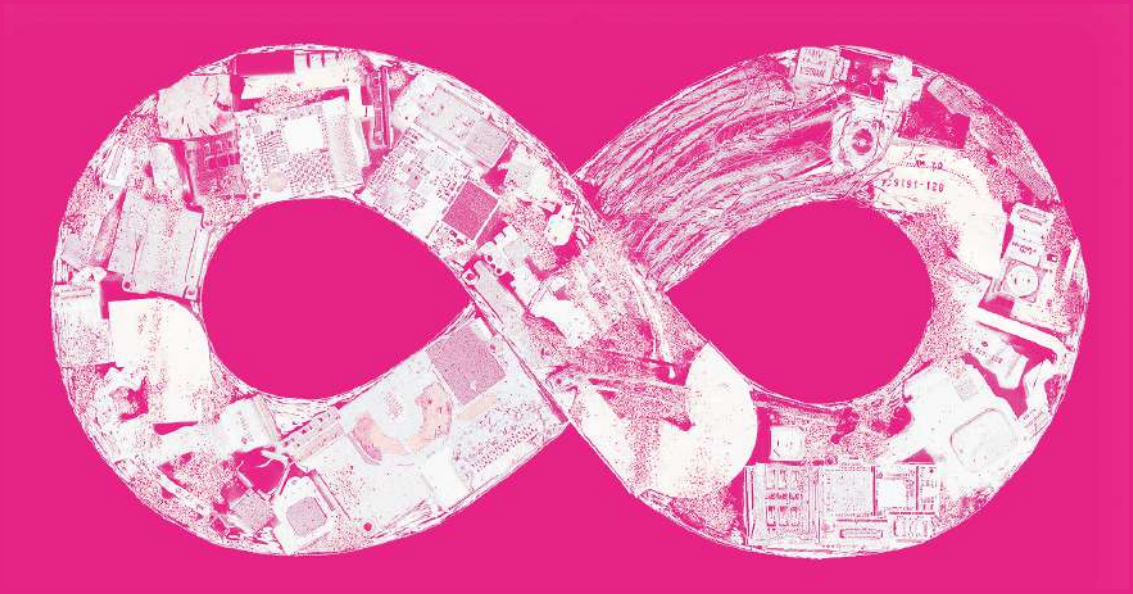
DESIGNING INTERACTION:

Electronic Art and the Autistic Experience



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Cynthia Patricia Villagómez Oviedo

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Electronic Art and the Autistic Experience

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DOI.ORG/10.52501/cc470

COMUNICACIÓN CIENTÍFICA
PUBLICACIONES ARBITRADAS
HUMANIDADES, SOCIALES Y CIENCIAS

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COLECCIÓN CIENCIA e INVESTIGACIÓN

Designing Interaction:

Electronic Art and the Autistic Experience

Cynthia Patricia Villagómez Oviedo
(Author)

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1.-

Villagómez Oviedo, Cynthia Patricia,

Designing interaction : electronic art and the autistic experience / Rubén Flores González.— Mexico City : Comunicación Científica, 2026.(Coleccion Ciencia e Investigación).

124 pages : ilustrations ; 23 × 16.5 centimeters

DOI: 1052501/cc.470

ISBN: 978-968-9803-26-3

1. Autismo. 2. Neurodiversidad. 3. Arte por computadora.

[1. Autism. 2. Neurodiversity. 3. Computer art.]

LC: RC553.A88 V55 DEWEY: 616.85882 V55

First edition published by Ediciones Comunicación Científica, 2026.

• Cover design: Cynthia Patricia Villagómez Oviedo
• Interior design: Guillermo Huerta

Ediciones Comunicación Científica, S. A. de C. V., 2026,
Av. Insurgentes Sur 1602, piso 4, suite 400,
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comunicacioncientificapublicaciones @ ComunidadCient2

ISBN 978-968-9803-26-3

DOI 10.52501/cc.470

This work was evaluated through an external blind peer review process. Both the review documentation and the book itself are available for consultation in open access at en https://doi.org/10.52501/cc.470

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I have devoted the last thirty-four years of my life to teaching. In the classroom, I have found not only a profound vocation, but also the conviction that knowledge opens pathways to a freer, more conscious, and more fulfilling life.

Cynthia Villagómez

Dedicated to the family members and friends of autistic individuals who, day by day, strive to understand them better and support their well-being and quality of life.

Acknowledgments

I would like to express my gratitude to the spiritual tradition that has guided my life; to my family; to my loving partner, José de Jesús Camarena Hernández; to my extraordinary daughter, Sara Sofía Parrales Villagómez; and to Rosalinda Oviedo, Francisco Villagómez†, Eduardo Oviedo†, Lourdes Aimé, Virna Alejandra, and Diana Elizabeth Villagómez†, whose love and support have accompanied me throughout my journey.

I am also grateful to the institutions that made this research possible: the University of Guanajuato and the National System of Researchers of the National Council of Humanities, Sciences and Technologies (CONAHCyT), Mexico.

Introduction

This research emerged from an interest in establishing interdisciplinary connections among electronic and digital art, interaction, emotion induction, and creative production processes in art and design. These themes have constituted the author's main research interests in recent years and have gradually converged in the present subject of study: Autism Spectrum Disorder Level 1 (hereafter referred to as ASD Level 1) and electronic art. The research is grounded in the premise that electronic art may contribute positively to the experiences and well-being of individuals with ASD Level 1.

Accordingly, this study offers an analysis and reflection based on the practice of electronic art, the possibilities for interaction that this artistic field provides, and its potential to foster opportunities for social engagement that may be beneficial for individuals with ASD Level 1. In this sense, the research seeks to contribute to the development of more inclusive environments, particularly for people with so-called "invisible" disabilities, such as ASD Level 1.

Furthermore, the number of individuals diagnosed within the autism spectrum appears to have increased significantly in recent decades. Earlier estimates suggested a prevalence of approximately one diagnosed individual for every 127 people[1], a trend that may be partly explained by improvements in diagnostic criteria and assessment tools. This growing prevalence underscores the relevance of the present topic.

[1] Autism Spectrum Disorder Collaborators. (2025). *Global, regional, and national burden of autism spectrum disorder and its attributable health burden, 1990–2021: Findings from the Global Burden of Disease Study 2021. The Lancet Psychiatry.* An estimated 61.8 million individuals worldwide (approximately one in every 127 people) were on the autism spectrum in 2021.

Despite increased awareness, autistic individuals continue to face stigma, largely due to limited public understanding of autism and the challenges associated with it. In Mexico, misconceptions and insufficient knowledge about autism remain widespread, extending in some cases even to healthcare professionals. As a result, many autistic individuals encounter obstacles in their daily lives and often lack adequate social and institutional support. Ideally, social practices, policies, and accommodations should help mitigate some of the difficulties associated with the condition; however, such measures remain limited in many contexts. Consequently, some autistic individuals choose not to disclose their diagnosis and instead cope with the associated challenges privately to avoid discrimination.

Nevertheless, there has been progress in Mexico regarding the recognition of psychosocial and invisible disabilities. Public institutions have implemented measures such as disability identification credentials and the recognition of diagnoses issued by private practitioners, which can contribute to improving the quality of life of autistic individuals.[2] Despite this, significant challenges remain. These include the need for diagnostic services provided by public institutions that are accessible to the broader population since private diagnostic assessments are often excessively expensive; the expansion of existing support programs to reach individuals of all ages; and greater education and public awareness regarding autism among autistic individuals and neurotypical individuals alike.[3]

In addition to the issues described above, this research examines the characteristics and living conditions of individuals with autism spectrum disorder as a means of understanding their potential connections with electronic art. It also seeks to identify aspects of electronic art that may contribute to the creation of safe spaces for autistic individuals and support processes of self-regulation, both of which are essential to quality of life and,

[2] Through the recognition of disability credentials, autistic individuals may receive accommodations in settings such as airports, including exemption from immigration queues, priority boarding procedures, and other accessibility measures. Additional benefits may include eligibility for vehicle registration permits and certain tax-related discounts, depending on applicable regulations.

[3] A neurotypical person, by contrast, is someone whose neurological development, information processing, and behavioral patterns generally conform to the norms and expectations considered typical within a given society.

in some cases, personal well-being and survival. Accordingly, this study adopts a transdisciplinary approach, bringing together ASD Level 1 and electronic art. It is proposed that the intersection of these two fields may open new avenues of research beyond those explored in the present work.

Part of the challenge in studying autistic adults with ASD Level 1 and their relationship to electronic art is the scarcity of existing research on the subject. This is compounded by the difficulties associated with diagnosing individuals with ASD Level 1, many of whom have learned to camouflage or mask their autistic traits in predominantly neurotypical environments. Furthermore, ASD Level 1 is frequently associated with high intellectual abilities. This dual condition is known as twice-exceptionality, a concept used to refer to individuals who...

> …demonstrate the potential for high achievement or creative productivity in one or more domains such as mathematics, science, technology, the arts, visual and spatial fields, the performing arts, or other areas of human productivity, and who also exhibit one or more disabilities (...). These disabilities include specific learning difficulties; speech and language disorders; emotional and behavioral disorders; physical disabilities; autism spectrum disorders; or other health impairments, such as attention deficit/hyperactivity disorder. (Reis, Baum, & Burke, 2014, p. 222, as cited in Conejeros, 2018, p. 18)

Consequently, many of these individuals spend most of their lives without a formal diagnosis, with their high abilities often masking the presence of autism or another disability. As a result, they may achieve success through their exceptional talents while simultaneously experiencing the challenges associated with their autistic condition or other disabilities. Some authors have suggested that between 14% and 20% of students with high intellectual abilities also have additional educational needs, such as attention deficit hyperactivity disorder, learning difficulties, or autism spectrum disorder (Fernández, as cited in Picart, 2019).

The present research was conducted over a four-year period. During this time, documentary research was carried out through the collection and analysis of books, films, and documentaries, while fieldwork involved consultations with professionals and individuals on the autism spectrum.

