have appeared in the last few years; the next wave of creativity in this field is probably still a few years away’ (Mezei, 1976). ‘While the seeds of his disenchantment with Art and Technology [could] be seen’ already in 1969 (Shanken, 2001, p. 118), Burnham, organiser of the Software exhibition, would in 1980 publish a self-explanatory article
titled ‘Art and Technology: The Panacea that Failed’. In it he would enumerate the failure of previous AST attempts, such as E.A.T., *Cybernetic Serendipity*, CAVS and ‘Maurice Tuchman’s five-year symbiosis at the Los Angeles County Museum (1967–71)’, namely the ‘Art & Technology’ program (Burnham, 1980, p. 242). In retrospectively looking at these developments, in 1980, Burnham concluded that ‘only within the past ten years have we begun to accept the possibility that technological solutions are not universal panaceas’ (Burnham, 1980, p. 246). Helmar Frank, a former PhD student of Abraham Moles (Klütsch, 2007b, p. 421) and later an active participant in information aesthetics, nevertheless ‘gave up and concentrated on education and psychology’ (Nake, 1971).

Jonathan Benthall, a critic who had had a column on art and technology at *Studio International* and was, together with Metzger, one of the signatories of the Zagreb Manifesto (seen previously), left the field to concentrate on anthropology. In his words: ‘I later felt I had exaggerated its [artificial intelligence, technology] importance from a philosophical point of view […] I left because I felt avant-garde contemporary art led to a dead end […] you have to go to a lot of blind alleys before you find anything interesting’ (Benthall, 2012, 18min); Benthall would leave the field in 1974 – like many others, never to return.

### 3.3.1 Conventions: Why conceptual but not computer art?

Seen retrospectively, it is incredible that computer art survived the late 1960s and early 1970s. Not only was the field plagued by internal conflict over its own definition and self-criticism but the larger artistic world was not kind to it either. The technophobic cultural shift of the late 1960s, which had caused some members to propose a new direction for the field, had also positioned the larger artistic world in diametrical opposition to AST in general and not only computer art. Moreover, the exogenous
cultural shift that had affected the discourses arguing for art, science and technology was also responsible for changes in some AST artworks themselves. In other words, even works of computer art started to change around this time. From abstract compositions based on pseudo-random generators, resembling those products of concrete and constructivist artists, the new production that started to emerge was beginning to experiment with figurative and sometimes explicitly political subjects. Perhaps the most famous example in the literature is Charles Csuri’s Random War (Fig. 49, 50), from as early as 1967, where images of toy soldiers are randomly distributed over the paper and divided into two opposing factions: one red and the black. Stretched across the page are the names of those soldiers and the result of their imagined conflict: dead, missing, injured etc. ‘Ohio State University administrators, faculty, and staff, as well as famous people of the time, such as Ronald Reagan and Gerald Ford, become soldiers in Csuri’s Random War, clearly suggesting war’s indiscriminate nature’ (Glowski, 2006, p. 76). Winner of the 1967 Computer and Automation contest (of which the previous recipients were Nake in 1966 and Noll in 1965) with another figurative work, Sine Curve Man (Fig. 51), Csuri may be seen as anticipating the problems facing computer art. Instead of presenting the geometric abstractions of early winners and participants, as in Nake’s and Noll’s case, Csuri won the prize with a rather disturbing decomposition of a man’s face.

In the same year, in 1967, his computer animation ‘Hummingbird received an award at the fourth International Experimental Film Competition in Brussels. Thereupon, the Museum of Modern Art in New York purchased the film for its permanent collection’ (Rosen, 2006, p. 39). Csuri was quite different from most early computer artists. He had a classical artistic education but at the same time had fought in the war, and the National Science Foundation financed his projects in the same way most military research was
done at the time. What differentiated him was his understanding of the computer as just another tool. As Rosen explains:

Charles Csuri’s concept of art only seemed to resemble the militant ideas of ‘the computer as artist.’ Csuri never called into question the authority of the human artist. He did not cultivate the rhetoric of the extinction of the subject, of a transhuman art. As much as he explored the computer, the machine itself as a symbol of rationality and discipline never stood in the centre of his reflection. The computer was a tool, which he tried to master and enhance. Foremost in his mind was that the relationship between man and machine was always, to a certain degree, reciprocal, and that in the process of taming, so to speak, the one who tames is transformed as well. (Rosen, 2006, p. 40)

Despite showing an alternative to computer art done at the time, by not alienating his art from the social context of the time and by seeing the computer as just another tool, Csuri, because of his attachment to the computer and despite his early successes in traditional artistic institutions, was nevertheless seen in the same way as other computer artists of the time. He recalls the situation as one of intellectual isolation:

Nobody in the art would talk to me […] and it took me three years before I could get a paper published on the ideas of computers and art [When] I finally got published, guess where? In the International Journal of Electrical Engineering. In hindsight […] I can’t believe I was not kicked out of university. (Csuri, 2009, my translation)

As in Brown’s ‘kiss of death’, Csuri felt that the very mention of the computer revolted people and alienated him from his artistic peers. These terrible reactions compelled Csuri to produce a whole series of drawings reflecting the attitudes he faced. Hosted at The Ohio State University’s Charles A. Csuri Project (Advanced Computing Center for the

Another already established artist who later migrated to computers was Harold Cohen. Coincidentally, his work as also supported by the National Science Foundation (Feigenbaum, 1984). However, Cohen had a completely different take from Csuri on the relationship between artists and computers. For more see Nunez (2015).
Arts and Design, 2007), these sketches portray demons, dismembered people, computers and automatons in a macabre fashion that reminds one of early medieval drawings (Fig. 52, 53). However, no other item in this same collection more represents the antithetical nature of computers and art than a letter from Artforum. An attempt to present the work of Csuri to its editor failed miserably: ‘When Matthew Baigell, assistant professor at the Art History Department of The Ohio State University, in 1967, sent an article to the journal [discussing Csuri’s works], he received a two-sentence answer from Philip Leider, one of the editors, which illustrates the atmosphere in those days’ (Rosen, 2006, p. 40). Because of Csuri’s attachment to the computer, and despite his early successes in traditional artistic institutions, the letter read: ‘Thanks for the enclosed manuscript on Chuck Csuri. I can’t imagine Artforum ever doing a special issue on electronics or computers in art, but one never knows’ (Leider, 1967).

The fact that Csuri was rejected by the art world is not surprising. Apart from the bad reputation given to computing at the time, something else, this time endogenous to art world concerns, was at play. Computer art, given its novelty (and perhaps even today), required a specialised kind of knowledge that no one in the traditional arts possessed. Despite the theoretical efforts of Burnham (1968a, 1970b), Reichardt (1968b), Youngblood (1970) and many others, active participants in the traditional art world who attempted to justify computer art or AST attempts, computer art introduced a lingo that was not part of the artistic vocabulary. Each one of these (and others) had developed a line of thought that justified the computer as a natural development within art history203. I

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203 As Taylor correctly points out, ‘what becomes apparent is that commentators follow the modernist convention of historicising “new” artistic trends by showing how they had evolved from past forms. Computer art, which at the time was an incommensurable object, was given legitimacy through its connections to the modernist movement and was thus authenticated within the history of art. In the future, conceptual art and the history of photography would also be employed to legitimise the claims of computer art’ (Taylor, 2004, p. 78). Some of these attempts will be seen over the course of this section.
will not attempt to map all these arguments since this would render yet another thesis. What I want to stress, however, is that, despite this effort, computer art did indeed present serious problems for art world participants. Exogenous cultural factors may have played an important and crucial role in determining the fate of AST but we should not in any circumstances forget that the conventions of the art world were (and are) not ready to accommodate this kind of artistic proposal; that is, the art world lacked even the most basic understanding of what a computer was, let alone of computer art and its algorithms.

‘Conventions’ may seem a derogatory word for some. After all, the very logic of avant-garde is supposedly focused on the overpowering of old conventions in favour of new, challenging ones. The truth, however, is that not all conventions are thrown out when a new style emerges. I am not, then, talking about stylistic conventions but of deeper, simpler and mundane ones. Let’s picture a scenario where we have side by side a collection of artworks hung on a wall. They were produced over the past two hundred years and, loosely, represent different points in the history of art. Let’s assume that they are, for example, neoclassical, romantic, impressionist, expressionist and cubist paintings. When we stand within a hall and look at them, the changes between neoclassical, romantic, impressionist, expressionist, cubists and so on may seem revolutionary and, in an art historical sense, they certainly are. The problem here is that between all those changes, between all those pictures, some conventions persisted: they are all artworks, paintings in our case, realised via a technology of pigments and brushes, conceived by a unique individual, usually within the confines of a rectangular area, mainly on canvas, and later framed and exposed on a wall either privately or publically. Stylistically these artworks may be completely different and a world apart, but their basic features nevertheless persist. By and large computer art, when initially produced in 1965, mimicked those conventions. We should be not surprised, again, that Nake’s and Noll’s earliest experiments were done with previous artistic styles in mind, those of Klee and Mondrian respectively. Neither should we be surprised that they hung their works on a
wall and called them art: that was what people did when they created pictures. Now, for Nake, Nees, Noll and other computer artists, there was no question regarding their situation. They had written a program, a logical and algorithmic description of processes, which in turn resulted in the pictures seen at the time. The creation of the artwork was theirs and not, as people saw, the computers’. However, for the general public and for the art world’s traditional members, that was never a clear fact. They never understood that computers were stupid things, only capable of very fast calculations, that could not think for themselves. These simple programs did not account for intelligence, ever. Even some computer artists got mixed up about this. Taylor reminds us that ‘Noll’s Mondrian Experiment had questioned the belief that creativity is “the personal and somewhat mysterious domain of man”’ and that ‘Kawano felt that the computer artist never produces the work of art; rather the computer [does], programmed with “artificial creativity”’ (2004, pp. 78–79). Some like Bense, albeit for different reasons as seen earlier in this text, helped to portray this idea of artificial intelligence – which in a sense equates to imagining the machine as an intentional agent – by proposing the term ‘artificial art’. Retrospectively, it was only in some circumstances that it became clear that the computers did not have agency, as exemplified by Nees’ ‘controversial’ answer.

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204 This is a subject that, in itself, would result in another thesis. Luckily for us Salah (2008) does very good work in mapping out the philosophical discussions regarding machine agency, which, in fact, is attached to the very notion of consciousness. Her *Discontents of Computer Art* is the perfect introduction for those interested in both the philosophy of the discussions and its relation to computer art.

205 A point that artists still disagree upon, including it seems Harold Cohen, up to his death in April 2016.

206 Taylor reinforces this narrative, of computer creativity, by recalling a quote from an influential artificial theorist, Marvin Minsky, which proposes that ‘human creative process is no different in kind from what happens in their machines. An artist has an algorithm in his head just as much as a computer does. They go on to dismiss free will as an illusion, no different from random choice, so the chance element in their programs should complete the equivalence of human and computer artistic creation’ (in Taylor, 2004, p. 86).
in that first exhibition of 1965; and, as we know, even then that was not clear enough.

The confusion over whether a human or a machine had created the artwork perhaps did more harm to the field than any other misunderstanding. It would create the intolerable situation of, firstly, computers threatening a perceivably (very) human activity and, secondly, breaking a key convention: that of human agency. *Art, after all, is produced by humans and not by inanimate objects or animals.* People had questioned the authorship of art before, but never had the human been completely taken out of the picture (no pun intended)\(^{207}\). As Rosen explains,

> the art audience was at a loss with computer-generated art. Ken Knowlton described this perplexity: ‘The machinery which intervenes between artist and viewer precludes a great deal of normal communication. Even at the first stage – the punched card – one cannot tell whether the card was punched tenderly or in fury.’ For those who had no insight into the computing process, computer art remained largely inaccessible. In addition to this helplessness resulting from a lack of knowledge on a technical level, the aesthetic theories of computer art did not enter the contemporary art discourse beyond a more general discussion of art and technology. No cultural authority tried to challenge computer art’s aesthetic, to develop it and to spread a certain understanding. (Rosen, 2006, p. 40)

In the socially charged and increasingly technophobic atmosphere of the 1960s, people felt threatened by computers perhaps as much as by nuclear annihilation. That was very obvious, for example, in the works of science fiction novels. Salah, whose observations concur with my interpretation that computers threatened the convention of human agency in the arts, demonstrates, for example, that:

> the striking fact in these [science fiction] stories is that no matter how much a robot tries, it can never become human [and is] almost always pictured as capable of mimicking humans and having human faculties […] The fear of computers, the fear of intelligence in an ‘other’ that is capable of thinking and creating, played a role in forming a certain reluctance to associate any kind of art with

\[^{207}\] Perhaps the most vocal supporter of an artificial intelligence program in the field was Cohen and his AARON software, which has been continually updated over the years. For more on Cohen see McCorduck (1990).
computers in the public mind. Obviously, there were other problems, most importantly the fact that a normative definition of art involves the intentions of the artists. (Salah, 2008, pp. 35, 42)

Salah’s ‘normative definition’, a convention by all means, although it speaks of a convention regarding art itself and not, as one might expect, regarding a style, genre or medium, stands above all the other stylistic conventions that computer artists attempted consciously or otherwise to adopt. We have already seen, for example, how the efforts of the European pioneers were partially inspired by Bense’s theories, which, given his personal history, were closely related to the concrete movements of both Europe and South America. Concrete art may never have been central to the artistic world of the time, which was then centred in New York rather than in any European city (and naturally reflected the interests of the North American developments of first abstract expressionism and then pop art), but concrete art was never deemed un-artistic or non-art at all; perhaps it could be considered bad art but it was still art. Computer art on the other hand, by confusing the very paradigm of human agency, had its very label as ‘art’ questioned. In this context, it is unsurprisingly that one of the points raised by Nake in his PAGE 18 text stressed that the ‘debate centers around the question “Is it art?” [while the discussion] shows virtually no progress’ (Nake, 1971). For him agency, although he would still favour the coding itself more than the final pictorial object, was never a worthy question.

Despite interpreting computer art as a development parallel to concrete art, or yet, as in Csuri or Cordeiro’s (Fig. 54) case, by highlighting social themes over computer artworks, computer art still struggled over its own legitimacy. In the late 1960s through the early 1970s, however, a new discourse attempted to legitimise computer art via a different narrative. In this new attempt computer art became not the inheritor of modernity, via concrete art, but a representative of one of the most successful new practices of post-war art: conceptual art. Indeed, even today conceptual art has been described as the most closely related artistic form to computer art (Tamblyn, 1990; Popper, 1993; Shanken, 2002; Paul, 2003, p. 11; Weibel, 2005, p. 338; Nake, 2010;
Taylor, 2014, p. 46). If we accept, according to the literature, that computer art is closely related to (or in fact a development of) conceptual art, we must also assume that something must have happened along the way in order to justify that previous negative reaction. From an art historiographical perspective, claims regarding the proximity between conceptual art on the one hand and computer art on the other must be followed by two questions. Firstly, regarding its validity, were the perceived characteristics of conceptual art, as developed in the late 1960s, similar to the ones proposed by (some) computer artists? Following this, then, it is fair to raise a second question: Since both art practices allegedly share so many characteristics and concerns, why was one accepted by the art world while the other languished at the periphery?208

We know that the pictorial computer art and mainstream art, at least at the time and given the misunderstanding of the former, could never be reconciled given the former’s human agency problem. Nevertheless, as Taylor (2004, p. 46) demonstrates, there are instances were both artworks, conceptual and computer, are incredibly similar209

208 As Salah rhetorically asks: ‘The art world had seen enough abstraction and all sorts of geometrical designs, be it under the name of Abstract Art, Constructivism, Op Art, Suprematism, or Abstract Expressionism. It was ready to accept artistic instances without the presence of artworks, as in the case of Happenings, Flux, and Conceptual Art. If abstraction was not the issue, then what was it that Computer Art really lacked?’ (Salah, 2008, p. 51).

209 Here Taylor is speaking of two strikingly similar artworks, one by Manfred Mohr, P 159A (1973), and Sol LeWitt’s 122 Variations of Incomplete Open Cubes (1974). As he sees it ‘Rosalind Krauss, Lucy Lippard, or Donald Kuspit, who all wrote on LeWitt’s cubic work [nevertheless] prejudged [Mohr’s] work on the grounds of its computational basis’ (Taylor, 2004, p. 46). Moreover, as Taylor also correctly points out, ‘in LeWitt’s words, conceptual art was “emotionally dry” and looked “hard and industrial” [while] computer art evoked similar descriptions’ (Taylor, 2004, p. 47). We should also note some limits to this comparison. As Taylor again correctly posits: ‘The most substantial difference, however, is the disassociation by LeWitt and most other conceptual artists with the reductivism and rationalism of mathematics. As LeWitt stipulated, conceptual art does not have “much to do with mathematics, philosophy or any mental discipline”’ (Taylor,
What was it then that made computer art and conceptual art produce such similar outputs? As early as 1962, as Taylor points out, ‘Umberto Eco coined the term Programmed Art to describe the formalised trends in European conceptual based art’, while, moreover, both art practices ‘appealed to the same concepts of objectivity and the will to detach the art object from the idea’, as in the case of Nake’s emphasis on algorithms rather than the final output (Nunez, 2015) or the processes of LeWitt. ‘Moreover, both worked with seriality and permutational sequences’ (Taylor, 2004, p. 44).

Even computer art’s overreliance on scientism, as proposed by the (failed) quantitative proposals of Bense and Moles, had given away to a more relaxed attitude towards the acceptance of irrationality or intuition in computer art. This change in attitude could already be seen, for example, at the 1973 Tendencije 5 exhibition, which, instead of focusing solely on research and computers, added, for the first time, the theme of conceptual art to its subtitle. Moreover, as artist Radoslav Putar suggests, the working title of Tendencije 5 debate ought to be titled ‘The Rational and Irrational on Visual Research’ (Putar, 2011b, p. 482). The very possibility of irrationality or subjectivism in a previously computer or concrete art event was already a game change. If we look back at, for example, Bense’s and even New Tendencies’ discourses some years earlier, we will see, as previously demonstrated here, that the idea was precisely to rid artistic practice of any kind of personalism, subjectivism or irrationality. Hence, the very possibility of discussing these dogmas should not be taken lightly. As Putar highlights,

2004, p. 49). Moreover, through statements such as that conceptual artists are ‘mystics rather than rationalists’ (LeWitt in Taylor, 2004, p. 49), conceptual artists are distanced even further from the radical formalism of computer art.

Tendencies 5: Constructive Visual Research; Computer Visuals Research; Conceptual Art.

Once again the reader should recall that this was exactly the discussion between the paulistas concrete and the curiocas neoconcrete artists.
‘the rational and the irrational do not have the connotation of terms which mutually exclude one another’ (Putar, 2011b, p. 482). Yet another very clear example of this reorientation towards conceptual art, even in AST developments entirely focused elsewhere than the computer itself, is Burnham’s *Software* exhibition, previously seen in this text. Although not a prior supporter of the rational formalist tendencies especially seen in Europe and South America, the similarity between his and *Tendencije* 5’s proposals is remarkable. As Rosen explains, Putar may have only ‘implicitly indicated that one might also describe processes of Conceptual art as data processing. Whether the concept linking the computer and Conceptual art, as developed by […] Burnham […] was known to him, remains uncertain’ (Rosen, 2011b, p. 39). It is important to remember that Burnham was not only a supporter of post-war technology and art; as Shanken reminds us, Burnham ought to be seen ‘as the pre-eminent champion of art and technology of his generation’ (Shanken, 2001, p. 107). Some context is necessary in order to comprehend Shanken’s claims. Burnham was not an outsider in relation to the art world. Pretty much the opposite is true. He was a writer (1968–1970) and associate editor (1972–76) on *Arts* magazine and a contributing editor (1971–1972) to *Artforum* (Shanken, 2001), the same magazine that had previously answered a submission of a paper on Csuri to say that it would never produce a special on computers and arts.

But what did Burnham actually propose regarding that problematic *Software* exhibition? So far we have only seen that it did not end well, either for the Jewish Museum or its curator. Could this rejection by the art world be related to its theoretical proposal, of reading AST productions (such as computer art) through the lenses of conceptual art? And was Burnham, as one reviewer at the time described it, drawing ‘upon the prestige of these disciplines [of concept art]’ (Mallary, 1970, p. 189)212? *Software*’s principles were spelled out over a short period between 1968 and 1970, in

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212 That is, riding on the successes of conceptual art.
various articles and two books: *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century* (Burnham, 1968a) and *The Structure of Art* (Burnham, 1970c). The latter book, which features heavily in the AST literature today, was described by one reviewer at the *Leonardo* journal as being a ‘manifesto, not a history’ (Lynton, 1970, p. 108). Burnham’s 1968 *Artforum* article, ‘Systems Esthetics’, which may be considered the biggest attempt by an art world member to legitimise the production of AST, can be argued to surmise Burnham’s manifesto. To begin with, Burnham depicted the world then in a transitory state, from ‘an object-oriented to a system oriented culture’ (Burnham, 1968b, p. 31, original emphasis). This change, a ‘morphological development’, as in Kuhn’s paradigmatic change, founded over the ‘nature of current technological shifts’, created a ‘dichotomy’ between the ‘finite, unique work of art’ and ‘conceptions which can loosely be termed unobjects’ (Burnham, 1968b, p. 31). These unidentified ‘unobjects’, which may include ‘kinetic and luminous art, some outdoor works, happenings and mixed media presentations’ (Burnham, 1968b, p. 31), pertaining to a new, as yet to be named category, are the result of the intuition of artists who have ‘grasped’ the ‘present age[‘]s’ distinctions. Among the many changes caused by technological development, Burnham does seem to recognise a shift that people would

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213 For a short introduction to these works, from an art historical point of view, see Skrebowski (2006).

214 Surprisingly, the same reviewer, Norbert Lynton, was both a *Guardian* reviewer and the head of art history of my school, Chelsea. Unfortunately he died in 2007 (McNay, 2007).

215 A central AST institution that shall be discussed in the next section.

216 When I say ‘biggest’ I am talking both literally and metaphorically: literally because Burnham was one of the most active writers to support AST, both in his books and articles, and metaphorically because Burnham, in a sense, was a central figure within *Artforum*, the art world’s publication *par excellence*. However, ‘for a writer who was a significant theoretical force in his day – sitting on *Artforum*’s masthead alongside Lawrence Alloway, Annette Michelson, Michael Fried and Rosalind Krauss – Burnham’s work is now relatively obscure’ (Skrebowski, 2006, p. 3).
today label as moving towards the ‘information society’ where ‘in the automated-state power resides less in the control of the traditional symbols of wealth than in information’ (Burnham, 1968b, p. 31). Narrating this change towards an understanding of our social and natural world as similar entities, and borrowing much from cybernetics’ understanding of such change, Burnham highlighted that, because of growing information, the world had become more and more complex. Hence, ‘the priorities of the present age revolve around the problems of organization’ (Burnham, 1968b, p. 31). For Burnham and for others who subscribed to cybernetics’ tenets, the insight that everything could be seen as information, although not spelled out by him within this text, reflects Wiener’s initial insight when designing the anti-aircraft systems previously mentioned; that is, human, machine and nature are just parts of a system rather than separate, distinct units. In this new paradigm the aesthetic impulse, previously justified by the use of art objects, seemed to him ‘naïve’ (Burnham, 1968b, p. 31). Differently from the previous rational formalists, however, he recognised the new aesthetic impulse now ought to be based on two assumptions:

The specific function of modern didactic art has been to show that art does not resides in material entities, but in relations between people and between people and the components of their environment […]

In an advanced technological culture the most important artist best succeeds by liquidation his position vis-à-vis society […] At the outset the artist refused to participate in idealism through craft […] Instead the significant artist strives to reduce the technical and physical distance between his artistic output and the productive means of society. (Burnham, 1968b, p. 31)

Fantastically, Burnham in effect rejects the most extreme view of previous rational formalism in favour of a very particular reading of cybernetics itself – which as we previously saw was used to justify the deterministic and quantifiable experiments of early
computer artists$^{217}$ – while, at the same time, stressing that in this vision of society artists should not ape the ‘syndrome of formalist invention in art, where discoveries are made through visual manipulation’ (Burnham, 1968b, p. 31). A testament to the degree to which scientific theories can be translated by the artistic field, this complete reformulation of cybernetics as understood by rational formalists is important in itself. This constant game, of reinterpretation, of translation, from one field to another, unsurprisingly, was also conducted over Burnham’s own work. His late recognition outside the circles of AST can be seen in recent attempts at his ‘recovery’ (Skrebowski, 2006); in the labelling of his work as ‘visionary’ (C. A. Jones, 2012); in readings of his work as ‘prophetic’ among a ‘burgeoning interest in systems amongst artists and writers on art’ (Halsall, 2008, p. 99); in work highlighting his ‘prescience’ while acknowledging the prevalence of his thought ‘in the design world’ (Jones, 2011); in examinations of his oeuvre as the harbinger of a ‘new aesthetic’ (Paul and Levy, 2015, p. 36); and so on$^{218}$.

$^{217}$ This rejection becomes clearer in Beyond Modern Sculpture, where Burnham, while acknowledging that Europeans were the first to investigate cybernetics for artistic purposes, argues that those Europeans did not achieve a concept for a new art form. In his words: ‘In 1958 the scientist Abraham Moles published his *Théorie de l’information et perception esthétique*. Moles points to some conclusions about the limits of modern communication as defined by information theory; he lays down aesthetic conditions for channelling media; yet he does not attempt to construct a style, a means, a message or a new art form. Less elaborate, but more ambitious in intention is Max Bense’s *Programmierung des Schönén*, published in 1960. For the experts, at least, Bense’s work categorizes the various philosophical, mathematical and literary approaches to text analysis, with particular emphasis on the statistical methods of information theory. Bense also does not attempt a new art form’ (Burnham, 1968a, p. 344).

$^{218}$ For a comprehensive review of Burnham’s historiography since the 1990s, see Shanken (1998, 2009). As Shanken posits: ‘Historical and critical writing addressing these aesthetic theories began to emerge in the 1990s and accelerated in the 2000s, when a number of exhibitions and symposia were devoted to related themes. These include: *Open Systems: Rethinking Art c. 1970* (Tate Modern, 2005); *Systems Art* (Whitechapel Gallery, 2007); *Imaging by Numbers* (Block Art Museum, Northwestern University, 2007); and
The irony behind it at all, for me, is extraordinary. With Burnham having been disregarded some fifty years ago because of a bias against computing technology in particular and all things scientific in general, today people in the larger art world, while maintaining an active interest in him, may claim for example that ‘Burnham hinted at, but never comprehensively followed through on, a disarticulation of systems theory from its techno-industrial deployment [and] in so doing he only suggested the conceptual possibilities that systems theory might offer a critical art practice’ (Skrebowski, 2006) – that is, sorry, Burnham: close but no cigar.