As previously mentioned, the author has conducted research on electronic art from a variety of perspectives since 2007, laying the groundwork for the present study. In this case, however, the focus has shifted toward neurodiversity. Likewise, the analysis of electronic artworks and developments has included both national and international examples. The geographical origin of the works was not a primary consideration; rather, priority was given to their potential relevance and applicability to interaction involving individuals with ASD Level 1.

During this period, the objective was to generate a body of knowledge concerning the potential of electronic art as a catalyst for cognitive experiences in neurodivergent adults with Autism Spectrum Disorder Level 1 (ASD Level 1). This was pursued through the study of neurodivergence and the identification of electronic artworks and projects capable of generating experiences related to cognitive processes, including perception, thought, memory, and information processing. Such an approach entails examining the potential benefits of recreating adaptive experiences through electronic art within the scope of the present study.

This line of inquiry is particularly relevant because, in recent decades, the benefits of art for autistic individuals have been explored primarily within therapeutic contexts. Comparatively little attention has been given to electronic artworks that may be meaningful or beneficial for individuals on the autism spectrum, or that have been specifically created with this purpose in mind. The aim of the present research is therefore to explore the possibilities of electronic art as a means of providing individuals with ASD Level 1 access to environments that offer a sense of spatial and temporal safety, while also facilitating communication and interaction with others when desired.

In order to address these issues, it was necessary to ask a series of guiding questions: What environmental factors support the development and well-being of adults with ASD Level 1? Are there case studies that demonstrate how individuals with ASD Level 1 may benefit from electronic art, and what are the distinctive characteristics of such cases?, How can electronic art become a tool for better understanding the needs of individuals with ASD Level 1 and for creating inclusive and safe environments that contribute to their quality of life? How might the practice of electronic art be creatively adapted to support the development and well-being of individuals with ASD Level 1?

Subsequently, a set of objectives was established to guide the research process. These included investigating the historical background and theoretical concepts related to ASD Level 1 and electronic art in order to provide a solid foundation for the study and the necessary arguments for its development; identifying technological elements that could facilitate the accessibility of electronic artworks and projects for neurodivergent individuals with ASD Level 1 through the analysis of works created by both autistic and non-autistic artists; examining the potential of electronic art to support neurodivergent individuals in areas such as emotional self-regulation, social skills development, and the management of hyper- and hyposensitivities; and exploring sensory experiences in neurodivergence and their possible influence on interactions with electronic artworks and creative technological environment.

The present research is supported by its originality and innovative character, which stem from several factors. Although studies addressing art and disability, as well as art and neuropsychology, already exist, the specific perspective of examining electronic art through the lens of neurodiversity remains relatively unexplored. To date, no published work has been identified that brings these two fields together in the manner proposed here. It is therefore suggested that investigating neurological differences among individuals may enrich electronic art practices, just as electronic art may offer new perspectives for understanding neurodiversity.

Furthermore, the subject of this study occupies an intersection among the arts, technology, neuroscience, and psychology, creating opportunities for the generation of new knowledge and perspectives. At the same time, it may contribute to greater inclusion, recognition, and empowerment of the autistic community through artistic and cultural narratives that foster visibility, participation, and understanding.

In this regard, the research project addresses issues of significant social relevance, including accessibility, diversity, and inclusion in the arts. Examining how electronic art can serve as a medium for expression and interaction for individuals with ASD Level 1 carries important social and cultural implications. The findings of this study may inspire new artistic practices, pedagogical approaches, and public policies that promote access, participation, and agency for neurodivergent communities within the fields of

electronic art and broader social contexts. Therefore, the originality of this research lies in its distinctive approach, the interdisciplinary intersection that makes it possible, and its potential to increase the visibility of socially and culturally underrepresented groups.

The present research is rooted in the author's early inclination toward observation, analysis, and the pursuit of knowledge.The inclusion of the following biographical information is pertinent because the author is both the researcher and a member of the Autism Spectrum Disorder Level I (ASD-I) community. This dual position provides an important context for understanding the motivations, perspectives, and development of the study. From childhood, I developed a particular interest in biological systems and the careful observation of my surroundings, activities that helped strengthen skills related to attention, documentation, and critical reflection. Later, during adolescence, reading and writing became essential tools for understanding and interpreting reality, revealing to me the value of documentary research and the construction of well-founded arguments.

At the same time, various experiences in community service and teaching contributed to the development of communication and leadership skills that would later find continuity in my academic career. However, it was during my undergraduate studies in Graphic Design at the School of Design of the National Institute of Fine Arts in Mexico City that my interest in artistic production, visual experimentation, and the systematic study of creative processes became firmly established.

After joining higher education as a university lecturer in 1993, reading, research, and critical reflection became integral components of my professional practice. Following my appointment at the University of Guanajuato in 2002, research assumed a formal and permanent role within my academic career. Initially, my interests focused on graphic design, creativity, and methods applied to art and design. Later, my collaboration with cultural media organizations strengthened my skills in documentation, analysis, and the dissemination of knowledge.

The completion of a Ph.D. in Visual Arts and Intermedia at the Polytechnic University of Valencia marked a decisive turning point in my academic trajectory, as it enabled the consolidation of a research line focused on Mexican electronic art. Since then, my studies have addressed topics

related to artistic production processes, the cultural roots of electronic art, interaction, emotions, and aesthetic experience, resulting in a range of academic publications.

More recently, my interest in understanding the relationship between art, emotions, and neurodiversity emerged from a personal experience. In July 2023, I began a series of diagnostic assessments that resulted in a diagnosis of Autism Spectrum Disorder Level 1 (ASD Level 1) and high intellectual abilities. This experience led me to establish a connection between the study of electronic art and autism.

This line of inquiry subsequently found its primary expression in my doctoral dissertation, developed as part of a second doctoral degree in Aesthetic Theories, from which the present book is derived. In this work, I examine the ways in which artistic technologies may contribute to a better understanding of diverse perceptual and cognitive experiences. Accordingly, this book forms part of a broader research trajectory aimed at connecting theoretical inquiry with contemporary issues of inclusion and neurocognitive diversity.

To conclude this section on the rationale behind my research trajectory and the relevance of investigating the relationship between electronic art and neurodiversity, it is important to acknowledge that new insights into ASD Level 1 in adults continue to emerge through books, academic articles, conferences, associations, and a wide range of online resources. Many of these sources provide valuable information and contribute to the growing body of knowledge on the subject.

At the same time, although a number of common characteristics have been identified among individuals with ASD Level 1, the diversity of profiles, affinities, and differences that exist within the autism spectrum is an inherent aspect of the condition, making it a complex area of study. In other words, every autistic individual is unique. Consequently, knowledge about autism remains in constant development, and it is suggested that identifying intersections between electronic art and ASD Level 1 in adulthood is both relevant and necessary. Artistic works may contribute to a deeper understanding of the experiences and needs of autistic individuals, while also helping to foster environments that are safe, inclusive, and supportive.

It should also be noted that the present study is grounded in a qualitative research approach[4], with the aim of gaining an in-depth understanding of the experiences, perspectives, and characteristics of adults with ASD Level 1 and exploring ways in which electronic arts may contribute to improving their quality of life. Within this framework, numerical measurements were not considered a primary means of analysis. Rather, the study adopts an exploratory perspective, seeking to identify new insights and information regarding the relationship between electronic art and ASD Level 1 in adults, a field that remains under development.

The study is also descriptive in nature, as it examines the characteristics and conditions that facilitate the development of electronic art and its potential contributions to the quality of life of individuals with ASD Level 1. The research was conducted following the logic of an inductive process, aimed initially at exploration and description and subsequently at the generation of theoretical perspectives. In other words, the study moved from the general to the particular, drawing upon empirical data to formulate broader interpretations and generalizations (Hernández et al., 2018). For this purpose, the data obtained through documentary analysis and interviews were examined and interpreted, allowing conclusions to be drawn from each case. In this way, a range of perspectives and viewpoints from the participants were incorporated into the study.

The exploratory phase of the research initially consisted of an extensive review of the literature produced by recognized experts on ASD Level 1, including works such as Tony Attwood's *Guide to Asperger's Syndrome* (2022), among more than twenty authors consulted over a four-year period and cited throughout the bibliography. This process was complemented by extensive online searches for updated information on autism through national and international autism associations, as well as publications by healthcare professionals, psychologists, educators, and other specialists

[4] "It focuses on understanding and gaining an in-depth perspective on phenomena by exploring them from the participants' viewpoint within their natural environment and in relation to their context [...] It is selected when the objective is to understand participants' perspectives regarding the phenomena that surround them, to gain deeper insight into their experienc es, viewpoints, opinions, and meanings—that is, the way participants subjectively perceive their reality. It is also recommended when the topic under study has received limited prior exploration." (Hernández et al., 2018, p. 364, author's translation).

addressing autism and ASD Level 1.

In addition, attention was given to digital spaces created by autistic individuals themselves. This included following and participating in online communities and communication channels dedicated to autism, such as those maintained by Nuria Hidalgo on YouTube, Instagram, Telegram, and WhatsApp, as well as the channels of specialists, researchers, and writers who are themselves autistic, including Bea Sánchez, Ernesto Reaño, and Anabel Cornago on YouTube and Instagram.

Participation also extended to social networks and support groups composed of autistic individuals. These included Nuria Hidalgo's Telegram group *A los 40 Autismo*, whose 36 members regularly share experiences, reflections, and mutual support in dealing with the challenges associated with living with an invisible disability. Other groups included the WhatsApp community *Aspies Amigos de Nuria*, composed of 12 members, and the Telegram dissemination channel *Autismo con Daniel Millán*, a non-interactive information channel with approximately 1,300 subscribers dedicated to raising awareness and sharing information related to autism.

In addition, although numerous conversations among autistic individuals were observed within social media groups and online communities, most of these interactions have not been cited in this study. These spaces can be considered, to a certain extent, private environments, and permission was not obtained to reproduce participants' comments outside of their original context. For this reason, their contributions have informed the researcher's understanding of the subject without being directly quoted.

To better understand contemporary representations of autism in popular culture, several television series featuring autistic-coded or explicitly autistic characters were analyzed. These included *The Big Bang Theory* (CBS, 2007–2019), featuring the ASD Level 1 character Sheldon Cooper; *Young Sheldon* (CBS, 2017–2024); and *The Good Doctor* (ABC/Sony, 2017–2024). These productions were examined from the perspective that, although they have increased public visibility of autism, they often reinforce stereotypes and simplified representations of autistic individuals rather than providing a nuanced understanding of the condition.

Films were also reviewed, including *Rain Man* (MGM, 1988), which presents challenges similar to those identified in the television series mentioned

above, and *Temple Grandin* (HBO Films, 2010), a biographical film depicting the life of an autistic woman whose innovations transformed livestock management practices. Unlike many fictional portrayals, this film offers valuable insights into the experiences and capabilities of autistic individuals and contributes meaningfully to public understanding of autism.

In addition to the aforementioned, contact was established and interviews were conducted with several experts in the field. These included Christian Nicolás Díaz Márquez, a psychologist at the Mexican Clinic for Autism and Developmental Disorders, Bajío Branch (CLIMA), located in León, Guanajuato; Jessica Zarza Romero, Ph.D., a psychologist affiliated with the Asperger México Association and certified by the Semel Institute for Neuroscience and Human Behavior[5] for the care of adolescents with ASD Level 1; Gilberto Medina Hernández, M.D., Ph.D., a psychiatrist at the Dr. Enrique Caldera Cosío General Hospital of the Ministry of Health in Mexico City, as well as a professor of psychiatry at the National Autonomous University of Mexico (UNAM) and the Higher School of Medicine of the National Polytechnic Institute (IPN); and Virna Alejandra Villagómez Oviedo, M.Ed.[6], who holds a Master's degree in Special Education for Moderate and Severe Disabilities from the National University in Costa Mesa, California, and a Certificate in Autism Specialization from the University of California, Los Angeles (UCLA). She currently serves as a Transitional Kindergarten teacher in the Moderate/Severe Autism Program at Greenwood Elementary School in Montebello, California, United States.

The research setting consisted of both in-person and virtual interviews conducted with these specialists, whose professional experience and expertise provided valuable perspectives for the development of the study.

Participation in specialized events also formed part of the research process. These included the 5th Ibero-American Virtual Autism Conference,

[5] Semel Institute for Neuroscience and Human Behavior. (2025). *UCLA Peers Clinic.* https://www.semel.ucla.edu/peers/adolescents-certified-international/mexico

[6] She earned a Bachelor's degree in Special Education with a concentration in Hearing, Speech, and Language from the Escuela Normal de Especialización, Mexico City. She has more than three decades of professional experience in special education, including sixteen years dedicated to autism education and intervention. In addition, she holds a Certificate in Early Childhood Special Education from Loyola Marymount University (LMU), Los Angeles, California.

held from November 6–8, 2024, and organized by *Iluminemos por el Autismo* and *AM Autismo Morelia*, as well as the Autism Parenting Summit, held from May 16–19, 2025.

Furthermore, the present research is concerned with the "...meaning of experiences and human values, the individual perspective of people, and the natural environment in which the phenomenon under study occurs" (Hernández et al., 2018, p. 368, author's translation).

Also, the topic of ASD Level 1 has been approached with the necessary care to avoid adopting negative perspectives that could contribute to the stigmatization of the condition. At the same time, efforts have been made to avoid romanticizing, idealizing, or advocating for autism. Rather, the objective has been to develop a balanced and informed understanding of the experiences and realities associated with ASD Level 1.

Thus, the present research evolved as the inquiry progressed, making it possible to identify key concepts related to neurodivergence, Autism Spectrum Disorder Level 1 (ASD Level 1), and electronic art for neurodivergent individuals. This latter topic constitutes one of the principal contributions of the present study, as no direct precedents addressing it have been identified. It should be reiterated that research situated at the intersection of these fields of knowledge remains extremely limited, if not virtually nonexistent. This is not the case, however, with research on art and autism more broadly, for which a growing body of literature and empirical evidence is available.

The techniques employed for data collection included unstructured observation, open-ended interviews, document review, and the evaluation of personal experiences. Together, these methods contributed to the description, understanding, and interpretation of the specific phenomenon of electronic art for neurodivergent individuals with ASD Level 1, through the perceptions, meanings, and experiences shared by participants.

Based on this empirical and reasoned foundation, it has been possible to develop an artistic proposal within the field of electronic arts that also constitutes an interdisciplinary methodology related to artistic production processes designed for individuals with disabilities.

Furthermore, the present research examines the historical background of autism, common myths and realities associated with the condition, the characteristics of individuals on the autism spectrum, and the classification

of autism according to levels of support needs. It also addresses the history of electronic art in Mexico, artworks created by autistic individuals, and those aspects of electronic art that may serve as resources capable of contributing to the quality of life of autistic people, particularly individuals with ASD Level 1.

Considerable attention was also devoted to the consultation and analysis of source materials. The objective was not only to gather information, but also to deepen the interpretation of the phenomena under study. Whenever possible, primary sources of data were identified and prioritized over secondary interpretations of those sources. This process added a degree of complexity to the research, as many primary sources consisted of scientific articles reporting empirical studies, which required additional effort and specialized analysis in order to be properly understood and interpreted.

Chapter 1. Autism, Neurodiversity, and Sensory Experience

It is necessary to introduce the concept of ableism, as it also provides part of the rationale for the present study. Ableism refers to the belief that autistic individuals represent a deviation or error in the course of human evolution, when the opposite may in fact be true. The invisible oppression experienced by people with disabilities throughout history is well documented. This form of oppression has often been based on the assumption that disabled bodies and minds occupy a passive role and are inherently dependent upon healthcare professionals and caregivers.

As a consequence of this perspective, the medical model traditionally used to address disability has focused primarily on treatment and correction. In this regard, "the actions that are carried out are aimed at curing and treating; ultimately, normalizing and concealing disability, which is always understood as something negative that must be eradicated" (University of Málaga, 2019, pp. 1–2, author's translation).

From the perspective of the neurodiversity paradigm, certain interventions have been criticized for prioritizing the normalization of behavior—so that disability becomes less visible—rather than fostering an understanding of the needs of autistic individuals. In this context, autistic crises or episodes, including meltdowns, burnout, chronic anxiety, depression, and related challenges, are often addressed through regular consultations with psychiatrists and psychologists, as well as through pharmacological treatment. While such interventions may be beneficial and necessary in many cases, some medications can also produce side effects and require ongoing medical supervision. This underscores the importance of developing a society that is better informed about and educated regarding neurodiversity.

The invisible oppression experienced by autistic individuals can manifest itself in a variety of contexts. One example is social isolation, which may arise from multiple factors, many of them rooted in misconceptions about autism. Among these is the belief that autistic individuals lack emotional reciprocity simply because they do not express their emotions in conventional ways, make limited eye contact, or experience difficulties with certain social skills.

Although every autistic person is unique, their forms of communication may differ from neurotypical styles of interaction. For example, autistic individuals may use highly formal language, display atypical patterns of intonation, or exhibit other distinctive communicative characteristics. Autism is also frequently and incorrectly associated with intellectual disability, even though intellectual disability is not present in all autistic individuals.

In this regard, although autistic individuals may face a range of challenges, including atypical sensory profiles that can make certain sounds intolerable, altered pain perception, or difficulties related to communication, it is also true that autism is associated with characteristics that have historically contributed positively to society. Several authors have suggested that traits now associated with autism may have supported technological and cognitive innovations that were advantageous to prehistoric human groups (Spikins & Wright, 2016).

One of these potentially beneficial characteristics is hyperfocus, or the ability of some autistic individuals to sustain exceptionally high levels of concentration on topics or activities that are of particular interest to them. In many cases, their engagement with these areas of interest can be described as highly systematic and analytical, sometimes resembling a scientific approach. In the case of autistic individuals with high intellectual abilities, considerable attention is often devoted to details and patterns. As will be discussed later, several studies have found that a significant proportion of autistic individuals without intellectual disability demonstrate cognitive abilities that are average, above average, or in some cases, exceptional.

In addition to the characteristics described above, autistic individuals may demonstrate an aptitude for identifying connections between seemingly unrelated objects, ideas, or fields of knowledge. As a result, systems thinking and the creation of complex conceptual frameworks are often cited among their strengths. Spikins and Wright (2016) advocate for a redefinition of

autism as a form of human variation that encompasses both strengths and challenges, rather than viewing it solely as a disorder.

Among the abilities discussed in this context are exceptional skills associated with technological innovation, mathematics, chemistry, and engineering (Brown et al., 2009, as cited in Spikins & Wright, 2016); the recognition and analysis of complex patterns (Hayden & Villeneuve, 2011, as cited in Spikins & Wright, 2016); the establishment of rules and norms that facilitate cooperation among interconnected societies whose members interacted only infrequently (Spikins & Wright, 2016); and capacities related to creativity and artistic production, among others.

Understanding Autism Spectrum Disorder Level 1

Until 2014, individuals who would now be classified as having Autism Spectrum Disorder Level 1 (ASD Level 1) were commonly diagnosed with Asperger syndrome, a term derived from the name of one of the first physicians to describe and study the condition. However, with the publication of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) in 2013, a significant change in diagnostic classification was introduced. Under the revised criteria, the separate diagnosis of Asperger syndrome was discontinued and incorporated into the broader category of Autism Spectrum Disorder, with different levels of support needs, including ASD Level 1.

Despite this change in diagnostic terminology, many specialists, organizations, and members of the public continue to use the term Asperger syndrome when referring to ASD Level 1, particularly in Mexico and other Spanish-speaking contexts.

In addition to the changes in diagnostic classification described above, the diagnosis of autism was initially a complex process. In most cases, autism was identified in boys, while it was only rarely recognized in girls and women. This was largely due to the ability of many females to mask or camouflage autistic traits, making it considerably more difficult to associate their behaviors with autism. As a result, the development of medical and psychiatric knowledge concerning the recognition of autism has been gradual.