In conclusion, despite all the apparent similarities between concept and computer art, today and then AST did not find its profile raised by its new narrative, which moved away from rational formalism and closer to the late 1960s and early 1970s concerns of the art world: in effect, anti-formalist in nature and emphatic about the dematerialisation of the art object. Even a possible nod to computer art such as Burnham’s affirmation that ‘It no longer helps to display a system as a static entity’ (Burnham, 1968a, p. 131) – that is, the graphical output of algorithms – could not satisfy the already ingrained and widespread certainty that, ultimately, computers – and science by extension – were bad for art. While computer art primarily had the problem of human agency against it, larger

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AST developments were, as we have previously seen, branded as supporters of the military–industrial complex. As Rosen, after paraphrasing Samuel Beckett’s rhetorical question ‘What matter who’s speaking?’ into ‘Does it matter who’s calculating?’, simply states: ‘It made a difference if the artist or the computer calculated’ (Rosen, 2011b, p. 35). The infallible connection to the material world of technosciences was responsible for the scorn of Burnham’s ideas. The merit on which Burnham and all others were judged, despite claims to the contrary, was not based on aesthetic, art theoretical, philosophical, taste, stylistic, conceptual or any other considerations\(^{219}\). AST and earlier computer art were (and perhaps in a sense are) judged by their simple and not necessarily true affiliation with the technoscientific world. The merit observed was and is based on moral and political assumptions, and not artistic ones. This ensuing situation, best summarised by Shanken in his thesis, was that:

Public skepticism towards the military–industrial complex after May 1968 and amidst the Vietnam War, the Cold War, and mounting ecological concerns, all contributed to problematizing the artistic use of technology – and the production of aesthetic objects in general – within the context of commodity capitalism. Conceptual Art, on the other hand, with its assault on the modernist object,

\(^{219}\) One could add to this list of problems, between computer art/AST and the art world, the relationship between AST and the art market. Although I believe this is not a central issue here, since taste and hence demand itself are proxies of capital – both social and economic, as seen in Bourdieu (1996) – the simple fact that the art object in computer art, as argued many times by artists in the field, can be thought of as centred on coding itself and not its visual output is quite problematic for a market that strives at the exchange between capital and theoretically unique objects. Here, again, the comparison between computer and conceptual art is illuminating. Since both affirm the dematerialisation of the art object, it is interesting to note that where computer art struggled conceptual art succeeded. Since this thesis is most concerned with the production of art and not its consumption, I shall not continue on this line of inquiry. Having said that, consumption – or the lack of it – may in the future prove pivotal for the development and narrative of AST. For an introduction to the economic field concerned with art consumption, see Heilbrun and Gray (2001), Ginsburgh and Throsby (2006), Zorloni (2013) and Horowitz (2014).
became increasingly central to a variety of artistic discourses, ranging from Post-Minimalism to Performance and from Installation to Earthworks […] Conceptual Art, in fact, had become so well absorbed into the international art market by 1974 that Sarah Charlesworth, Michael Corris, Joseph Kosuth, and Mel Ramsden initiated *The Fox*, (1975–6), in order ‘to establish some kind of community practice [for] the revaluation of ideology.’ The disjunction between the critical and public reception of Conceptual Art and Art and Technology in the early 1970s contributed to exacerbating distinctions between these two artistic tendencies, rather than to identifying continuities between them. For it stands to reason that artists, critics, dealers, curators, and collectors invested in internationally prestigious Conceptual Art would want to distance themselves from any association with Art and Technology, which, for the reasons explained above, had become increasingly peripheral to contemporary artistic concerns. (Shanken, 2001, pp. 145–146; see also Taylor, 2004)

So, if conceptual art, despite its similarities with computer art, had become the norm, what happened to the hundreds of individuals who were actively engaged with AST efforts? Since they were certainly not part of the artistic discourse and its historical development – literally peripheral in their positioning, or, as in the case of computer art, not considered to be art at all – how could they survive? That is our next subject: the institutionalisation of AST.

### 3.4 A persistent field: Institutionalisation

The clear division of conceptual art, on one side, and computer art and AST, on the other, not only illustrates the tortuous path of artistic legitimisation but also highlights the utmost failure of AST – computer art included – to achieve that legitimisation in the eyes of a large majority. Yet, despite this failure, why are we still talking about things such as digital art, new media art, art and science and so on? How has a completely renegade artistic practice, which in some cases may (wrongly) not be considered art at all, persisted over time? How come an art form, not accepted as such by the high priests of the art world, has flourished despite not being accepted as such, as *art*? Despite their production
being branded as *non-art*, as in computer art, or *bad-art*, as in later AST developments, people still kept working, producing, writing and showing artworks pertaining to this once small sub-culture. The result of this continuous effort, helped and supported by various patrons, academia and industry, allowed AST to flourish despite and in defiance of art world precepts. Here is the paradoxical existence of AST: while fighting for a recognition that never came, it became institutionalised and, consequentially, autonomous. New values, theories, ideas; new institutions, dedicated spaces and publications; its own awards, heroes and myths: whole new sets of organisations were deployed in order to accommodate and support AST. Had its rejection never occurred, had the earlier pioneers succeed, we would not be talking about AST as a separate burgeoning field but, instead, as a note on a page in some obscure art history book – AST would be, perhaps, *passé*. Here I argue that no other example better demonstrates the detachment of AST practices from the larger art world than its own specialised institutions. In other words, it is by looking at AST’s institutions that we can clearly see its eventual autonomy being constructed *apart* from the larger art world.

First things first: when I say that AST developed into a whole new world, I am not saying it is completely detached from the art world. In fact the opposite is true. AST is art and, hence, it still relies on some conventions and institutional arrangements just as ‘traditional’ contemporary art does in order to proliferate. We can think about some AST exhibitions, for example, as being pretty much in tune with the white cube of contemporary art; AST uses institutions such as museums and galleries in order to accommodate its production; and AST has the usual reliance on the system of awards, which theoretically are expressions of quality as well as consistency with a certain kind of value. AST is, in other words, art – as long as people recognise it being worthy of such a label. Think, for example, of cinema, or opera, or theatre, which are still recognisable artistic forms, albeit of a different kind from the visual art that we are referring to: these are not judged, shown, preserved or distributed in the same way that visual, contemporary
art is. The theories, methods of evaluation, venues and even vocabulary used to describe these art forms are different from those of other visual arts. These are, nevertheless, recognised as art but perhaps not pertaining to the label ‘contemporary art’. AST, similarly to those, is recognised as an artistic form but also, it can be argued, does not pertain to visual, *contemporary* art. Please beware that we must understand the ‘contemporary’ in ‘contemporary art’ as a label and not a simple adjective. As we know there is a category of cultural products (loosely) defined as contemporary. The boundary of this field, of contemporary art, while not rigidly defined, since intersections with different artistic and cultural forms may occur, is still nevertheless present. Things do not simply pertain to contemporary art at will. The act of labelling something as ‘art’, ‘cinema’, ‘dance’, ‘opera’, ‘contemporary’ etc. is, then, a negotiated process, between the many different agents of the pre-existing field: artists, curators, institutions, historians, critics, philosophers and so on. What demarcates the boundary of those different domains, then, is this negotiation: an ongoing process that is never fully agreed upon and that does not demand a full consensus. It suffices that a group of people agrees about it for the label to be at least partially successful. That is what happened to AST. While it was not fully recognised or considered worthy, a (large) group of individuals nevertheless agreed about it. AST may have failed to convince the art world of its worthiness to be labelled as contemporary art, but it still succeeded in producing a consensus about its importance for a minority. Hence, many of its institutions have persisted over time.

Of all AST’s persistent institutions, no other has endured or succeeded as much as *Leonardo: The Journal of the International Society for the Arts, Sciences and Technology*, the next subject of this thesis. AST, while not wholly similar to contemporary art, still shares much of its structure with *visual* contemporary art. It has performances, art objects, installations and so on. It has awards, museums, degrees and exhibitions. What differentiates AST from contemporary art, then, must be something else, something that resides not in simple stylistic or institutional conventions. The fact
that there are occasions when the boundaries of these two fields are blurred makes this task, of demonstrating the detachment and autonomy of AST, even more difficult. *Leonardo*, however, aids our research both as an example and as a case study: apart from its being the embodiment of collective activity, of AST’s supporters, it is in this kind of institution that the discourses of AST are shaped and become detached from contemporary art. Founded in Paris by artist and research engineer Frank Malina back in 1968, the journal was created with the explicit objective of ‘addressing the two cultures debate’220 (Malina, 2008, p. 2) and it has outlived many of the labels proposed by AST’s members and outsiders over the years. Although open to all artists, from any kind of background (Malina, 1968a), in its early editions there was already the sense that the journal favoured the ‘eggheads’ (Gray, 1968). The journal might have been open to all; its target audience, however, it was clearly not your average artist. Its articles, from its earlier editions to today, are quite precise, technical texts and not poetic, speculative ones. *Leonardo* is, even today, not a space for wild manifestos or provocative essays; in fact, it resembles an ordinary academic journal, with all the expected conventions from referencing to an emphasis on clarity. An emphasis on academicism can also be seen in the content of the articles themselves, usually very much concerned with projects aiming at rationalising artistic practice, similarly to the rational formalist efforts previously seen in this thesis. We have, for example, in its first edition, a text by the designer and architect Stanley Tigerman discussing the ‘fundamental characteristics’ of ‘man-made diagrams’ – that is, ‘horizontal planar forms’ – ‘to better understand the role they will play in the forthcoming computerised world’ (Tigerman, 1968, p. 35); the discussions of

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220 According to Malina’s son, Roger, the current editor of *Leonardo*, his father and C. P. Snow were friends at the time (Malina, 2013, p. 422).
L. Alcopley\textsuperscript{221}, the pseudonym of Dr Alfred Copley (Lambert, 1992), a medical researcher and artist interested in the formal discussion of his own work as structures and non-structures (Alcopley, 1968); and a text by Gillian Wise, a constructive-oriented artist bent on formally analysing the components and the internal dynamics of the forms contained in her own work (Wise, 1968).

This assumption, in which artists ought to write clearly about their own work, can be seen in Malina’s first editorial, published in Leonardo’s first issue of 1968. In this text, taking its clues from the technoscientific world very close to him, and despite himself being an artist, he perceives a gap in the market for artists to discuss their own work. This situation, regarded by him as a failure, is seen as ‘partly due to the highly individual character of artistic expression, but also because a strong opinion has held sway that artists should leave verbal description of and analysis of their work to other professions’ (Malina, 1968a, p. 1). Again equating an artistic rationale with a technoscientific one, Malina understood this reluctance as a matter of ‘secrecy’, of keeping one’s trade secrets hidden from public eyes. Scientists, in his view, ‘who are no more skilled than artists with the written word, are expected to write about original aspects of their work’ (Malina, 1968a, p. 1) and, hence, so should artists. He believes there is a benefit in this direct communication, in educating the young in order to prevent ‘needless re-discovery and repetition of errors [that] can only be minimized by the free disclosure and exchange of information’ (Malina, 1968a, p. 1)\textsuperscript{222}. ‘Stringent editorial guidelines’ against what Malina perceived as a ‘romantic, anti-rational climate’ widely present ‘among the practitioners

\textsuperscript{221} A book about him was published posthumously by Pergamon Press in 1993 with the most appropriate title: \textit{One man – Two Visions: L. Alcopley – A. L. Copley, Artist and Scientist}.  

\textsuperscript{222} Regarding the idea that rationality and science can contribute to art, or that both must find common ground, one text in this same first issue affirms otherwise and, ironically, it was written by a biologist and not an artist (Waddington, 1968).
and teachers of the visual fine arts’ (Malina, 1978, p. 1) became a central tenet of the journal. That would hardly change over the years\(^{223}\).

Apart from *Leonardo’s* enthusiastic embrace of science and its conventions, another aspect is clear in its early editions: almost no articles debated the cultural climate of the time. Despite some notable exceptions\(^ {224}\), appearing too sparsely over time, *Leonardo*, very much like *PAGE* after Metzger, did not worry about present problems and was instead focused on the possibilities of the future. That Malina himself was investigated for supposed links with the (US) Communist Party by the FBI perhaps may be used to explain this absence\(^{225}\) in its inception. Nevertheless, I do not think that was

\(^{223}\) We can see this continuity not only among the articles but also among the editorials of *Leonardo* itself, such as in Malina (1983, 2001, 2008), Ione (2007) and Babcock (2009).

\(^{224}\) Among its earlier editions we can name articles such Egbert’s (1970), which attempted to explain the idea of avant-garde in both artistic and political contexts, Shields’ discussion (1973) of the validity of an idea of ‘black aesthetics’ (considered by him as futile) and also Phillips’ (1973) concern over the ‘elitism’ of populist artistic forms. Those and others, however, were shy in comparison to Metzger’s politics in *PAGE*.

\(^{225}\) His son Robert keeps these files on his own personal website but you may also find them on the FBI’s website (FBI, n.d.; Malina, n.d.). In a rather illuminating article, Johnson (2014) describes Malina’s investigation: ‘Was Malina in fact a communist? In 2009 I studied Malina’s considerable FBI file, and I also went through his papers at the Library of Congress. The records show clearly that Malina was likely a member of a Los Angeles branch of the Communist Party in the late 1930s. His FBI file, for instance, contains a copy of a 1939 application to the Communist Party, in what appears to be Malina’s handwriting. He was also no fan of capitalism. In a 1936 letter to his parents, he wrote, “Events in Europe are certainly leading to another war. There seems to be only one hope, overthrowing of the capitalist system in all countries and an economic union of all nations.” Of course, at the height of the Great Depression, countless academics, artists, professionals, and others held such views […] As for espionage, there was perhaps reason to at least suspect Malina. Several security breaches occurred during his tenure at [the Jet Propulsion Laboratory], the most significant involving classified lab documents that turned up in the hands of a Russian courier. According to a 1942 FBI report, at least five unnamed informants identified Malina as a possible spy; the report concluded that “the loyalty of the subject would be questionable if he had to decide between our
the only reason. Malina’s background as a scientist, including his friendship with C. P. Snow, as well as his emphasis on rationality point to a figure in the mould of Bense, intent on demystifying art and the artist rather than commenting on the social issues of the time\(^{226}\) – in a sense, a person more rational formalist and less political. *Leonardo* over the years became more attuned with its social context, but that was never a central issue within its pages. It is important to note that the journal did also present opposite points of views, usually debated in the letters section. Ultimately, however, *Leonardo* never had a Metzger. To read its editorials, even today, is to peek inside the rationale of Snow’s two cultures and its time\(^{227}\), preceding the technophobe turn of the 1960s; as both Salah (2008) and Taylor (2014) correctly point out, we can say that the dream of bringing both fields together is what is most dear to *Leonardo*. Yet, as Salah demonstrates, *Leonardo*, despite aiming for scientific clarity, did not achieve its desired result:

The demand for an ‘analytic’, scientific language was never satisfied, and the published articles were below the standards of scientific research, even though they

\(^{226}\) In fact some of *Leonardo*’s articles were deliberately engaged in the explanation, uncovering and demystification of art and artists themselves. Examples can be seen in Souriau (1968), Osborne (1971), Ferren (1972) and Lynes (1972).

\(^{227}\) I say ‘its time’ because, as we have seen previously, there is a tendency to rush to attribute to early computer art the same preoccupation, as in Klütsch (2007b).
had the necessary cosmetic outlook. This brings me to my core argument: *Leonardo* did not deliver the equivalent of what could be tagged as ‘scientific standards in humanities’ […] What is required of empirical research, most importantly refutability and reproducibility was never required of humanities studies […] *Leonardo* did not attempt to create a similar set of rules, which would be meaningful for humanistic tradition, but rather echoed the policy of empirical research in demanding a scientific look in the papers it published […] a closer look reveals that this façade conceals shabby attempts to be more scientific that either resulted in pseudoscience, or at best, approaches that are much closer to humanities than sciences […] *Leonardo* did not become a bridge between arts and sciences. Instead it created a new culture, closer to sciences than arts. (Salah, 2008, pp. 93–94)

This new culture ushered in by *Leonardo*, perhaps a ‘third culture’, resulted in a product that is classically defined neither as art nor as science. *Leonardo’s* editorial guidelines, I argue, have then been responsible for the creation of a new set of conventions, from pseudo-scientism to an emphasis on future technoscientific scenarios that do not match the preoccupations of ‘normal’ contemporary art. Anchored by a technophilic belief that society is (once again) changing rapidly, it is up to these new artists, the new Renaissance people, to tackle these new mysteries. Evidently *Leonardo’s* own name, borrowing from Da Vinci, positioned its members as enlightened individuals engaged at the heart of an increasingly and rapidly changing society anchored in new technologies and scientific discoveries (Malina, 1983). Similarly to the diagnosis of

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228 This third new culture is best explained by Salah with reference to ‘John Brockman, who in his book “Third Culture” (Brockman, 1995) interviewed several leading scientists about their theories in particular, and about the nature of scientific inquiry in general. Brockman’s hypothesis was that, since the predominant culture of the 21 century is science, a direct link between scientific research and the general public should be established […] The name “Third Culture” is a direct reference to Snow’s introduction to the second edition of “Two Cultures”. Published in 1963, “The Two Cultures, A Second Look” forecast a third culture that would emerge from the gap between the two cultures and take up the task of providing communication between the two. Although Brockman borrowed Snow’s term, his definition of the third culture is crucially different than Snow’s definition. In Brockman’s opinion, a new scientific intelligentsia was coming into being, who by-passed the “literary intellectuals” and directly addressed the culture at large. His aim was to provide the medium for this communication’ (Salah, 2008, pp. 102–103).
E.A.T. or C.A.S., then and again, the remedy of many of its articles is devoted to the education of new recruits, promoting ‘the advancement of artistic research and academic scholarship at the intersections of art, science, and technology’ (Leonardo, 2015). Already in its earlier editions, and before the creation of the Leonardo Education and Art Forum, which provided the previous quote, articles would pore over the subject of the failings of the educational system and/or how to prepare the next generation for the future to come (Draper, 1969; Sonntag, 1969; Adiseshiah, 1970; Lipman-Wulf, 1972)\textsuperscript{229}.

Although I have not touched on the subject, the relationship between computer art practitioners and the Leonardo community is worth mentioning. This relationship, a very ambiguous one\textsuperscript{230}, can be exemplified by Malina’s 1971 commentary, in which he demonstrated a ‘very critical attitude towards the output of computers’ (Malina, 1971, p. 263). Computer art, strangely enough, despite appearing only intermittently in Leonardo (Salah, 2008, p. 88), is at times portrayed sympathetically (Holloway, 1972) and at other times critically (Thompson, 1974); in short, for much of the 1970s and 1980s computer art was hesitantly commented on. That is not to say it was not commented on at all. The opposite here is true: even pedagogical texts were published in Leonardo (Turnbull, 1971). In this context it is also important to stress the continuous and constant participation of one of the most vocal supporters of computer art, Herbert W. Franke,
who had an enormous output over the years. This continual albeit sometimes intermittent presence makes computer art a central part of AST, as illustrated by *Leonardo*. We could also add Salah’s remarks that point to *Leonardo*’s close relationship with other computer art institutions even today:

> It supports prominent Digital Art websites like Rhizome or Digital Art Museum, and organizations like Digital Art Saloon. This support manifests itself in different types of connections. For example, in order to publish on the Rhizome web, one needs to get into contact with the editor of *Leonardo*. Digital Art Museum is granted a special permission by *Leonardo* to duplicate vital papers on Computer Art that were (first) printed in the journal. Every year, *Leonardo* publishes a special issue on Digital Art Saloon edited by the organizers of the event. Furthermore, through the Science, Technology and Arts organization, specifically founded for this purpose, *Leonardo* coordinates events to bring scholars from different disciplines under one roof. (Salah, 2008, p. 89)

Although Taylor (2004), for example, pictures computer art separately from the art and technology efforts of *Leonardo*, he also finds the trope of the renaissance, and *Leonardo* itself, as central to the ‘movement’ of computer art. Correctly, though, he realises that *Leonardo*’s principles promoted self-reliance and not the artist–scientist collaborations of earlier attempts such as E.A.T., and this, in turn, would inform many in the next generation, resulting in the figure of the artist–programmer as ‘an agent of cultural conciliation’ (Taylor, 2004, p. 105). A result of the previous (failed) attempts at unifying artists, engineers and scientists; cheaper and more available computing; and

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232 An affirmation that I have disputed previously, not from a classical art historical point of view but from a sociologically inspired method, on the basis of the ‘lowest common denominator’ argument of the material (technoscientific) and intellectual (rational formalism) contexts that inform much of the rationale behind both practices.
perhaps more importantly an ‘emphasis on computer literacy in universities and colleges’ (Taylor, 2004, p. 106), this new enlightened artist would combine artistic insight and scientific knowledge, embodying the renaissance dream pointed to by Leonardo. Perhaps best exemplified by Harold Cohen (Nunez, 2015), these new entrants were not in the beginning as technically or mathematically proficient as the first wave of computer artists (e.g. Nake, Nees and Nees) yet they managed to produce highly complex artworks while taking advantage of the educational establishments dedicated to computers and the arts. In this sense, then, the pedagogical efforts of CAS and Leonardo were indeed successful. Since the efforts of such institutions attracted a new generation into the field, we were bound to see its reflection in the academic world itself. Not only people in AST were and are very active in academia, from Bense to Nees and from Cohen to Malina, but also the universities themselves were in fact the laboratories where people could develop their work. Artists did not need to partake in industry, as in the Bell Labs of E.A.T. and Noll, but instead, given the increasing popularity of the machine, the tertiary education system became the host of many developments. Here I believe that it is Mason (2008, 2009), by mapping the influence of both cultural and educational institutions over British computer art, who provides the best case study of this relationship between the educational institutions that nurtured computer art and its individual actors. Reminding us that ‘although a surprising amount of activity did take place [and] most of it existed largely outside what may be considered mainstream art world’ (Mason, 2009, p. 246), Mason argues:

One of the main characteristics of British computer arts of the 1970s was that it involved artists who either learned to write code themselves or built up a working relationship with scientists, engineers, or technicians, at a time when the computer itself was at a formative stage. By the early 1970s, the major route into computer arts was through a select number of art schools. These provided not only education and training but, in some cases, career incubation, employment, research facilities, and networking opportunities. In a few institutions, at least, the result was that artists had the opportunity to access expensive and specialized computer equipment and technical expertise (generally belonging to science and maths departments) for the first time […] Thus at a polytechnic, it was
theoretically possible to study art and craft (technology) together, as in the first public art school at South Kensington in 1837. (Mason, 2009, p. 255)

It was not only in academia and publications such as Leonardo, however, that AST developed independently from the larger art world. Its relationship with industry, as in its early days, was and is also very much present. Let’s take, for example, the relationship between computer art specifically and trade/academic associations such as SIGGRAPH, which has supported computer art via a system of exhibitions, talks, seminars and awards since 1981 (Prince, 1989). ACM/SIGGRAPH, or the Association for Computing Machinery’s Special Interest Group on Computer Graphics, founded in 1969, by 1998 was ‘a large, professional society with the word’s most impressive computer graphics conference’ with a total income of ‘more than $12 million’ (Williams, 1998, p. 48): computer graphics and not computer art is, quite literally, its trade.

The development of computer art in the UK, via its links with academia, resulted primarily from ‘a sympathetic social and political climate […] The computer manufacturing industry was reorganized, the use of computers in higher education was examined, and the education sector itself was reformed. Under Harold Wilson’s “White Heat” government, post-war expansion of science funding was massive […] Science and technology seemed the talisman that would, through modernization, solve the problems of what was perceived as slow economic growth and decline’ (Mason, 2009, p. 246). The reader should also recall that, despite Mason’s affirmation that the UK was an exceptional example, it was not the only one. Wisnioski (2013), for example, traces the development of AST in MIT’s Center for Advanced Visual Studies, whereas Enrique Alés (2000, 2003) dissects the origins of computer art in the Centro de Cálculo de la Universidad de Madrid. We have also the work of Shanken (2005), which succinctly but extensively maps many other different interactions. From this point of view, of academia supporting an artistic practice, since the centres of research and production were not relegated to traditional artistic departments, we can say again that the state-led push towards science, in the UK and elsewhere, is what made these developments possible.

Accordingly, its contribution to industry has also been important: ‘The development of virtual reality, for example, benefited enormously from the creation of SIGGRAPH, the ACM’s special interest group for computer graphics. This organization brought together university and industry researchers, as well as users of computer graphics, from a variety of fields (e.g., arts, entertainment, medicine, and
Nevertheless, SIGGRAPH’s involvement with the computer art field, in fact, can be traced to an even earlier time, if we consider that *Computers and Automation*, the same magazine that awarded the first prizes in computer art, was founded by Edmund C. Berkeley, populariser of the idea of the electronic brain and the founder of both ACM (SIGGRAPH’s parent institution) and *Computers and Automation* (Denning, 1988).

Another symbol of its importance for the field can be seen in *Leonardo’s* attention to SIGGRAPH’s exhibitions and events, publically announcing and discussing them as in the example of the memorable 1989 *Leonardo Supplemental Issue*. The importance of this issue as well as of SIGGRAPH’s exhibition is well documented by Taylor (2004), who posits the exhibition as a central event in the history of computer art as an idea:

1989 was a pivotal year in the history of computer art. Two crucial proceedings took place: the annual Siggraph conference and CAA meeting which together provided the genesis for a number of wide ranging and ideologically diverse journal articles […] these articles reframed the reception and understanding of the computer and its future role in the arts. The conference proceedings, and the articles which followed, responded to a crisis of confidence surfacing within the entire computer art project […] At the close of the decade, commentators and critics began a comprehensive evaluation of computer art in the face of what appeared to be computer art’s abject failure in gaining acceptance into the artworld. Antagonism and frustration surfaced in a series of polemic events and articles, which solidified into a position opposed to the modernist ethos of conservatism and technological utopianism that was such a dominant part of computer art discourse […] The computer, as it became increasingly accepted in its new pluralistic form, proved a valuable postmodern art tool. This had profound effects for the 1990s, especially in discourse surrounding ‘new media art’ and ‘digital art’. As computer art became increasingly contested the term effectively becomes nebulous, prompting artists and critics to invent more descriptive terms. This fragmentation meant that computer art never again held the exclusive position it once enjoyed. The discourse lost much of its historical manufacturing). Its annual conferences have become a show-case of new technology and a primary forum for exchanging new ideas’ (National Research Council, 1999, p. 141).
importance to the new paradigms (such as ‘digital art’) that co-opted computer art’s history for its own genealogy. (Taylor, 2004, p. 194)\(^{235}\)

Although the following discussion is interesting in itself, since it demonstrates the substitution of one nomenclature, ‘computer art’, with another, ‘digital art’, as an attempt to renew a field damaged by a lack of legitimation (Taylor, 2004, p. 194)\(^{236}\), for the purposes of this thesis it is more important to look at where it happened: at events such as SIGGRAPH and within the pages of publications such as *Leonardo* – not in traditional art world biennales, publications, museums or books. By the end of the 1980s the institutions dedicated to AST, which had emerged from the cultural onslaught of the late 1960s and early 1970s, were more than established institutions. These were not only proliferating but also becoming bigger, richer while at the same time being followed by other newer institutions\(^{237}\). A quick Google search for the terms ‘digital art’, ‘new media

\(^{235}\) This transformation, from *computer* to *digital art*, is well documented in the fifth chapter of Taylor’s PhD thesis (Taylor, 2004). We should not forget that, in the mid-1980s and towards the mid-1990s, even before ‘digital art’ became the predominant label, ‘electronic art’, as in the work of Popper (1993) and the formation of the Inter-Society for the Electronic Arts (ISEA) in 1990 (and also supported by a special issue of *Leonardo*), held some currency. These different labels, with different emphases and theoretical assumptions, however, never managed to bring the field together. As demonstrated previously in this thesis, any attempt to unite the works of a heterogeneous group of artists by aesthetic criteria that do not necessarily correlate to the artworks in question is doomed to failure. Again, I believe, it is better to understand these developments according to their lowest common denominator and their institutions rather than a constructed aesthetic criterion.

\(^{236}\) Although Taylor posits this questioning of computer art, by quoting articles such as Ken Knowlton’s ‘Why It Isn’t Art Yet?’, as a problem that is decidedly of the late 1980s, as we previously saw the problem existed since the early days of computer art. Concerning this fact, I believe it is better to understand the change from computer art to digital art as the peak of a long-standing problem and not as a new phenomenon, which is most certainly not the case.