According to Víctor Ruggieri and José Luis Cuesta Gómez (2019), although descriptions of autistic characteristics can be found in earlier records, it was Leo Kanner and Hans Asperger who introduced the concept of autistic disorder during the mid-twentieth century. However, an important early contribution is the work of Grunya Efimovna Sukhareva, who in 1926 described six children whose clinical characteristics and developmental trajectories closely resemble what would today be recognized as autism, particularly presentations associated with high intellectual abilities and what is now referred to as Level I Autism Spectrum Disorder (ASD-I). As Ruggieri and Cuesta Gómez explain, it was not until the 1980s that autism came to be understood "as a neurodevelopmental disorder with a biological basis, caused by genetic and environmental factors" (2019, p. 25, author's translation). From that point onward, education increasingly came to be regarded as one of the most effective means of promoting positive development among autistic individuals.

Earlier decades had already documented isolated cases that, in retrospect, appear consistent with autism; however, these cases were not classified as such and were instead grouped under other psychiatric disorders (Ruggieri & Cuesta Gómez, 2019, p. 26). Paradoxically, confusion between autism and other conditions remains relatively common today, particularly in cases of ASD Level 1. In some instances, autistic individuals may initially be diagnosed with bipolar disorder, schizophrenia, borderline personality disorder, or other psychiatric conditions before autism is correctly identified.[1]

There are numerous myths and misconceptions surrounding individuals with ASD Level 1. Examining these beliefs provides an opportunity to address some of the characteristics commonly associated with ASD Level 1.[2] The myths discussed below have been identified both through both interactions

[1] According to conversations and testimonies shared in online communities of individuals with ASD Level 1, including the Telegram group *A los 40 Autismo* moderated by Nuria Hidalgo, the WhatsApp group *Aspies Amigos de Nuria*, among others.

[2] Additional sources consulted included the WhatsApp groups *Aspies Amigos de Nuria and Autimadres*; the YouTube channels *A los 40 Autismo* by Nuria Hidalgo, Ernesto Reaño (autistic author and researcher), and *Mamá Valiente* by Bea Sánchez (autistic author and researcher); as well as Instagram accounts such as *Profesor Autista* by Antonio Jiménez, a history and philosophy teacher, and *Wiskas* by Ainhoa Castaño, an autistic student of Computer Engineering and Electronic Engineering at the Autonomous University of Barcelona (UAB), among others.

within ASD Level 1 communities and comparisons with published literature on the subject. It is suggested that many of these misconceptions have contributed to the social exclusion and misunderstanding of autistic individuals. In this regard, it is important to recognize that "autism is not a disability that can be perceived through a person's physical appearance, but rather through social interaction. This often leads to erroneous judgments about behavior, causing individuals with this condition to be labeled as eccentric or ill-mannered" (García & Huitrado, 2024, pp. 4–5, author's translation).

Another common misconception is that autism is necessarily accompanied by intellectual disability. While intellectual disability may be present in some cases, this is not always the case. Autism can also occur in individuals with average, high, or exceptional intellectual abilities. Traditional intelligence quotient (IQ) classifications generally consider scores below 70 to be indicative of intellectual disability; scores between 85 and 115 as average; scores above 115 as reflecting high intelligence; scores above 130 as indicating superior intellectual ability; and scores above 145 as characteristic of exceptionally gifted individuals. A significant proportion of autistic individuals demonstrate cognitive abilities above the population average. According to the Fundación ConecTEA (2023), approximately 10% to 15% of autistic individuals have IQ scores within the high-ability range, with scores exceeding 115.

It is also worth noting that there is evidence suggesting that the mental effort associated with social interaction in individuals with ASD Level 1 may result in fatigue, meltdowns, autistic burnout, and, in some cases, even physical symptoms resembling those of a common cold, among other effects. These responses may arise from prolonged exposure to sensory, emotional, and cognitive stimuli. The duration and intensity of such episodes vary according to the individual, their sensory profile, age, the length of exposure to the stimuli, and other factors. In some cases, these experiences may temporarily limit an autistic person's ability to engage in other activities for hours or even days. From a personal perspective as an individual with ASD-I, an afternoon spent socializing with my partner's friends may require one or even two days of recovery, depending on whether the gathering is accompanied by additional social interactions or by exposure to visually and sonically stimulating environments, such as supermarkets. Engaging in informal

conversations can feel cognitively comparable to playing a game of chess, requiring continuous attention to verbal and nonverbal cues, turn-taking, and social expectations. As a result, concentration on everyday tasks often becomes difficult afterward. It is also important to recognize that autism is a dynamic, lifelong condition.

Furthermore, a lack of awareness of one's own diagnosis may lead autistic individuals to place excessive demands on themselves in social situations, as well as in work-related and everyday activities. Over time, this pattern of overexertion can negatively affect quality of life, as individuals may struggle to understand the causes of their fatigue and the emergence of comorbid conditions associated with chronic stress and generalized anxiety.

However, as the saying goes, "when you meet one autistic person, you have met one autistic person," because every case is different. For example, some autistic individuals may experience language-related difficulties, while others may not. Some may exhibit repetitive speech patterns or be perceived as overly formal or self-assured in conversation, although these characteristics should not be considered universal. At the same time, certain traits appear more frequently within the autistic population, including emotional dysregulation associated with difficulties related to Theory of Mind, commonly understood as the ability to recognize and interpret what other people think, believe, or feel, and to anticipate how they may act in a given situation. As Baron-Cohen explains, "It is also described as mind-reading; consequently, it is as if [people] with Asperger syndrome had mindblindness" (Baron-Cohen, 1995, as cited in Attwood, 2022, p. 183). These challenges, together with the discomfort or difficulty that some autistic individuals experience when making eye contact, can create fertile ground for misunderstandings during social interactions.

Discussing the characteristics of autistic individuals would have limited relevance without also considering the consequences of inadequate or insufficient support. In many cases, psychosocial interventions are required to address social-communication difficulties, in addition to medical services, physical rehabilitation, special education, and other forms of support, many of which are costly and not readily accessible (Schieve et al., 2012, as cited in Zavaleta, 2018, p. 9). Moreover, autistic individuals "...present a high rate of comorbidity with other medical conditions, such as gastrointestinal problems, as well as mental health disorders, particularly anxiety disorders

(42–55%) and irritability (85%) (Mayes et al., 2011) [in addition to] other behavioral problems (7–37%) (Simonoff et al., 2008; Bauman, 2010)" (as cited in Zavaleta et al., 2018, p. 14, author's translation).

While the preceding discussion helps to outline certain aspects of autism from the perspective of the scientific literature, Autism Spectrum Disorder is also understood within the framework of neurodiversity as a form of human variation, that is, a different way in which a human brain may function and process the world. Within the current diagnostic framework, three levels of support needs are recognized. Individuals with ASD Level 1 generally require less external support from caregivers or support systems than individuals with ASD Levels 2 or 3, who typically require more substantial assistance and may depend to a greater extent on others in their daily lives. The diagnostic criteria currently established in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) are presented below. It should also be noted that autism is not generally regarded as an accessory condition that a person simply "has," but rather as an integral aspect of how an individual experiences, interprets, and interacts with the world. For this reason, many people prefer identity-first expressions such as "being autistic" rather than person-first expressions such as "having autism."

According to the DSM-5, the diagnosis of Autism Spectrum Disorder (ASD) is based on persistent difficulties in social communication and social interaction, together with restricted and repetitive patterns of behavior, interests, or activities. These social difficulties are generally manifested in three principal domains, although it should be emphasized that their expression varies considerably among individuals:

a) Social-emotional reciprocity. Individuals may experience difficulties initiating or maintaining reciprocal conversations, sharing interests, or responding appropriately to social interactions. In some cases, this has been metaphorically described as a form of "emotional blindness," although such difficulties often diminish when conversations involve subjects related to the autistic person's areas of special interest.
b) Nonverbal communication. This domain includes differences in eye contact, body language, facial expressions, and the use of gestures. Such behaviors do not necessarily indicate a lack of social interest;

rather, they may be related to sensory overload or to adaptive strategies developed through processes of masking or social camouflaging.

c) Understanding and maintaining relationships. Many autistic individuals experience difficulties interpreting implicit social norms, understanding the emotional states of others, or adapting their behavior to different social contexts. Although some develop effective compensatory strategies, they are often perceived by others as different, unconventional, or eccentric.

The DSM-5 indicates that autistic individuals commonly exhibit one or more of the following characteristics within the domain of restricted and repetitive patterns of behavior, interests, or activities:

a) Repetitive or stereotyped behaviors, including repetitive body movements, echolalia, or distinctive uses of language.
b) A need for routine and predictability, often manifested as significant distress in response to unexpected changes or disruptions.
c) Restricted and highly focused interests, which may provide a sense of well-being, stability, and emotional regulation, and which can encompass a wide variety of subjects.
d) Hyper- or hyposensitivity to sensory stimuli, considered by many autistic individuals to be among the most disabling aspects of autism due to the intensity with which sounds, lights, textures, smells, or tastes may be perceived.

Sensory sensitivity constitutes a fundamental element in understanding the autistic experience, as certain environments may become profoundly exhausting or even inaccessible. Recognition of this characteristic of autism has led to the creation of sensory and emotional regulation spaces in a variety of public settings. For example, some shopping centers in different countries have established calm rooms, sensory rooms, or sensory spaces specifically designed to support autistic individuals.

Within the sensory intensity and constant stimulation that often characterize large commercial environments, these spaces provide opportunities for sensory regulation by reducing noise, visual overstimulation, and other potentially overwhelming stimuli. They may include features such as quiet

surroundings, subdued lighting, soft textures, comfortable seating, and calming sensory resources that help autistic individuals regulate their nervous systems when experiencing sensory overload.

Examples of such sensory and emotional regulation environments can be found in shopping centers around the world. The Sunway Putra Mall, in Kuala Lumpur, has maintained a dedicated sensory-friendly facility for autistic individuals since 2019 (Supramani, 2021, para. 8). Similarly, the St Enoch Centre opened a calm room in 2018 for autistic individuals and people with special needs who may find crowds and the sensory demands associated with shopping overwhelming (The Herald Scotland, 2018, para. 2).