\(^{237}\) Among the new members, it is worth mentioning Ars Electronic, founded in 1979, which had among its founders no less than Herbert Franke. Similarly to in SIGGRAPH, however, the line between
art’, ‘art and technology’ and so on reveals an enormous variety of festivals, biennales and institutions dedicated exclusively to such practices. Moreover, commercial and industrial links are not only present in the institutional arrangements of professional societies but are also seen in engagements between artists and industry (Shanken, 2005; Mason, 2009). It is as if a full circle has appeared: first scientists entered the art world because they created art with industrial technology, and then it was artists who entered industry via their use of industrial technology. As Mason explains, the ‘downturn in public sector funding in the 1980s coincided with a rise in demand from the commercial sector for sophisticated graphics, which were rapidly becoming more easily produced by a computer than by traditional methods, thus encouraging a move for some artists into private sector freelance or part-time contract jobs’ (Mason, 2009, p. 258).

Supported indirectly by the state and via the academic world, and promoted by industry, AST had, after the cultural turn of the late 1960s, developed its own network of institutions in order to survive. That today we have a massive variety of labels to describe its actions, always at the fringe of the art world, its market and its institutions, is only testimony to its continuous development and heterogeneity, similarly to and despite art itself. From this perspective, in light of the field’s isolationist tendencies, it is unsurprising that Leonardo itself, as a journal, can be thought of as knitting together a close community via its articles and editorial guidelines. As Salah demonstrates with a smart use of statistical data via both text mining and analysis, ‘only about 45% percent of [Leonardo’s] papers have art related subjects’ (2008, p. 95). Moreover, and perhaps even more characteristic of such an insular impulse, is the fact that circa 39 per cent of its articles reference the journal itself (Salah, 2008, p. 96, tables 1, 2) and not another journal or source. Humanities journals and authors have been shown to have a lower propensity artistic and industrial/commercial application was blurred. For example, its annual award Prix Ars Electronica, awarded since 1987, is usually shared between members of the AST community and industry.
for self-referencing (e.g., compared to fields pertaining to the life or natural sciences) (Snyder and Bonzi, 1998; Hyland, 2003), as they tend to rely on sources other than traditional journals. Only a few other humanities journals self-reference as much as the articles in Leonardo; the average rate is around 20 per cent (McVeigh, 2002). Although high self-referencing can be attributed to smaller and newer fields, for Leonardo that is not the case²³⁸.

By 1996 a different landscape had emerged. Given the pervasiveness of computing technology and growing knowledge of it, especially via the Internet, that is not surprising: the biggest obstacle to learning and using the computer had finally been broken. Nevertheless, in the same year an influential media theorist, Lev Manovich, proposed in a provocative blog post at Rhizome, and long after the institutional debate that relegated computers to a part of a larger digital art discourse, a simplistic, short, incomplete but yet catchy text titled ‘The Death of Computer Art’ (1996). In summary, in this text he claims that the convergence between computer art and the art world will never happen (Manovich, 1996). The reason for this, and here is the catchy part, is that they belong to different worlds: ‘Duchamp-land’ and ‘Turing-land’. Although simplistic in the sense that he does not acknowledge the structural basis for the development of his Turing-land (as seen throughout this thesis), he is right in positioning Turing-land’s output as diametrically opposed to that of Duchamp-land²³⁹. In order to demonstrate this

²³⁸ It is interesting to note that Salah does not further develop these numbers, which are used to exemplify (correctly) the characteristic of a new field produced around Leonardo. Both this technique and its insights, I believe, may produce valuable results in the future. Moreover, corroborating the thesis that computer art is central to AST and vice and versa, after art (45.6 per cent) and psychology (15.2 per cent), computer science (8.4 per cent) is the third most common topic over Leonardo’s pages, surpassing traditional artistic subjects such as the humanities (4.6 per cent) and even philosophy (2.1 per cent) (Salah, 2008, p. 96).

²³⁹ I honestly do not consider his rationale, simplistic and reductionist, to be a worthy effort. Since it is impossible to find the full text today (only excerpts found in Rhizome), and since most of the links to it
argument, the next section will focus on one example: the treatment of genetics by both AST and contemporary art.

3.5 Conclusion: The persistence of optimism

Within the cultural field usually described as contemporary art there is one marginal subgroup, which I label AST, that has embodied a unique discursive position within its parent field\textsuperscript{240}. This discourse, which we may refer to as pro-science and technophile, although not unique to AST, does seems at odds with the technophobic discourse of the broader artistic world\textsuperscript{241}, which is why we may regard it as unique within contemporary art. This division, although not homogeneous across the whole artistic field, is the central concern of this case study. Hence, the conclusion of this chapter investigates how different artistic discourses and practices interpret and represent scientific thought.

\textsuperscript{240} Part of this section was presented at the CHArt 2014 Conference (King’s College) and at the Medical Imagining International Conference (Ulm University), and is forthcoming in the collection titled \textit{Popular Culture and Biomedicine: Knowledge in the Life Sciences as Cultural Artefacts}.

\textsuperscript{241} Although this thesis stresses the importance of technology in the uneasy liaison between these two fields, we cannot forget that this is not computer art’s only problem with the art establishment. An idiosyncratic set of conventions or even the lack thereof, seen previously and as understood by Becker (2008[1982]), also contributed to this tension. Even pioneers in computer art, such as Herbert Franke (1985, p. 153), recognised this as a problem. In some other cases, such as the Stuttgart group led by Bense, a completely new set of conventions, and their respective values, was proposed (Klütsch, 2007a, 2007b, 2012). Needless to say, the previous section has explored the consequences of these new values: the creation of new institutions dedicated exclusively to this practice.
Working as proxies of this larger struggle, between AST and contemporary art, the result of this inquiry shows that artists generally positioned within AST not only understand science differently from their artistic peers but also represent it in a very particular and positive way: whereas AST artists see science and technology as beneficial, empowering and, ultimately, progressive tools that can improve our human condition, artists in the larger art world see technology and science as proxies of an increasing technocratic, dehumanising society that promotes the idea of unregulated progress and poses a threat to the last sanctuary of humanness: art itself. One of the reasons for this division, as I have previously argued, is the result of AST’s problematic and continuous development as an independent art world, beginning with the 1960s computer art ‘movement’, and as a technophilic cultural field. Achieving relative success in an increasingly culturally hostile environment, computer art expressed the technocratic spirit of previous decades in a moment when this very spirit was losing momentum. Inheriting computer art’s nurturing mechanisms – industry and academia – as well as much of its rationale, AST has come to embody and continue early computer art’s technophilic position within a broadly technophobic artistic field. The main points of this conclusion are hence threefold. Firstly, I historically ground today’s division, between artistic technophilia and technophobia, as a consequence of exogenous cultural changes and not only endogenous artistic ones.\footnote{242} Secondly, by stressing the importance of larger cultural changes in the artistic perception of science, I show that these oppositional artistic discourses are not only produced by individual dispositions but are also the result of historically constituted

\footnote{242}{Also referred to as opportunity spaces or ‘political opportunity’ (Meyer and Staggenborg, 1996; Meyer and Minkoff, 2004), these exogenous factors are larger historical, social, intellectual and material changes outside the scope of the artistic world in question. For an overview of the benefits and limits of this concept applied to the study of artistic worlds, as well as further conceptualisation, see Baumann (2007a, p. 52; 2007b, pp. 21–52). For more information on the conceptualisation of art as a collective activity, consult the first chapter.}
collective frames employed in order to justify one’s art. Thirdly, as we examine recent AST discourse and demonstrate its institutional resilience despite larger artistic opposition, we will find that its current position resembles that of authors positioned within the transhuman field, indicating not only a mere coincidence but, I believe, a larger cultural trend.

Before we proceed the reader should recall that AST, which encompasses labels such as digital art, computer art, electronic art, art and science, new media art and so on, refers to artists and aestheticians who invariably discuss, produce or criticise artworks created with the help or within the scope of technologies created after the Second World War. Moreover, in addition to this continuous engagement with technoscientific developments and discourses, we also find AST in the institutions dedicated to its own promotion. Usually displaying an emphasis on information technologies, the digital computer being the most obvious one, AST’s members cannot be easily grouped as a single ‘art historical’ movement if not without reference to their use of such technologies, methods and institutions – as demonstrated extensively over the course of this thesis. Resulting sometimes in a naïve and exacerbated scientism that has persisted over the years, AST in fact is not a term that describes or defines a group of closely connected individuals but rather a term that works as an umbrella term, uniting those distinct cultural products of post-war art that emphasise the connections between art, science and technology, both as an artistic subject and as a medium. It is not my intention to provide an art historical definition of this field. This has been done many times before and a consensus has never been achieved. With the label AST I am aiming at the lowest common denominator. A restrictive term would be self-defeating to the endeavour of this

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243 A concept also drawn from the social movement literature, collective action frames developed from the work of Goffman (1986) and can be seen as ‘sets of beliefs and meanings that inspire and legitimate the activities and campaigns of a social movement organization’ (Benford and Snow, 2000, p. 614).
thesis since, differently from art theoretical studies, I am not interested in an aesthetic proposition. Instead, I focus on the material, discursive and institutional links uniting those artists and theoreticians into a single albeit loose group. It is also important to note that this combination of words – ‘art, science and technology’ – is not proposed out of thin air and follows the subtitle of the most enduring publication dedicated to AST: Leonardo: The Journal of the International Society for the Arts, Sciences and Technology, today published by MIT Press. Leonardo, I argue, has followed and shaped AST since its very early days; this case study will provide an example of such influence on a micro-level – that is, that of the artwork itself.

In order to demonstrate that AST artists today are in a position of veiled conflict with many in the artistic field, I will compare the artworks and discourses of three different individuals. One of them, Eduardo Kac, is a representative of AST practices; the other two, the duo Jake and Dinos Chapman, represent the larger artistic world. The rationale for this choice is clear: all of them share the propensity to discuss and interpret genetics. The result of this comparison demonstrates that, on the one hand, we have a technophilic group, AST, which assumes that scientific developments are not only normal but also central to artistic debates. Its rationale, even today, is centred on the argument that, since science cannot be stopped, artists are obliged to make its progress more humane. It mainly perceives technology as neutral and concludes that it is up to us to make sure it is put to good use. On the other hand, we have a larger, as yet more artistically dominant, technophobic group. This group belongs to the larger contemporary art world and assumes technology and science to be proxies of an increasing technocratic, dehumanising society that not only promotes the idea of unregulated progress but also poses a threat to the last sanctuary of humanness: creativity and art. This group refers to AST as naïve and utopian since neither science nor technology are neutral.

First let us focus on the Chapmans’ artwork Zygotic Acceleration, Biogenetic, De-sublimated Libidinal Model (1995) (Fig. 57). An unsettling but also kitsch sculpture,
this creature looks everywhere; there is no place where you can escape from its many faces. Its body is a confusing interconnected amalgam of human forms. Sexual organs, both male and female, are distributed unevenly across its many faces. On its many legs, there are sneakers instead of feet. Despite its youngish looks, according to the duo, these are not children: ‘Our organisms are genetically mature and dislike being called children. They wear sneakers so that they can run fast like super-powered nomads’ (Chapman and Chapman, n.d.). There is a strong and well-defined strategy in *Zygotic Acceleration*, as well as other works from the duo, that seems to be absorbed and understood by all its fans and critics: its capacity to visually shock and spark a debate on the limits of representation (Stallabrass, 2006, pp. 102–103; TATE Liverpool, 2006; Grunberg, 2007).

Intended to be a commentary on our modern morality and the body (Grunberg, 2007), the Chapman duo’s work uses mannequins of deformed children as a way of inciting a reaction from the viewer. Clearly involving some avant-garde ideas of shock value, it is interesting to note that, for the supporters of both brothers, art theory is used as a form of defence against claims of sensationalism (Stallabrass, 2006, p. 102). *Zygotic Acceleration*, however, apparently does not aim to criticise genetics or other ‘anti-humanist viruses’ (Chapman and Chapman, n.d.). Jake Chapman succinctly exposes this idea by affirming that the brothers ‘work analytically rather than critically. We aren’t trying to solve genetic engineering problems when we deal with the subject of cloning’ (in Kunsthaus Bregenz, 2005).

Despite their claim that they are not interested in commenting on genetics itself, *Zygotic Acceleration* epitomises the popular reading of genetics as an immoral and monstrous practice. Its immorality stems from the proposition that genetics, in this understanding, is an ‘anti-humanist’ threat. The monstrosity of its result, the deformed children in *Zygotic Acceleration*, is then used against the viewer, who, consequently, ought to be disgusted by it. In other words, the Chapmans’ aesthetic strategy attempts to use this (perceived) terrible humanist threat, genetics, as a way of achieving a desired
moral panic (Chapman and Chapman in Grunberg, 2007, p. 11). Not only do they establish genetics as sinful but they also choose to engage with it knowing that it will cause their desired result: moral panic. When they say that they do not want to resolve the ‘genetic engineering problem’ it is because, from their point of view, this problem is not theirs. Their intention is to use these ‘problems’ to excite reactions from viewers. Genetics, by its very use, as a trigger of moral panic, is defined and represented as a horrendous practice and not something to be celebrated or even discussed. It has already been defined as such. They may say that they ‘work analytically rather than critically’; however, this is not what we see in action with Zygotic Acceleration, itself a very critical depiction of genetic engineering.

It is true that their career is not solely dedicated to the theme of genetic engineering as a trigger of ‘moral panic’. They have also used their well-known shocking strategies to discuss other topics such as capitalist and postcolonial institutions (as seen in The Chapman Family Collection, 2002) and war (as seen in the Disasters of War, 1993, and Hell, 2000, series). What unites those works, apart from their obvious attempt to shock, is the conversation around topics such as modernity and its consequences. The idea of rationalisation, though not clearly expressed, can be found under the veil of visual aggression that made the duo so famous. Consequentially, it is no coincidence that their choice of McDonalds, as one of the targets in The Chapman Family Collection (Fig. 58), mirrors recent attempts to recast the Weberian notion of rationalisation of contemporary society via the work of sociologist George Ritzer and his book The McDonaldization of Society (1996). Another evidence of such a play on the idea and precepts of

244 Jake Chapman hints that even their technique, a rather traditional one, partakes in this dialogue. Their work ‘parasitically, or vampirically, depends upon all the forms of art production which should, under the conditions of progressive modernity and liberal humanism, have been buried for being Luddite or non teleological. So our excavation of all these zombified art techniques visit the healthy, vital, modernist body with all the diseases which give it its momentum’ (in Chapman and Baker, 2003, p. 8).
rationalisation can be found in *Ubermensch* (Fig. 59), from 1995. In this sculpture we find theoretical physicist Stephen Hawking atop a fake hill in his wheelchair and, as a newspaper critic points out, it is ‘clearly not a homage to Hawking’s intellect or courage’ and rather ‘stresses his carnal weakness and mocks the idea that his mind has somehow conquered matter’ (J. Jones, 2012). In another newspaper article, from 2007, the brothers are accused of being anti-Enlightenment and against all kinds of ‘reason’. Reading their work as a ‘pure expression of postmodernist philosophy’ (Hari, 2007), the author believes something rather sinister is in play: ‘They vandalise and ridicule the fruits of reason […] Some foolish critics have praised the “moral anger” in the Chapmans’ work, directed at “injustice and cruelty”. Precisely the opposite is the case. This is immoral anger, celebrating injustice and cruelty as transgression’ (Hari, 2007).

One could indeed be tempted to understand the Chapmans as mockers and vandals of modernity, rationality and even Enlightenment ideals. What we cannot forget, however, is that theirs is a position pretty much in tune with the artistic debates emerging from the late 1960s, present not only in the arts but also in culture in general. The technocratic, rational and positivistic world being condemned and used by the Chapmans is precisely the world condemned by the counter-culture. Genetics, along with capitalism and technocracy, then, are portrayed as diseases facing individuals and societies and, in turn, are used as aesthetical artifices that should – in theory – wake people from their ‘artificial sleep’ (Grunberg, 2007, p. 28). The duo undoubtedly sit at the centre of what we have so far labelled as the art world. They have works commissioned by institutions such as the Tate, they are part of numerous private collections such as Saatchi’s, their works are constantly exchanged for hundreds of thousands pounds, they are highly visible in the specialist press, they are represented by highly prestigious galleries, etc. It would be naïve to consider these artists as marginal ones. Their prestige indicates a resonance with art world concerns and, despite some dissonant voices as exemplified by the critics
above, the fact is that they are central participants in the contemporary art world. The same, however, cannot be said of our next artist.

As Roger Malina remarked in 2001, *Leonardo* today receives ‘texts from a new generation of artist-researchers, artists very well versed in contemporary science or technology’ (Malina, 2001, p. 293). Holding to the tradition of 1960s technophilic artists, these new artists still struggle to bridge the two cultures. Aiding their effort, and central to many technological developments ever since, we locate, again, computing technology. According to Malina, ‘the shared language and tools of computer science have provided the basis for shared approaches for problem solving, new collaboration environments and ultimately the beginnings of overlapping epistemologies’ (Malina, 2001, p. 293). Eduardo Kac, our next artist, fits perfectly with the figure of the contemporary AST artist as painted by Malina. Despite being distant from the centre of the art market and institutions that usually legitimise production within contemporary art, Kac is central to the AST practices that emerged out of the early computer art of the 1960s. Very academically active (like his predecessors), averse to visual shock and not very much discussed within traditional art institutions, Kac is a central figure of our technophilic art world, the AST one, and is regarded as the creator or exponent of the bioart practice. Although not specifically looking for the kind of shock value operating in the previous example, Kac’s projects are, to say the least, anything but easy. In fact, the artwork that I shall now focus on not only generated a huge response but was also the reason for a dispute that itself exemplifies the contentious nature of the genetic engineering. Born in 2000, Alba (Fig. 60), the glowing rabbit, according to Kac

is an albino rabbit. This means that, since she has no skin pigment, under ordinary environmental conditions she is completely white with pink eyes. Alba is not green all the time. She only glows when illuminated with the correct light. When (and only when) illuminated with blue light (maximum excitation at 488 nm), she glows with a bright green light (maximum emission at 509 nm). She was created with EGFP, an enhanced version (i.e., a synthetic mutation) of the original wild-type green fluorescent gene found in the jellyfish Aequorea Victoria. (Kac, 2000)
Alba was shown for the first time in France in 2000. Surrounding her birth, there was worldwide media frenzy and a heated debate regarding the nature of Kac’s artwork. Differently from the previous example, the shock related to Kac’s work was not caused by its aesthetics. Instead, what most horrified people was the very idea of creating a living, genetically altered animal for art’s sake. If compared to Zygotic Acceleration, Kac’s *GFP Bunny* project – in which Alba was obviously central – is impossible to describe simply as an art object and can better be understood if divided into parts or modules. According to Kac, ‘Alba is undoubtedly a very special animal, but I want to be clear that her formal and genetic uniqueness are but one component of the “GFP Bunny” artwork. The “GFP Bunny” project is a complex social event that starts with the creation of a chimerical animal that does not exist in nature’ (Kac, 2000). Alba, in other words, was not herself an artwork. Instead, Alba was just a component, a starting point for an event that led to the artwork. In Kac’s words, the intention of this event was to produce a sequence of dialogues between ‘professionals of several disciplines and the public’ (Kac, 2000). Perhaps related to his background as an academic (similarly to many AST artists), Kac’s art project relies heavily on his theoretical writing. In his paper describing the *GFP Bunny* project, Kac looks at the history of the human and rabbit relationship, arguing that, contrary to popular notions, humanity has always interfered with the animals’ evolution (Kac, 2000). Despite the complexity of his artwork, Kac seems clear about its intention and objective. In true *Leonardo* fashion, and resembling Malina’s wish for artists to clearly discuss their own work, Kac’s website hosts many articles, examples and records related to the *GFP Bunny* project, written both by himself and others. The strategy here is to engage the public with his artwork and spark a debate on the issues raised by genetic engineering and transgenic organisms. In this case, *GFP Bunny*’s medium is not just an important aspect of Kac’s work but rather it is essential. Aside from the rabbit herself (if we regard her as a medium), there is an interaction between the artist and the public that
is achieved by a series of public interventions, objects, debates, articles and recordings, all accessible via Kac’s website (Fig. 61, 62, 63, 64).

Curiously, the controversy involved not only Kac but also his collaborators. In the popular press, the ethical issues concerning new genetically modified organisms were very much alive. Under the spectre of Dolly the sheep, genetically modified crops and mad cow disease, the debate developed within a partisan, rather bleak atmosphere (Dickey, 2001). Perhaps because of negative public opinion or perhaps because of honest ethical concern, despite helping Kac with the creation of Alba, the French state-funded research centre INRA (Institut National de la Recherche Agronomique) at the last minute rejected the use of Alba outside the walls of its laboratories. Ironically Alba, the key element in Kac’s artwork, ended up like any other scientific animal in captivity. In an article for Wired magazine, Christopher Dickey describes the tug-of-war involving Kac and his scientific collaborators (Dickey, 2001). In a sarcastic account of the conflict between artist and scientists, Dickey exposes the ways in which the public reacts and expresses itself. Again, that old Frankenstein myth is very much remembered. Searching for public reactions to GFP Bunny, we see that the idea of monstrous chimeras was involved in much of the discussion, expressing itself in both the press and academic circles. Kac’s radical approach not only exposed a bitter discussion about genetics as a whole but also had the effect of causing a debate on art’s (and science’s) responsibility and ethics.

Kac’s appropriation of genetics is very different from the Chapmans’. Not only do these artists differ in their opinion concerning it but they also represent genetics differently. The artistic representation and use of genetics offer the opportunity to discuss opposing practices that, otherwise, do not seem to have anything in common. Likewise, by contrasting Kac’s and Chapman’s artwork it is also possible to peek into the rationale of these artists’ field: respectively, AST and the broader art world. Juxtaposing the qualities of GFP Bunny and Zygotic Acceleration, we find opposing discourses in relation
to genetics, in particular, and science, rationality and technology more generally. While *Zygotic Acceleration* reutilises the representation of genetics as immoral and monstrous in order to criticise public assumptions of rationality and morality, *GFP Bunny* contests the very idea of this negative representation. On the one hand, the Chapmans’ use of ‘anatomical transgression’ (Chapman and Chapman, n.d.) is used to question the viewer, not genetics itself. Kac, on the other hand, intends to question the public’s understanding of genetics. Positioned in different art worlds, each one with its particular historical development, the artworks speak for two distinct artistic practices: one, sympathetic to genetics, does not represent but appropriates genetics for artistic purposes (*GFP Bunny*); the other, opposed to such engineering, appropriates not genetic techniques but instead its representation as an immoral practice (*Zygotic Acceleration*). AST and Kac, with their roots found in the rational rigours of institutions such as *Leonardo*, is then positioned in exact opposition to the precepts demonstrated by the Chapmans. Whereas the Chapmans are active participants in places such as the Tate Modern, Kac is, unsurprisingly, a member of *Leonardo*’s editorial board and an active member of the AST community.

Showing both resilience and – albeit localised – success, these technophilic practices demonstrate a propensity both to be contentious in nature and to reverberate with a certain section of the art public – one that constitutes in itself a rather detached and specialised group. In other words, AST still exists despite being criticised by the members of the art world and, at the same time, owes its existence to this very criticism: in order to prosper, AST enthusiasts had to separate from traditional artistic institutions and, in the process of doing so, created a new field for people willing to further the field’s ambitions. Ironically, the idiosyncratic technophilia of AST members, despite going against its parent field, is the reason for its growth into a specialised artistic field. Had AST members adopted the pessimistic discourse of other art world members, who would have represented the technophile among them? It should come as no surprise that AST is rarely seen in traditional visual art courses and instead is taught in specialised higher
education courses, usually by these same practitioners. The same observation can be raised with regard to the publications and festivals usually presenting those same artists. While, for example, the Chapmans enjoy huge success in commercial galleries and major art museums, AST artists are historically presented (but not exclusively) in specialised institutions. At the same time that we are not endorsing this division we cannot, however, pretend it does not exist. Since AST has been rejected by most of the art world, does this separation denote that artistic technophilia is something of a peripheral position, relegated to certain close-knit groups and technology enthusiasts only? Perhaps not anymore. AST has grown, from its very humble academic beginnings, to have hundreds of dedicated festivals, university degrees and awards. Lately the field seems to have found a new confidence that is reminiscent of the early practitioners’ calls for a new art for a new time. Some even affirm that the Venice Biennale, perhaps the central event in the art world calendar, has shown a tendency to display and comment on posthumanism, albeit ‘not of the technological variety’ (Auslander, 2004, p. 54), in some of its past editions.

Despite not being centred at the heart of art’s canonical attempts, AST artists not only find space for their technophilia but also manage to prosper and survive within a theoretically hostile environment: a technophobic art world.

It is important to remember here that Kac, in fact, is rather moderate in his technophilic position. At times, he seems very questioning of possible abuses of technology and, again, reiterates the position so common in his field that artists have a responsibility to ethically discuss future scientific possibilities (Kac, 2007c). If we

245 Kac, in his book Signs of Life (2007, p. 12), which celebrates bioart, stresses that the ‘writers and artists whose work forms this anthology don’t see their role as commentators chronicling or illustrating the burgeoning biotech culture. Rather, their work is engaged in shaping discourse and public policy, and in stimulating wide-ranging debate. The writers and artists in this collection also reveal an acute awareness of the ethical questions associated with biotechnology.’
want to find extreme artistic technophilia, we should look at the work of other artists, such as Orlan or Stelarc (Fig. 65, 66, 67). For these artists, genetic engineering is not a matter to be debated. They do not wish to discuss the positive or negative aspects of it. For them any scientific development, including genetics, is an aim, a right. Their objective is clear: to enhance humans. It is in artists such as these that AST’s technophilia becomes something else, something more vocal, moralistic and sometimes even sanctimonious. Stelarc specifically, highly active in the AST field, seems to offer the clearest apology for enhancement. Seeing genetic engineering, cybernetic implants and other yet-to-be-discovered technologies as part of an imagined arsenal against our obsolete body, Stelarc can be argued to be a quintessential transhumanist. The philosopher Keith Ansell Pearson (1997), for example, tried to distance Stelarc’s work from this optimistic, technologically oriented strand of transhumanism (philosophical posthumanism), towards the more cautious and questioning view usually but not always held by cultural transhumanists, but it is difficult to deny the artist’s own words. Pearson may indeed seem right in saying that Stelarc’s work resembles the kind of posthumanistic thought sponsored by himself, more concerned with the dissolution of boundaries than technological utopia. However, when we look at Stelarc’s own discourse, it is unfair to the artist to assume that he is not at all interested in the tech-optimistic edge of transhumanism shunned by Pearson. Stelarc, as we know, is no naïve adopter and is very clear in his texts about his intentions and expectations. Moreover, arguing that our body can no longer match the strenuous necessities of our new world, Stelarc asks:

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246 For a discussion regarding the similarities and differences between transhumanism and posthumanism, as well as their historical development, see Miah (2009), Hauskeller (2014a, 2014b) and Ranisch (2014).

247 In fact, in this same text quoted above, Pearson makes this assumption by stating that ‘Stelarc’s most famous statement, that “the body is obsolete” comes perilously close to the dubious accounts of evolution provided by techno neo-Lamarckians that I have been keen to criticise’ (1997, p. 227). In a kind of
How can the body function within this landscape of machines? […] Perhaps it’s now time to design the body to match its machines. We somehow have to turbo-drive the body-implant and augment the brain. We have to provide ways of connecting it to the cyber-network. At the moment this is not easily done, and it’s done indirectly via keyboards and other devices. There’s no way of directly jacking in. Mind you, I’m not talking here in terms of sci-fi speculation. For me, these possibilities are already apparent. What do we do when confronted with the situation where we discover the body is obsolete? We have to start thinking of strategies for redesigning the body. (Stelarc, n.d.)