> The primary purpose of sensory rooms is to create a safe and inclusive space where individuals, especially those with autism, can engage in sensory activities that promote self-organization and sensory integration. Sensory rooms offer a variety of benefits and serve diverse functions depending on the environment in which they are used. (ApexABA, 2025, para. 2)

According to ApexABA, sensory rooms offer a variety of benefits, the most notable of which include stress reduction through the controlled environments they provide; behavioral regulation by helping autistic individuals manage emotional responses and repetitive behaviors; improved attention and concentration through structured sensory experiences; sensory integration by supporting the organization and interpretation of sensory information; self-regulation through the creation of safe environments that support emotional regulation and allow individuals to modulate their surroundings; and social interaction by offering controlled spaces that encourage both relaxation and engagement with others.

These outcomes are achieved through the use of environmental features such as subdued lighting, comfortable seating, calming colors—including soft blues, greens, and neutral tones—noise control measures that minimize background sounds, and organized environments free from excessive clutter, with designated areas for specific activities. Sensory rooms may also incorporate specialized equipment and resources, including adjustable fiber-optic lighting; tactile walls and surfaces covered with soft fabrics or textures that provide comfort; weighted blankets and cushions that apply deep pressure

to the body and simulate a comforting embrace; bubble tubes and projectors displaying calming visual imagery that can produce soothing effects; relaxing sounds and music such as nature sounds (ApexABA, 2025); binaural audio[3] designed to reduce stress; and sensory swings or hammocks.

Figure 1.1. *Sensory Room, South Autism Center Zapopan, Guadalajara, Jalisco, Mexico*

Source: photograph taken by Cynthia Villagómez.

Particular attention should be given to the fact that a timely diagnosis of autism can significantly facilitate adaptation and access to a better quality of life for individuals on the autism spectrum. Conversely, the absence of an appropriate diagnosis may have negative consequences not only for the autistic individual—both mentally and physically—but also for those within their immediate environment. For this reason, understanding and

[3] Binaural beats are produced when tones of different frequencies are presented separately to each ear, creating the perception of a third tone. This auditory phenomenon has been associated with states such as relaxation, concentration, and sleep. Some studies suggest that binaural beats may contribute to stress reduction and improvements in mood, sleep, and attention; however, the available scientific evidence remains inconclusive. They are widely used as complementary tools in meditation and wellness practices. (Psychology Today).

disseminating knowledge about the characteristics commonly associated with autism is essential for promoting inclusion and enabling society to recognize both the challenges and the strengths of autistic individuals.

According to the DSM-5, autistic characteristics are present from the early stages of development, although they may remain unrecognized for many years due to adaptive social strategies. Many autistic individuals learn to imitate neurotypical behaviors in order to navigate different social environments; this process is known as camouflaging or masking and often involves a considerable emotional and cognitive cost. The DSM-5 further specifies that these characteristics must result in clinically significant impairment in social, occupational, or other important areas of daily functioning. Among the most frequently reported consequences are anxiety, chronic stress, exhaustion, depression, and a variety of conditions associated with sustained emotional overload. Numerous studies have indicated that social obstacles, unemployment, and the lack of appropriate support services increase the vulnerability of autistic populations. In this sense, social exclusion does not arise from autism itself, but rather from the absence of accessible and inclusive environments.

For a clearer understanding of these issues, the following section presents the different levels of support needs associated with Autism Spectrum Disorder, as well as a comparison between characteristics commonly associated with neurotypical and autistic cognitive processing.

Table 1.1. *Severity Levels of Autism Spectrum Disorder (DSM-5)*

Severity Level	Social Communication	Behavioral Inflexibility
Level 3 — Requiring Very Substantial Support	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few intelligible words who rarely initiates interaction and, when they do, uses unusual approaches solely to meet basic needs and responds only to very direct social approaches.	Extreme difficulty coping with change, and other restricted or repetitive behaviors markedly interfere with functioning across all areas of life. Intense anxiety and/or extreme difficulty shifting focus from one activity to another are characteristic features.

Note. Table 1.1 continues on the next page.

Table 1.1 *(continued)*

Severity Level	*Social Communication*	*Behavioral Inflexibility*
Level 2 – Requiring Substantial Support	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or atypical responses to social overtures from others. For example, a person who speaks in simple sentences, whose interactions are limited to highly specific interests, and who displays markedly atypical nonverbal communication.	Difficulty coping with change, and other restricted or repetitive behaviors are frequently apparent to a casual observer and interfere with functioning across a variety of contexts. Anxiety and/or difficulty shifting focus from one activity or action to another are commonly present.
Level 1 – Requiring Support	Without appropriate supports in place, differences in social communication can lead to significant challenges. Individuals may experience difficulty initiating social interactions and may exhibit clear examples of atypical or unsuccessful responses to social approaches from others. They may appear to have limited interest in social interaction. For example, a person who is able to speak in full sentences and engage in communication, but whose attempts at extended conversation are unsuccessful, and whose efforts to establish friendships may be perceived as unconventional and are often unsuccessful.	Causes significant interference with functioning in one or more contexts. Individuals may experience difficulty transitioning between activities, while challenges related to organization and planning can limit independence and autonomy.

Source: author's translation and adaptation based *on the Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2014).

Table 1.2. *Characteristics of Autistic and Neurotypical Cognitive Processing*

Differences in Cognitive Processing Associated with Autism and Neurotypical Development	
Neurotypical Brain	*Autistic Brain*
Hyperconnected patterns are present in infancy, followed by a gradual process of synaptic pruning in which less useful neural connections are reduced while responses to the environment are strengthened through experience and learning.	Some brain regions may remain hyperconnected throughout life, while others may be relatively underconnected. Each individual presents a unique pattern of neural connectivity, and differences in synaptic pruning have been reported.
Neural connectivity generally develops within typical developmental parameters, possibly as a result of ongoing processes of adaptation, refinement, and neural pruning.	Neural connectivity tends to be more diverse and variable[1]

Note. Table 1.2 continues on the next page.

[1] For further information, see Hahamy, A., Behrmann, M., & Malach, R. (2015). The idiosyncratic brain: Distortion of spontaneous connectivity patterns in autism spectrum disorder. Nature Neuroscience, 18, 302–309. https://doi.org/10.1038/nn.3919; and Dinstein, I., Heeger, D. J., & Behrmann, M. (2015). Neural variability: Friend or foe? Trends in Cognitive Sciences, 19(6), 322–328. As cited in Price (2022).

Table 1.2. *(Continued)*

Neurotypical Brain	*Autistic Brain*
Brains that generally adapt with relative ease to the sensory and social information received from the external environment.	Brains that may respond differently to environmental stimuli, including sensory hyper- and hyposensitivities, among other characteristics.[2]
Local-to-global information processing: details are integrated into a coherent and unified whole, with a predominance of global perception. This process is fundamental to sensory information processing, communication, and social interaction. For example, when asked to copy the drawing of a distorted three-dimensional object that could not exist in reality, the individual may experience confusion or hesitation because of the image's impossibility or lack of logical coherence.	Reduced global-to-local interference[3]: greater tendency to focus on specific details, with a predominance of local perception. For example, when copying the drawing of a distorted three-dimensional object that could not exist in reality, the individual may demonstrate greater ability to focus on each line and shape independently, reconstructing the image through attention to its component details.[4]
In social situations, attention is typically directed toward similarities among faces and toward the emotional expression of the face as a whole. Facial recognition and interpretation of emotional expressions are generally achieved through holistic processing.	A high degree of attention to detail may also be applied to social situations, leading to greater focus on specific facial features rather than on overall similarities or emotional expressions.[5] This may help explain why some autistic individuals experience prosopagnosia (face blindness)[6], a difficulty in recognizing faces, as well as challenges in interpreting emotional expressions commonly displayed by neurotypical individuals.

Source: author's translation and adaptation based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2014).

It is important to recognize that autism is a dynamic condition. Depending on the circumstances and environmental demands they encounter, an individual with ASD Level 1 may at times exhibit characteristics or support

[2] For further information, see the press release issued by the Weizmann Institute of Science: Autistic brains generate more information (2015). As cited in Price (2022).

[3] For further information, see Koldewyn, K., Jiang, Y. V., Weigelt, S., & Kanwisher, N. (2013). Global/local processing in autism: Not a disability, but a disinclination. Journal of Autism and Developmental Disorders, 43(10), 2329–2340. https://doi.org/10.1007/s10803-013-1777-z. As cited in Price (2022).

[4] For further information, see Mottron, L., Burack, J. A., Iarocci, G., Belleville, S., & Enns, J. T. (1999). Local bias in autistic subjects as evidenced by graphic tasks: Perceptual hierarchization or working memory deficit? Journal of Child Psychology and Psychiatry, 40, 743–755.

[5] For further information, see Hubl, D., Bölte, S., Feineis-Matthews, S., Lanfermann, H., Federspiel, A., Strik, W., & Dierks, T. (2003). Functional imbalance of visual pathways indicates alternative face processing strategies in autism. Neurology, 61, 1232–1237. As cited in Price (2022).

[6] For further information, see Minio-Paluello, I., Trevisan, D. A., Hamilton, A. F. de C., & Bedford, R. (2020). Face individual identity recognition: A potential endophenotype in autism. Molecular Autism, 11(1), 1–16. As cited in Price (2022).

needs more commonly associated with ASD Levels 2 or even 3. This highlights the need for greater awareness and understanding of autism within society, among the groups and communities surrounding autistic individuals, and, whenever possible, through the development of self-understanding among autistic individuals themselves.