Although sharing a certain technophilic predisposition, Kac’s and Stelarc’s artworks are not in any way precursors or central to today’s transhumanist debates. Instead, both artists are reminders of the importance of the subject for certain social groups and in culture in general. In fact, as observed by Hauskeller (2009, 2013), the subject is even becoming mainstream. Cinema, literature, video games, the arts… all those different cultural domains can provide useful examples through which to discuss technophilic (and technophobic) discourses. Questions regarding the future of scientific development, it seems, have become central to many cultural agents (again). I am not certain why, how or when this shift occurred; in order to answer this question, a whole different effort should be proposed. What seems clear is that, despite not being a consensual shift, as exemplified by the artistic output of the Chapmans, technophilia and its most extreme position, transhumanism, do resonate for some people. In relation to GFP Bunny, for example, Kac recalls that ‘in the beginning people were quite worked up about it; there was a greater concern and fear than exists now […] The discussion now is more philosophical; the sense that some impending doom is about to happen has self-censorship that seems selective, later in the text Pearson states that, although in his own writings Stelarc attempts to provide an agenda to guide the utilization of future technologies, he is not, ‘however, interested in his legislations concerning the future but rather with his art-praxis and with the modes of “becoming” contained within it’ (1997, p. 231).
completely vanished’ (in Anke et al., 2008, p. 307). The growth in technophilia, not only in the arts but also in culture at large, I argue, is one of the reasons for the expansion and resilience of AST. A convergence in discourses from different fields, such as philosophical transhumanism and AST, illustrates this larger cultural trend.

On his webpage Kac (2000) attempts to ethically justify GFP Bunny by arguing that humans have always meddled with the genetic development of rabbits. According to his narrative the GFP Bunny project breaks no social or ethical rule since ‘humans have determined the evolution of rabbits for at least 1400 years’ (Kac, 2000). Notwithstanding its validity, we also find a similar argument within transhumanist circles. Transhumanists and AST artists, at first, may seem to share only the call for a new, improved human. Their desire for human improvement, however, is not the only thing that relates these two distinct fields. Kac’s description of genetics, for example, as another normal/natural step in our will for knowledge, is reminiscent of Bostrom’s (2005) assertion that ‘human desire to acquire new capacities is as ancient as our species’. Both authors in this case base their arguments on the assertion that humans have always looked for ways to improve their own condition. Whereas Kac highlights humanity’s constant attempts to change other species for its own needs, Bostrom stresses that humans have always looked for ways to improve themselves. Although employing different narratives, Bostrom’s and Kac’s historical accounts define the progression and adoption of new scientific advances as normal, natural human tendencies.

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248 Kac also justifies his projects ‘artistically’, using both art historical and art theoretical examples that link his practice with previous artistic periods and ideas. In order to maintain a cohesive text, I will not discuss those arguments and instead shall look at his ethical assertions.

249 A similar historical argument is made elsewhere (Kac, 2007a, 2007b).

250 By dissecting the discourses of some notable transhumanists, Hauskeller highlights that they usually ‘presuppose a normative conception of human nature’ where there is ‘an argument that proceeds from a claim about what some being’s nature is to a conclusion that tell us what this being ought to do’ (2009, pp.
With an eye on the prize (the improvement of humans), both authors end up equating normalcy to virtuousness. One product of this hypothesised human nature\textsuperscript{251}, also commonly found in both AST and transhumanist discourses, is the idea that scientific and technological development has been accelerating over the years\textsuperscript{252}. Following a mode of thinking perhaps popularised after Moore’s Law, Bostrom (2002, 2005), Kac (2007a; 2007b) and Kurzweil (1999) – to name a few – assume and anticipate this theoretical scenario of ever-faster scientific and technological progress by proposing a discussion of its possible threats. Although Kac contends that genetics is not inherently immoral, his artwork can be seen as an attempt to discuss the future scenarios advanced by the ever-faster scientific discoveries. Particularly worried about governmental and corporate control of future techniques, Kac argues that ‘art can, and should, contribute to the development of alternative views of the world that resist dominant ideologies’ (2007b, p. 164). Kac’s artistic and academic work, then, wishes to propose genetics as a ‘critically aware new art medium’ against the perceived threats of an impending ‘biotechnology revolution’ (2007b, p. 180). This cautionary reaction to faster development, again, is mirrored by transhumanists. Bostrom’s conceptualisation of ‘existential risks’ (2002), for example, is another case where theoretical output, despite

\textsuperscript{251} For some, such as Kurzweil, progress is not only human but also part of the natural, physical world. The wish for scientific development is then not only a desirable human trait but also a naturally occurring phenomenon: ‘once life takes hold on a planet, we can consider the emergence of technology as inevitable’ (1999, p. 24).

\textsuperscript{252} ‘Progressivism’, in Ranisch’s (2014) terms. As we previously saw, this is a tendency present in almost all discourses attempting to justify AST or computer art as normal artistic or technological developments.
coming from people who advocate enhancements, is done in order to address possible future threats. Ultimately, both authors see their work as mandatory, as a duty they must undertake. For Kac art should address the whole set of problems that may be created by genetic engineering; the alternative would be no improvements in our condition at all or, yet, a catastrophic abuse of its ‘political and economic power’ (2007a, p. 2):

The success of human genetic therapy suggests the benefits of altering the human genome to heal or to improve the living conditions of fellow humans. In this sense, the introduction of foreign genetic material in the human genome can be seen not only as welcome but as desirable […] Rather than embracing a blind rejection of the technology, which is undoubtedly already a part of the new bioscape, citizens of open societies must make an effort to study the multiple views on the subject […] Inasmuch as this seems a daunting task, drastic consequences may result from hype, sheer opposition, or indifference. (Kac, 2000)

Raising a similar argument, Bostrom, in his transhumanist declaration, affirms that:

In planning for the future, it is mandatory to take into account the prospect of dramatic progress in technological capabilities. It would be tragic if the potential benefits failed to materialize because of technophobia and unnecessary prohibitions. On the other hand, it would also be tragic if intelligent life went extinct because of some disaster or war involving advanced technologies. (2005)

For both, then, there are not one but two possible disasters: the misuse of ‘advanced technologies’ or, perhaps even worse, our ‘blind rejection’ of their possibilities. The very possibility, not the certainty, of enhancing oneself is what drives both calls for action. The pro-enhancement stance of transhumanists and AST artists, then, rests on the likelihood of a future advancement and not on something concrete and actual. These possible future scenarios, supported positively by the belief that science will ever improve and negatively by the possibility of its misapprehension, point to a question that these authors pre-emptively answer: Would you prefer the fantastic, limitless future of an enhanced humanity or the hypocritical negation of what humans can achieve? Their
answer is not only positive, of course, but also proactive (Ranisch, 2014), since policy is constantly an objective\(^{253}\).

Differently from the larger art world, which suspiciously and sometimes ambiguously represents these possibilities\(^{254}\), AST artists go to lengths when trying to justify their technophilic position. The conclusion reached by Kac, that improvement via genetic engineering is desirable, rests on two different and consequential assumptions. First, he sees genetic engineering as a natural consequence of human will and agency. Genetic engineering, then, is seen just as an extension of ancient breeding techniques that, according to his narrative, have always been part of human development. Second, if this interaction with other species also changes humans along the way, we cannot consider humans, or other species, as finished entities. Humans, subsequently, can also be affected by those same techniques developed towards other species. If we perceive deficiencies in humans, then, why not to improve them in the same way we did with animals? Kac’s human, like his transgenic rabbit, is far from a final product. As demonstrated by Hayles (1999) in her historical account of posthumanism, the very same intellectual culture arising from post-Second World War developments, pivotal events for both AST and transhumanism, supported a discourse (via cybernetics) that understands the self as information and hence bounded not by its body but by its system:

Of all the implications that first-wave cybernetics conveyed, perhaps none was more disturbing and potentially revolutionary than the idea that the boundaries of the human subject are constructed rather than given. Conceptualizing control, communication, and information as an integrated system, cybernetics radically changed how boundaries were conceived […] Seen from the cybernetic

\(^{253}\) Kac, for example, in his *Signs of Life* (2007), describes its contributors as not seeing ‘their role as commentators chronicling or illustrating the burgeoning biotech culture. Rather, their work is engaged in shaping discourse and public policy, and in stimulating wide-ranging debate’ (2007a, p. 12).

\(^{254}\) The chimerical sculptures of Australian artist Patricia Piccinini are another great ambiguous example.
perspective coalescing into awareness during and after World War II, however, cybernetic systems are constituted by flows of information. (Hayles, 1999, p. 84)

The disposition of Kac’s argument, developed under the same rationale exposed by Hayles, rests on the assumption that both the rabbit and the human, as species, evolved under mutual influence and, consequently, that it is right to question the definition of ‘purity’ by affirming not only that humans have always interfered in the development of other species but also that, naturally, as ‘humans domesticate rabbits, so do rabbits domesticate their humans’ (Kac, 2000). From Kac’s point of view, neither human nor rabbit are finished or immutable identities, and genetic engineering, therefore, does not alter this unfinished condition and, instead, may even be used to improve it. This conception of humans as unfinished and open entities, as expected, is again mirrored by Bostrom, who contends that, after Darwin, ‘it became increasingly plausible to view the current version of humanity not as the endpoint of evolution but rather as a possibly quite early phase’ (2005, p. 3). Although Hayles is more interested in the criticism of categories such as ‘humans’, the dissolution of boundaries between humans, animals, plants and even machines can be seen as a central pillar of enhancement advocates. Tellingly, both Bostrom and Kac evoke the work of physician and materialist philosopher Julien Offray de La Mettrie as a historical focal point in this narrative of human plasticity (Bostrom, 2005; Kac, 2007a, pp. 4–5). It was from him, perhaps, that the idea that ‘technology could be used to improve the human organism’ (Bostrom, 2005, p. 3) initially developed. La Mettrie, then, can be seen as their tragic heroic figure whose intellectual bravery was both profound and profane, and who, because of ‘suggesting continuity among plants, human and nonhuman animals, as well as machines […] was persecuted’ (Kac, 2007a, p. 5). What is at stake here, in this supposedly heroic struggle against ignorance, is the intention to control our destiny, our bodies and our conception of humanity. The human body in this conception is just another object, like the machine so usually remembered, and a faulty one for that matter. As Kac succinctly declares: ‘new
technologies culturally mutate our perception of the human body from a naturally self-regulated system to an artificially controlled and electronically transformed object’ (Kac, 1998).

The different and sometimes oppositional representations and appropriations of scientific subjects, such as genetics, reflect a division in the artistic world. This is a division between those who see and comment on science positively, the AST world, and those who appreciate it suspiciously and negatively, the broader artistic world. The reader, however, should not see this division as solid, dualistic or black and white. The positions of different artists, in a field as heterogeneous as the artistic one, cannot be simplified. The field seems more inclined towards a discrete, spectrum-like disposition in relation to its adoption, representation and support of scientific practices. Technophilia and technophobia should be seen as labels for the most extremes positions presented in both AST and contemporary art. The few examples provided in this case study describe individual positions that, nevertheless, reflect broader artistic attempts to discuss the importance and value of science. In the case of AST, given its smaller size in relation to the broader artistic field as well as the centrality of certain institutions such as Leonardo, it is easier to comprehend its technophilic tendencies. Its recent history, closely related to the wide debates of scientific progress over the past sixty years, also helps us to cement its more regular character compared to wider artistic debates.

Given this division, however, it may seem quite surprising that AST has survived to this day. If artists using emerging technologies have not been fully integrated within the artistic world, how could they continue to produce ‘art’? If Paul Brown’s ‘kiss of death’ still persists, why are more and more institutions created in order to accommodate these practices? The reason for this, I argue, is not that AST-related practices have become more accepted or integrated into the arts. AST has not softened its technocratic discourse. Despite some exceptional and unusual examples, AST is still a fringe and specialised artistic field. Institutions such as Leonardo still cater to AST in the same way
they did when they were created. AST has not changed its position, neither has the broader art world; as far as the art world is concerned, the technological and scientific criticism intensified in the late 1960s still persists.

What seems to have changed, however, is the propensity of people to accept this technophilic discourse. Exemplified by the similarity of AST and transhumanist discourses, and AST’s apparent rise in popularity, a new larger cultural trend might be emerging. The transformation of how certain social groups comprehend scientific and technological development, from suspicion to optimism, perhaps is best exemplified by Turner’s study on the ‘rise of digital utopianism’ (2006). By tracing the adoption of cybernetics and the technological optimism of the 1950s and 1960s among some groups within the counter-culture movement, which theoretically should have combated the visions of technocracy denounced by the artistic world that was part of the same counter-movement, Turner highlights the apparently paradoxical view that computers, once seen as the explicit representation of technocracy, became over the years a symbol of a ‘decentralized, egalitarian, harmonious, and free’ society (2006, p. 1). Although speaking of computational devices and their social symbolism specifically, and not genetics or science at large, Turner reminds us that the work of those actors in effect ‘naturalized and legitimated the technologies, theories, and work patterns of the scientific research world as cultural rather than simply professional styles’ (2006, p. 255). By framing their existence in technoscientific terms, individuals seem to become more inclined to accept enhancements as well as transhuman and AST discourses as normal human developments. The new possibilities opened up by conceivable future genetic therapies, under this new technoscientific ontology, where humans and societies are seen as malleable, upgradable and informational objects just like computers, for some, seem to become the norm.
Last words

Over the course of this thesis I have attempted to show the emergence of AST as an autonomous artistic world. This detachment from the art world, I argue, is the result of a paradoxical situation: while AST describes itself as art, and consequentially wishes to partake in the artistic canon and be recognised as a legitimate artistic expression, the wider art world’s negation, scepticism and sometimes outright artistic incomprehension, incompatibility and rejection have provided AST with the means, the will and the certainty over its own project to enable it to not only persist but also expand over time. Its message, repeated over and over again, in different guises but yet retaining the simple yet powerful call – that technoscientific developments are changing the world and we ought to do something about it – has resulted not only in growth but also in autonomy. This autonomy, complete with a whole new set of discourses that frame technoscientific developments in a particular positive light, by emphasising their social transformative aspects and/or by highlighting the necessity to engage with them in order to ‘humanise’ technology, was then followed by the creation of institutions that have supported and disseminated AST’s technophilic ideals. Instead of being a cohesive group, in a traditional art historical sense, the group that has emerged is a heterogeneous amalgam of agents that do not necessarily agree on a single course of action – that is, they each propose a different interpretation of how to engage and live with, or what are the dangers and the potentials of, an increasingly and rapidly changing world affected by technoscience. Common to them all, however, is their engagement in this debate. Participating directly, via discourse, or indirectly, via the adoption of these technologies developed after the Second World War, the artistic production is as varied as the diagnosis and prognosis of the current situation: they have been rational formalists attempting to transform art into a scientific practice (as in the early computer art wave);
they proposed an engagement with industry and technology in order to either humanise both (as in E.A.T.) or explore potential artistic practices (as in Reichardt’s Cybernetic Serendipity); they proposed to coerce the very same tools developed by the military–industrial complex to fight against capitalism and the art market (as in Tendencije); they wanted to reshape artistic practice into a scientific model, aiming for a demystified art and a more humane science (Malina’s Leonardo); they believed in the capacity of technoscience to transform our bodies and minds into something new and potentially improved (as in Kac’s and Stelarc’s work); and so on. Despite the differences between the members of AST, they have all agreed that society was changing via technological development and that something ought to be done about it, either by dreaming of bright new futures or by discussing and engaging with science and technology right now. They have generally been technophiles, believers in the transformative aspects of technoscience as much as in their capacity to partake in this transformation. At its most extreme and utopian position, AST proposes, in essence, a new ontology where the boundaries between humans and the natural/material world are dissolved: the end of humanism and the rise of transhumanism.

Yet, perhaps as important as recognising this unity in diversity, my research also points to the influence of non-artistic exogenous factors in the development of AST. Using material usually relegated to footnotes, this thesis reiterates the importance of exogenous factors in the formation of new artistic practices against more formalist or essentialist art histories. Consequentially, we have seen that AST’s continuous relationship with the larger cultural, material and political fields has been manifested in the importance of the underlining optimism intrinsically linked to technological and economic development after the Second World War – optimism that positioned technocratic principles such as modernisation theory and computing machines as well as scientific development as harbingers of a new prosperous era, potentially creating a positive environment that allowed the very idea of art being made by computers possible;
in the development of a collection of rational formalist theories, which could be described as supporting a scientific faith anchored in the moral righteousness of scientific methods and in particular empiricism and positivism, perhaps best exemplified by the use of cybernetics by artists and theorists, which in turn informed some of the earlier discourses arguing initially for computers and later for a broader understanding between art, science and technology; in AST’s symbiotic relationship with the military–industrial complex, a product of the Cold War and its national policies, which in fact indirectly supplied AST with its tools and directly financed some of the biggest exhibitions during its early period, as well as in its relationship with academia, which, in time, became a hub for producers in a time when the necessary equipment and knowledge were not only rare but also incredibly expensive to anyone outside industry; and, finally, in the fateful rise of the counter-culture movement and its technophobic turn, whereby the relationship between AST members and the military–industrial complex was called into question, resulting in AST being pictured by outsiders and even some internal members as a collaborator of the status quo and, consequently, in diametrical opposition to the general inclination of the artistic and cultural field as humanistic and anti-technocratic.

With all those factors in mind, and on a final note, we might then ask: What does the future hold for AST? As we realise the importance of all the aforementioned factors, where is AST placed at the moment? What are the current proposals for the future of the field? Here, and again, the answer seems to lie in the tools and the larger cultural field and not in artistic debates only. Rather like jazz, for example, which ‘spread faster after the introduction of industrialized production and distribution of phonograph records’ (Becker, 2008, p. 322), so would AST grow with the advent of, firstly, the personal computer and, then, the Internet. Since many of its artworks already relied on computers or, at least, were conceptualist in the sense that they were as much as textual as pictorial, as in the case of Kac’s GFP Bunny, the Internet provided a low-cost platform for their dissemination. Likewise, the tools of its trade, mainly in the form of computers,
partnerships with scientists and/or technoscientific techniques, also became cheaper. Gone were the days when computers cost hundreds of thousands of pounds. Direct communication and the availability of information, via email, websites, search engines, forums etc., invariably made it easier for a previously restricted practice to become widely available. It is notorious that even programming languages became simpler, less abstract, away from machine language and closer to a natural human syntax than before. Anyone who has ever used something like Processing or Pure Data will know what a difference these tools meant – for someone without formal computing education – in learning, programming and creating. Not only were those tools free but they were also informed by, discussed and taught by a very engaged community: forums, projects and examples were there, for free, for anyone minimally interested in learning. Universities’ monopoly over the knowledge to work with the converging tools of the post-war era, the computational apparatus, consequentially diminished. Concerning this very decrease in price and the wider availability of technology and its know-how, a similar point could be raised in relation to hardware: no longer did industries hold the influence they once had. That is not to say that industry and academia are no longer central to AST. The examples provided in the introduction to this thesis dismiss this theory of complete independence from industry or academia.

However, while institutions such as Leonardo are still central forums of (mainly academic) discussion, the field has become more and more heterogeneous and multifaceted, with Leonardo, for example, holding considerably less power than it once did. Such is the proliferation of publications, cultural centres and festivals that it is impossible to compile this development without leaving the majority of its components to one side. A quick, unscientific search on Google for the exact term ‘new media art journal’ returns 9720 links; ‘new media festival’ returns 88200 links; ‘new media art society’ 12100; ‘new media art group’ 7060; ‘new media art exhibition’ 90000; and so on. Here is where AST really shows its vitality, not as a single stylistic artistic practice
but as a movement in the classical sociological meaning of the word. Although most of
the links returned pertain to the same webpages, the sheer amount of websites makes this
compilation a project for a data-mining technical paper. Ultimately, one thing can be said:
with the growing number of competitors, traditional spaces invariably have lost some of
their lustre. Note that I say ‘some’ and not all. That is because _Leonardo_ and other
traditional institutions such as Ars Electronica, MIT Media Lab, SIGGRAPH,
Transmediale and ZKM still function as nodes in a huge network that can be thought of
as the active, living world of AST.

In the midst of this newfound heterogeneity, something else also happened to
AST: not only did it continue to develop its own ideas but it also started to interact with
new disciplines that emerged as a consequence of computing technology’s explosion.
Although not necessarily dominant in artistic discourses, nor central to AST today, these
new disciplines, such as software studies, digital art history, digital humanities, data
visualisation and information studies, are now also discussed within AST circles because
of their shared interest in information technology. These most recent developments,
although not discussed in this thesis, point to a vigorous field that, similarly to the
technology itself, is developing quickly over time. AST, in this case, demonstrates an
open mindedness that should be seen in conjunction with its ability to promote and
celebrate the new. Here AST is, in fact, striving to adapt itself to newer discourses that,
similarly to its own original position, are engaged with our newest machines.

This act of appropriation, of translation, should not, despite its apparent
omnidirectional movement, be thought of as an exclusive characteristic of contemporary
AST. Since AST in fact predates most of these new emerging disciplines, we should not
be surprised that some of its early ideas have themselves been rethought by these new
disciplines. That people discuss, then, computational culture today, as in generative or
computer art back then, should come as no surprise. In this context, neither should we be
surprised that artists today talk about computational art instead of simply computer art.
As AST has moved forward, alongside its newfound partners and cousins, it has also adopted the terminology and the new emphases of its time. Whereas, for example, as we previously saw, Bense would emphasise the generative aspects of algorithms, as in early computer art, the focus now seems to be directed towards the capacity of computers to generate images via data inherently outside the machine. This data or information visualisation, to use the current terms, instead of emphasising the potential of random algorithmic processes, highlights the chaotic aspects of reality that, in turn, can be exploited by programmers and artists interested in the use of vast amounts of data recently produced by, for example, social media or search engines.

If AST’s variety is a direct consequence of technological developments, both facilitating and proliferating its techniques while widening its scope, how can we make sense of it all? Returning to the question presented in the first chapter, regarding the impossibility of a stylistic explanation for the production of this huge output, what could minimally and coherently unite this new contemporary wave of production? Here, and again, the tools and the cultural context of AST are pivotal and show us the path towards a holistic understanding of the contemporary features of AST. With its historical genesis in mind, we should then focus on the development of a potential new kind of technophilia, away from the scientism of earlier periods and towards the utopian constructions of free, decentralised, non-hierarchical societies discussed by Turner (2006) and Barbrook (2007). Such a new kind of technophilia is also well exemplified by the development of the free software movement and by the entrepreneurial Californian ethic that informs many of the tools and discourses of AST’s post-Internet generation. It is also in evidence in the transhumanistic dreams of an enhanced human, seen in the mystical discourses of Ascott and in the technological determinism of Stelarc, which feed into a whole ecology of DIY body improvements pertaining to the trendy label of ‘body hacking’ and the increasing use of cognitive enhancers by members of academia and industry.
A future research project intended to explain the totality of AST and its troubling relationship with the art world today should not, then, preoccupy itself with defining AST within a philosophical theory that argues for certain particularities and qualities of its artistic production. This, again, would result only in a partial explanation, an artistic discourse that accounts for a section of AST and not its totality, and in arguments for certain kinds of art and against others not perceived as desirable. The reader should be aware that, although reflecting on the nature of AST is a valid preoccupation, in fact a critical one from the point of view of AST’s own criticism, this thesis has not talked about AST as a whole, about its underlying ideologies and its position within our contemporary culture. These partial explanations can only discuss small fragments of what has become a behemoth. This thesis obviously lacks such a discerning, critical intention. To define AST as an appropriate, worthy or good artistic practice has never been my intention. The benefit of this thesis lies in its explanatory and not its discriminatory potential.
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THERE SHOULD BE NO COMPUTER ART

Frieder Nake

Soon after the advent of computers it became clear that there was a great potential application for them in the area of artistic creation. Before 1960, digital computers helped to produce poetic texts and music; analog computers only occasionally generated drawings of sets of mathematical curves and representations of oscillations (see e.g. [3], [5] and [7]). But it was not before the first exhibitions of computer produced pictures were held (1966) that a greater public took notice of this threat, as some said... progress, as others thought. The threat and progress being the use of an extremely complicated, sophisticated, expensive and rational machine in the arts, i.e. in one of the last refuges of the irrational, as some believe. And it took another three years before there was a tremendous breakthrough caused by two big international exhibitions of 'computer art' ('Cybernetic Serendipity', London 1968, 'Computers and Visual Research', Zagreb 1969).

Since then, a serious discussion has been going on in the art world about the consequences and implications of the use of computers. Art magazines and full articles, exhibitions are held everywhere, seminars are offered by art schools, books are published, portfolios are sold. Computer conferences have their computer art sections, computer journals publish technical papers. Computer scientists are flattered by the little public success they make and amused by the interest artists develop. Artists surrender to the pressures of the new technique or laugh at the results, and get humiliated by the attitudes that scientists assume when they try to communicate with each other.

The discussion centers around the question "Is it or is it not art?", and is heated, often extremely ignorant and prejudiced, showing virtually no progress, highly repetitive, although the few interesting new methods and the little knowledge of computers that some artists need have been published several years ago. (See e.g. [4]. For a recent survey including a bibliography, see [8].)

I was involved in this development from its beginning onward (1964). I found the way the art scene reacted to the new creations interesting, pleasing and stupid. I stated in 1970 [6] that I was no longer going to take part in exhibitions.

I find it easy to admit that computer art did not contribute to the advancement of art if we judge "advancement" by comparing the computer products to all existing works of art. In other words, the repertoire of results of aesthetic behaviour has not been changed by the use of computers. (This point of view, namely that of art history, is shared and held against "computer art" by many art critics, compare e.g. [2].)

There is no doubt in my mind, on the other hand, that interesting new methods have been found, which can be of some significance for the creative artist. And beyond methodology, but certainly influenced by it, we find that a thorough understanding of "computer art" includes an entirely new relationship between the creator(s) and the creation. BENSE uses the term "art as a model for art" in this context [1].

The dominating and most important person in the art world today is the art dealer. He determines what is to be sold and what is not. It is the art dealer who actually created a new style, not the artist. Progress in the world of pictures today is the same as that in the world of fashionable clothes and cars: each fall, the public is presented with a new fashion, artificially (sic!) created almost a year before in the centers (Paris, London for clothes, Detroit for cars, New York for pictures). Differences from year to year are rarely ever substantial, in the majority of cases they are superficial and geared according to the salesmen’s requests and analysis of the market.

It seems to me that "computer art" is nothing but one of the latest of these fashions, emerging from some accident, blossoming for a while, subject matter for shallow 'philosophical' reasoning based on prejudice and misunderstanding as well as euphoric over-estimation, vanishing into nowhere giving room to the next fashion. The big machinery, still surrounded by mystic clouds, is used to frighten artists and to convince the public that its products are good and beautiful. Quite frankly, I find this use of the computer ridiculous.

In many publications on "computer art" we read complaints that "real" artists do not have access to computers because of the forbidding expense of the machine, and because of the artists’ lack of knowledge in programming. We also read that we could obtain really interesting and new results if artists had the opportunity (money) to realize their ideas using a computer, perhaps being helped by programmers and mathematicians." At the same time, artists become aware of the role they play in providing an aesthetic justification of and for bourgeois society. Some reject the system of prize and awards, disrupt big international exhibitions, organize themselves in cooperatives in order to be independent of the galleries, contribute to the building of an environment that people can live in.

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