In addition to the above, the complexity of autism is further compounded by the fact that "...autism is still diagnosed not on the basis of a brain scan, but rather on the behavior of the autistic individual and the difficulties they experience in navigating the world" (Price, 2022, p. 40). In this regard,

> Understanding ASD from a biological and neurological perspective is challenging because the disorder itself is defined exclusively by behavioral criteria, which continue to evolve as revisions are made to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM). Diagnosis remains based on behavior, in part because of the limited understanding of the underlying biological processes that contribute to ASD. As a consequence of this behavioral approach and the lack of knowledge regarding the biology of the disorder, the development of quantitative and objective biomarkers to assist in the diagnosis and management of ASD is still evolving. (Frye, 2020, para. 2, author's translation)

The Autistic Community and Public Awareness

The foregoing discussion reflects how autism is described in diagnostic manuals and scientific literature. However, what about the autistic community itself and its efforts to raise awareness, visibility, and recognition of the condition? The autistic community has gained increasing visibility through artists, public figures, and other individuals on the spectrum who have spoken openly about their experiences in interviews, autobiographies, conferences, and various outreach activities. In addition, some researchers have proposed retrospective diagnoses for historical figures whose behavior and life trajectories appear consistent with characteristics associated with the autism spectrum. Nevertheless, it is important to distinguish between confirmed diagnoses and posthumous or speculative attributions.

In Mexico, relatively few individuals have publicly disclosed a diagnosis of ASD Level 1, a situation that is partly related to the social stigma that continues to surround autism and to the difficulties many adults face in accessing specialized diagnostic services. Among the best-known cases are filmmaker and animator Jorge R. Gutiérrez, actor Héctor Suárez Gomís, jurist Armando Hernández Cruz, and neurodevelopment specialist Alejandra Aceves, all of whom have also contributed to the dissemination of information about autism and autistic experiences.

Internationally, prominent figures include Temple Grandin, a leading advocate for autism awareness; Anthony Hopkins, who has spoken publicly about the impact of his diagnosis on his professional life; environmental activist Greta Thunberg; Naoki Higashida, author of influential works on the autistic experience; and Elon Musk, who publicly disclosed his diagnosis in 2021. These individuals demonstrate that autism can be present across a wide range of fields, including the arts, sciences, activism, and technology.

Furthermore, there is a broad range of historical figures for whom posthumous diagnostic hypotheses have been proposed. Among those most frequently mentioned are Andy Warhol, Ludwig Wittgenstein, Isaac Newton, Nikola Tesla, Henry Cavendish, and Albert Einstein. In these cases, the proposed attributions are based on biographical accounts, observed behavioral patterns, or interpretations developed by contemporary researchers. Consequently, they should be regarded as possibilities rather than as clinical diagnoses.

The case of Albert Einstein has received particular attention due to the substantial body of literature relating certain aspects of his personality—such as social isolation, delayed language development, and intense dedication to specific interests—to traits that are now associated with autism. Nevertheless, as with other historical figures, any diagnostic claim remains speculative.

Regardless of the accuracy of retrospective diagnoses, these examples illustrate that autistic individuals have made significant contributions across numerous fields, including science, art, culture, and society. They also help challenge traditional stereotypes about autism and promote a broader understanding of neurodiversity. At the same time, it is important to recognize that characteristics associated with the autism spectrum may overlap with other conditions or life experiences; therefore, any retrospective interpretation should be approached with caution.

Chapter 2. Art, Electronic Art and Autism

Over the past several decades, the benefits of art for autistic individuals have been explored primarily within therapeutic contexts. In contrast, considerably less attention has been given to electronic artworks specifically designed to be accessible to autistic individuals or created with the purpose of supporting their needs and experiences. The aim of the present research is to explore the possibilities of electronic art as a means of providing individuals with ASD Level 1 access to spaces that offer both spatial and temporal security, while also facilitating communication with autistic peers and neurotypical individuals, among other potential benefits.

In this regard, it has been estimated that approximately one-third of individuals on the autism spectrum are non-speaking; however, visual communication provides a flexible means of processing and expressing thoughts and experiences (Bowles, 2024). For many autistic individuals, visual forms of expression may offer alternative pathways for communication that do not rely exclusively on spoken language.

According to the Mental Health Foundation, a leading mental health organization founded in the United Kingdom in 1949,[1] engagement with the arts can contribute positively to mental well-being. These benefits are associated with the feelings of enjoyment, fulfillment, and happiness that may arise through participation in cultural activities such as concerts, museum visits, dance groups, theatrical performances, and other forms of artistic and cultural engagement.

[1] The Mental Health Foundation defines the arts as encompassing visual and performing arts, traditional crafts, sculpture, digital art, text-based creative practices, dance, film, literature, music, singing, and even gardening and culinary arts.

> Engagement in the arts can have powerful and long-lasting effects on health. It may help protect against a range of mental health conditions, contribute to the management of existing mental health problems, and support recovery. (Coulton, Clift, Skingley, & Rodriguez, 2015, as cited in Mental Health Foundation, 2019).

The art and creativity programs developed by the Mental Health Foundation are based on the premise of encouraging people to explore and discuss emotions in ways that are both engaging and accessible. Their objective is to promote well-being and support individuals experiencing mental health challenges and psychological distress—conditions that are frequently reported among autistic populations. For autistic individuals, one of the particular advantages of art is that it provides a means of expression that does not necessarily depend on words.

Furthermore, participation in artistic activities can help strengthen connections among members of a community, reducing social isolation and preventing the loss of social bonds (Mental Health Foundation, 2019). This is particularly beneficial for autistic individuals, given the tendency toward social isolation that many experience. Consequently, engagement in the arts may contribute significantly to alleviating anxiety, depression, and stress, while also fostering a greater sense of belonging and social participation.

Moreover, the association between autism and artistic ability is widely recognized, to the extent that it is sometimes assumed that all autistic individuals possess remarkable artistic talents. According to Nicholas Bowles (2024), a contributor to I AM, a publication of the Autistic Society Greater Manchester Area, many people continue to stereotype autistic art as consisting primarily of highly intricate drawings.

In this regard, it is important to recognize that the detail-oriented focus often associated with autistic individuals represents only one characteristic that may enrich artistic practice. While attention to detail can be a valuable asset in artistic creation, it is by no means the only area in which autistic individuals can excel or realize their potential.

Figure. 2.1. *Voguels (2008). David Barth (age 10). Ink and colored pencil on paper*

Source: Moullin, J. (2009). Drawing Autism. Akashic Books.

A 2015 study[2] identified a correlation between autism and creative cognition, suggesting that autistic individuals not only perceive the world in a highly detailed manner, but may also do so creatively. To understand the significance of this finding, it is important to recognize that creativity has been evaluated through a variety of theoretical frameworks and assessment models. For example, Guilford's System of Creativity (Villagómez, 2017), particularly in relation to divergent production, considers the following dimensions:

a) Fluency: the quantity of responses generated. The assessment focuses on the number of different ideas or proposals produced.

[2] For further information, see Best, C., Arora, S., Porter, F., & Doherty, M. (2015). *The Relationship Between Subthreshold Autistic Traits, Ambiguous Figure Perception and Divergent Thinking*. Journal of Autism and Developmental Disorders, 45(12), 4064–4073. Available through the National Center for Biotechnology Information (NCBI), U.S. National Library of Medicine.

b) Flexibility: the variety of categories or types of responses provided. Each idea differs from the others and reflects alternative approaches or solutions to a given problem.
c) Originality: the production of unusual or uncommon responses, including non-conventional uses of objects, materials, or other resources.

The study in question examined the apparent paradox between creativity and autism. Given the characteristics commonly associated with autistic cognition, this finding is not entirely surprising, as autistic individuals often demonstrate a tendency to focus on details rather than on the overall whole. From a traditional perspective, such a cognitive style might not be expected to favor creative thinking; however, the study suggests otherwise.

The findings indicated that, although fluency was not a particularly strong characteristic in the generation of ideas among autistic participants, originality emerged as a significant strength. In other words, autistic individuals may not necessarily produce a greater number of ideas, but the ideas they generate are often more unusual, novel, or unconventional than those produced by non-autistic participants.

> ...whether individuals with subclinical autistic traits[3] possess cognitive styles that facilitate creativity or whether they are disadvantaged by the cognitive and behavioral rigidity associated with the autistic phenotype. [The authors examined] the relationship between divergent thinking (a cognitive component of creativity), ambiguous figure perception, and self-reported autistic traits in 312 individuals from a non-clinical sample. [...] Higher levels of autistic traits were found to be significantly associated with lower fluency scores on divergent thinking tasks. However, autistic traits were also associated with a greater number of unusual responses in these tasks. The generation of novel ideas is a prerequisite for creative problem-solving and may represent an adaptive advantage associated with autistic traits. (Best et al., 2015).

[3] Subclinical autistic traits are characteristics associated with the autism spectrum that are present in an individual but do not reach the threshold of severity required for a clinical diagnosis of Autism Spectrum Disorder (ASD). These characteristics may include patterns of behavior, thought, or perception that are commonly observed in autistic individuals, although they are expressed in milder or more subtle forms.

In addition to this, according to Nicholas Bowles, the study also revealed a relationship between autism and cognition, which is defined as "...all forms of knowing and awareness, such as perceiving, conceiving, remembering, reasoning, judging, imagining, and problem solving. Along with affect and conation, cognition[4] is one of the three traditionally identified components of the mind" (American Psychological Association [APA], 2018).

The same study found that when autistic participants were asked to generate multiple possible uses for a particular object, they tended to produce fewer responses than neurotypical participants. However, the responses they did provide demonstrated substantially higher levels of originality and ingenuity (Bowles, 2024). These findings suggest that autistic cognition may contribute to distinctive forms of creative thinking, particularly in tasks that value novelty and unconventional approaches over the sheer quantity of ideas generated.

Additionally, when discussing a study involving individuals with subclinical autistic traits—that is, individuals who exhibit mild difficulties in social communication, restricted or highly specialized interests, a preference for routines and structure, distinctive sensory processing patterns, and heightened attention to detail—it may be inferred that the participants displayed characteristics commonly associated with ASD Level 1 or, in some cases, ASD Level 2. This may help explain why numerous autistic individuals, particularly those requiring lower levels of support, have achieved distinction not only in the arts, but also in the sciences and in a wide variety of professional and creative fields.

As an example of attention to detail, presented below is a detailed map of the keywords identified in eight interviews conducted with Mexican electronic artists regarding their creative processes. The map is organized according to the different stages of the creative process: preparation, incubation and intuition, evaluation, elaboration, and communication. Notably, the author produced this analysis ten years before receiving an ASD Level 1 diagnosis.

[4] Conation refers to the set of functions related to the motivational and goal-directed aspects of personality, encompassing intentional impulses, motivations, volition, and the practical execution of intended actions. The conative dimension is traditionally distinguished from the affective and cognitive dimensions of the mind. In French psychology, the term has often been associated with the concept of "effort of the will," and in this sense may be considered synonymous with volition. Adapted from *Diccionario Médico* (Clínica Universidad de Navarra, n.d.; retrieved June 11, 2025).

The map reveals characteristics such as intense focus on a particular area of interest and a high degree of attention to detail. These qualities are reflected in works such as *Voguels* by David Barth (Figure 2.2, see page 47) and can also be observed in the technical drawings of livestock handling systems created by zoologist and autism advocate Temple Grandin.

Autistic Artists

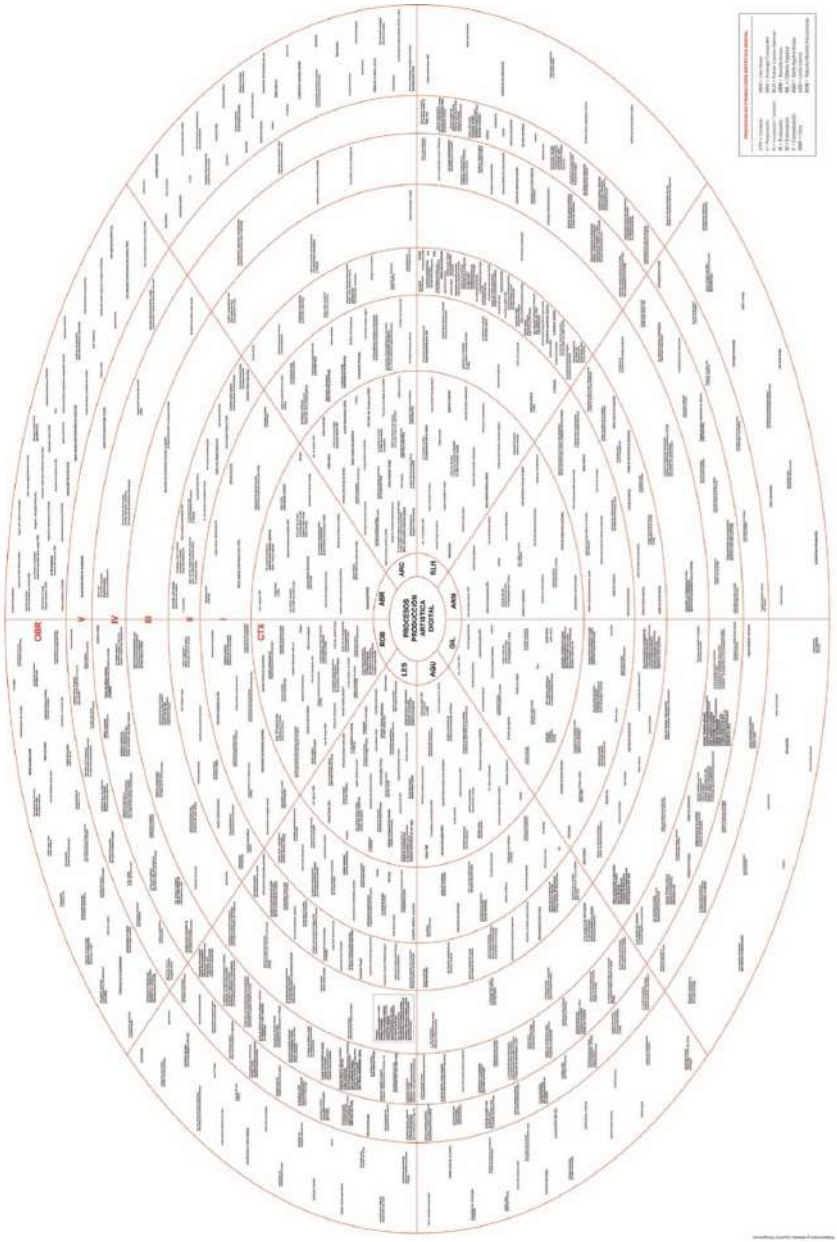
Stephen Wiltshire (London, 1974–) is a visual artist who received a confirmed diagnosis of autism at the age of three. Among his most notable artistic contributions is the extraordinary ability that earned him the nickname "The Human Camera." Wiltshire is capable of producing highly detailed and realistic drawings of urban landscapes entirely from memory, often after only a brief period of observation.

He did not begin speaking until the age of nine. According to accounts of his childhood, his teachers encouraged verbal communication by temporarily withholding his drawing materials so that he would need to request them back. From an early age, his remarkable artistic abilities attracted the attention of the press and various media outlets (Stephen Wiltshire, 2025).

Figure 2.3. *Stephen Wiltshire (n.d.). Photograph*

Source: *The Los Angeles Beat.*

Figure 2.2. *Keyword Map Derived from Eight Interviews with Mexican Electronic Artists Regarding Their Creative Processes (2014)*

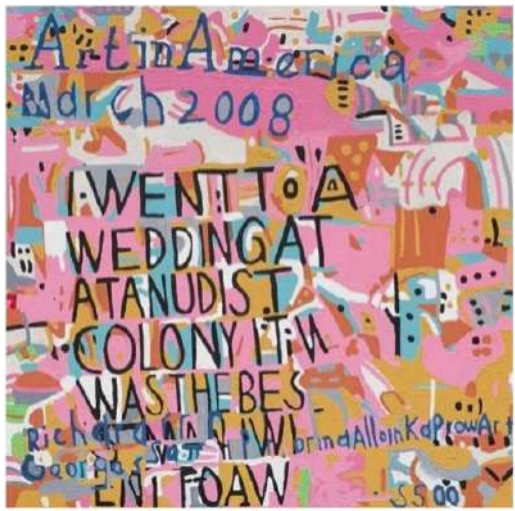


Prepared by Cynthia P. Villagómez Oviedo. Source: author.

Marlon Mullen (Richmond, California, 1963–) is a visual artist with a confirmed diagnosis of autism and is widely described as a non-speaking autistic artist. Among his most significant artistic contributions are his kaleidoscopic tactile paintings, many of which are based on images, layouts, and visual references found in magazines. Through the reinterpretation of printed media, Mullen creates highly distinctive works characterized by bold color, layered surfaces, and unique visual compositions.

His work forms part of the permanent collections of the Whitney Museum of American Art, the Museum of Modern Art, and the San Francisco Museum of Modern Art, among other institutions (NIAD Art Center, 2025).

Figure 2.4. *Marlon Mullen. Untitled (2018). Acrylic on canvas*

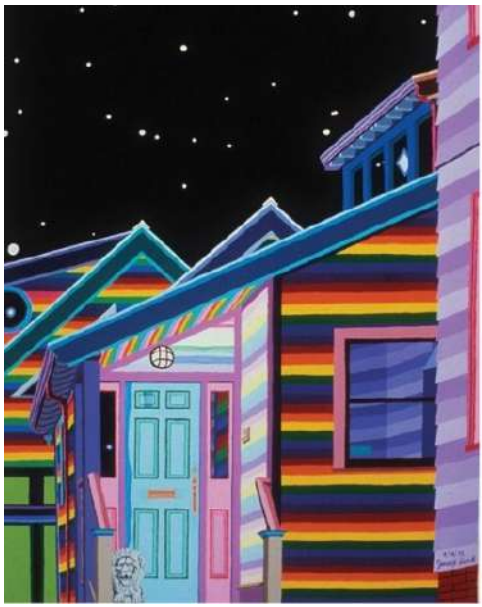


Source: *Disparate Minds.*

Jessica Park (Williamstown, Massachusetts, 1958–) is a painter with a confirmed diagnosis of autism. Her artistic contributions include colorful and highly detailed works depicting buildings, landscapes, and architectural scenes characterized by intricate geometric patterns. Her principal interests include Victorian architecture, urban landscapes, houses, and churches, subjects that she transforms into paintings whose visual qualities may be associated with aspects of the Pop Art tradition.

In 2003, she was awarded an honorary Doctor of Fine Arts degree by the Massachusetts College of Liberal Arts. Several books have been written about her life and artistic career, and her work has been exhibited extensively in museums, galleries, and cultural institutions (Good Purpose Gallery, 2025).

Figure 2.5. *Jessica Park. The Silverstein Houseand the Stoned Lion (1992)*



Acrylic on paper. Source: Gengarelly, Tony. *The Art of Jessica Park.*

Amanda Melissa Baggs, also known as Mel Baggs (Mountain View, California, 1980–2020), was a blogger, video artist, and autism rights advocate with a confirmed autism diagnosis. Their contributions extended well beyond the artistic sphere. Baggs identified as non-binary and wrote extensively about autism, disability, neurodiversity, and the rights of disabled individuals. Regarding their work, Baggs stated: "The most urgent thing was to convey that people who think and communicate in nontraditional ways are fully human, and that humanity is a spectrum rather than something that can be reduced to a normal/abnormal dichotomy" (Baggs, 2016).

Their writings, videos, and advocacy efforts left a lasting impact on the fields of neurodiversity and disability rights. Baggs was the creator of the short film *In*

My Language (2007), which portrays aspects of everyday life as a non-speaking autistic person. After its publication online, the film attracted considerable public attention and was featured by media outlets including CNN (Genzlinger, 2020).

Part of the significance of the work lies in the opportunity it provided for broader audiences to observe aspects of daily autistic experience, including routines, forgetfulness, intense interests, repetitive behaviors, and alternative forms of communication. Although Baggs' level of support needs was not publicly specified, their work has been included in the present study because of its exceptional capacity to communicate and illuminate the lived experience of autism.

Matthew Wong is considered one of the most talented painters of his generation according to *The New York Times* (2019). Matthew Wong (Toronto, 1984 – Edmonton, Canada, 2019) was a self-taught painter of Chinese descent whose work attracted significant attention from museums, galleries, collectors, and art dealers. He began painting in 2011 after studying the works of major painting masters through books and library collections. Despite his relatively short artistic career, he produced a remarkable body of work comprising more than one thousand artworks.

Figure 2.6. *Mel Baggs. In My Language (2007). Frame from video*

Source: YouTube.

His colorful landscapes, characterized by recurring patterns and intricate details, convey a profound sense of solitude that reflected experiences he described throughout his life. According to the New York gallery Karma, which represented him, the cause of his death was suicide. His mother, Monita (Cheng) Wong, stated that "Mr. Wong was on the autism spectrum, had Tourette syndrome, and had struggled with depression since childhood" (Genzlinger, 2019).

Wong's trajectory within the art world was both sudden and remarkable, particularly considering that painting became his principal artistic activity

only around 2013. Nevertheless, his work generated such a strong impact that critics frequently compared it to that of Vincent van Gogh—one of his acknowledged influences—as well as Milton Avery and other notable painters (Genzlinger, 2019).

The significance of Wong's artistic legacy was further recognized when the Van Gogh Museum organized the exhibition *Matthew Wong | Vincent van Gogh: Painting as a Last Resort*, presented from March 1 to September 1, 2024. In this regard, ...

> Both Van Gogh and Wong underwent a long search to find their calling in life, which ultimately turned out to be painting. Wong even regarded it as his 'last resort.' Both artists struggled with their mental health, which led to tragic and unexpected deaths. Despite many similarities, each created a highly individual body of work that is deeply personal and emotionally charged. Unlike Van Gogh, Wong's talent received broader recognition during his brief and turbulent career. Just five years after creating his first painting, a renowned museum acquired one of Wong's works, and many notable collectors soon followed. (Van Gogh Museum, 2024).

Figure 2.7. *Matthew Wong. The Kingdom (2023)*

Source: *The New Yorker.*

Although the sample of artists presented here is diverse and heterogeneous, it illustrates the remarkable variety of individuals who exist within the autism spectrum. Consequently, it is difficult to identify a single set of artistic characteristics common to all autistic creators. The only recurring feature that may be observed across these examples is a distinctive attention to detail, although this characteristic is expressed differently in each case and should not be considered universal among autistic individuals.

Art as a Support Resource for Autism

For a neurotypical person, engaging in artistic activities—whether through creation, participation, or appreciation—can be a positive, relaxing, and stimulating experience. Artistic engagement often provides rewarding experiences that may benefit individuals facing challenges such as anxiety, depression, and other forms of psychological distress.

I recall a personal experience during the COVID-19 pandemic in the city of Guanajuato in mid-August 2021, when collective life was only beginning to resume. My daughter and I enrolled in a clay sculpture workshop. The group consisted of two young participants, an older woman, the instructor, and myself. The afternoons seemed to pass quickly as we learned new techniques, worked with our hands immersed in clay, and developed ideas for future projects. It was an enriching experience that illustrated how artistic activities can foster learning, concentration, creativity, and enjoyment. Art provides opportunities that enrich people's lives, regardless of whether they identify as artists. Through artistic practice, individuals may encounter new forms of expression, reflection, social interaction, and personal fulfillment, all of which can contribute positively to their overall well-being.

Of course, there is a distinction between artistic activities and art per se. Nevertheless, the boundaries between the two have become increasingly blurred in recent decades. The number of people producing digital images has grown exponentially, and many now disseminate their creations through the internet and social media platforms. The production of images is no longer an activity reserved exclusively for artists, nor do we inhabit a historical moment in which works of art are necessarily unique and irreproducible.

Today, the concept of art continues to evolve, shaped not only by emerging technologies but also by the social, political, and economic transformations of contemporary societies. Equally important are the changes occurring within human culture itself, including shifts in values, beliefs, and social constructs. These issues will be examined in greater depth in the section devoted to electronic art.

In this context, individuals on the autism spectrum may also experience a sense of achievement, satisfaction, and personal accomplishment through participation in artistic activities. These benefits are not exclusive to neurotypical individuals. Moreover, many researchers and practitioners have recognized the strong visual thinking abilities frequently observed in autistic individuals, a characteristic that may be particularly advantageous for non-speaking autistic people. In this regard, "...and even for those [autistic individuals] who are able to articulate their thoughts, words often fail to accurately convey their perceptions. By contrast, visual communication provides a flexible and sensory-rich medium through which ideas can be expressed, explored, and processed" (Bowles, 2024).

In an interview conducted for this research, Christian Nicolás Díaz Márquez,[5] a psychologist specializing in autism, proudly showed me several artistic works created by his clients that he displayed on the bookshelf in his office. Among them was a shark meticulously sculpted in modeling clay by an eight-year-old autistic child. Although the figure was rendered in a cartoon-like style, it incorporated every detail of the animal, including a complete set of teeth.

Although most people experience positive effects from participating in artistic activities—whether in the visual arts, music, or other creative disciplines—Christianne Strang, a board-certified clinical art therapist, neuroscientist at the University of Alabama at Birmingham, and former president of the American Art Therapy Association, offers a more specialized perspective on the benefits of artistic practice for autistic individuals (Bowles, 2024). According to Strang, these benefits include the following:

[5] Interview conducted with Christian Nicolás Díaz Márquez at the Mexican Clinic for Autism and Developmental Disorders (CLIMA, A.C.), Antonio Madrazo Boulevard 6903, Real de los Murales, León, Guanajuato, Mexico, July 2023.

a) Communication and Expression. The nonverbal communication afforded by artistic activities enables creative forms of expression that frequently overcome difficulties associated with verbal communication. Through artistic practice, individuals may communicate feelings, thoughts, and emotions that might otherwise be difficult to express.
b) Sensory Stimulation. Through the use of diverse textures, colors, and materials, artistic experiences can provide sensory input that is calming, pleasurable, and meaningful for individuals with sensory sensitivities. Artistic activities may also promote sensory integration and support the development of fine motor skills.
c) Emotional Regulation. Art provides a safe and constructive means of exploring and processing emotions, thereby supporting emotional self-regulation and self-awareness. In addition, the nonverbal communication of emotions can help overcome barriers associated with autistic communication styles while facilitating a deeper connection with one's emotional experiences. This process may contribute to greater emotional understanding and the development of effective emotional management strategies.
d) Improvement of Fine Motor Skills. The precise and coordinated movements required for activities such as drawing, painting, sculpting, and other artistic practices may help improve fine motor skills and hand–eye coordination in autistic individuals.
e) Enhanced Attention and Concentration. Artistic practice encourages sustained engagement and may facilitate entry into states of deep concentration or flow. As a result, it can contribute to the development of sustained attention, attention to detail, mindfulness, and cognitive flexibility, all of which are valuable in everyday life.
f) Increased Self-Esteem. Artistic activities often take place within contexts that involve social recognition, exhibition, collaboration, and achievement. These experiences can foster feelings of accomplishment and success, thereby strengthening self-esteem and self-confidence.
g) Social Interaction. Art provides opportunities for social interaction and collaboration, allowing autistic individuals to practice social skills while fostering a sense of belonging, acceptance, and connection with others.

h) Self-Expression and Identity. Artistic practice offers opportunities for self-expression, autonomy, and the communication of personal thoughts, emotions, and experiences. Group artistic activities may also support the development and affirmation of personal identity while increasing confidence in social interactions.
i) Stress Reduction. By allowing individuals to explore and process their feelings through nonverbal means, artistic activities may contribute to emotional regulation and help reduce stress and emotional overload.
j) Enhancement of Cognitive Skills. Artistic activities encourage problem solving, critical thinking, and spatial reasoning. They may also promote the development of executive functions such as planning, organization, and decision-making—skills that are essential for managing everyday challenges and that may be particularly beneficial for autistic individuals.

In addition to the above, the art therapist Christianne Strang argues that neuroscience can help strengthen confidence in art therapy as a therapeutic approach, since a neuroscientific perspective may enhance our understanding of the neural processes underlying the highly complex interaction between perception, cognition, emotion, and behavior.

In this regard, she refers to "…an overview of the current evidence and limitations of the neurobiological concepts of neuroplasticity, mirror systems, and interoception as applied to art therapy practice..." (Strang, 2024, p. 1). According to Strang, critical analysis and a deeper understanding of the scientific foundations of these concepts can be used to inform and guide art therapy practice.

Chapter 3. Electronic Art, Emotion and Inclusion
Background of Electronic Art

As we turn to one of the central themes of this book, it is important to address the historical background of electronic art. As both an artist and researcher in the field of electronic art, I consider this discussion essential because knowledge of this branch of contemporary art remains limited, particularly in Mexico. Based on my personal experience as a lecturer and advocate for Mexican electronic art, I have found that examining the historical origins of electronic art significantly contributes to a broader understanding of its nature, development, and cultural significance.

Historically, art has been shaped and influenced by the technological and scientific advances of its time, as well as by prevailing social and political ideologies. Identifying a single historical moment as the origin of electronic art is difficult because its emergence resulted from the convergence of multiple developments occurring over extended periods of time.

Among these developments were the technological transformations initiated during the Industrial Revolution, driven by the introduction of steam-powered machinery. This period witnessed the development of key technologies such as batteries, the telegraph, the telephone, and systems for generating electrical power, all of which contributed to the widespread adoption of technological devices in everyday life. Equally important were the advances in the electrical and mechanical processes associated with photography, cinema, and later video technologies. Photography, in particular, emerged as an artistic medium during the nineteenth century and demonstrated from an early stage the close relationship between art and technology. By the mid-1800s, photography had already begun

to establish itself as both a technical and artistic practice, illustrating how technological innovation could transform visual culture and artistic production.[1]

Although the Arts and Crafts Movement emerged in the late nineteenth century under the influence of John Ruskin as a reaction against industrialization and mass production, promoting craftsmanship and handmade aesthetics, its high production costs limited its accessibility to the broader public. At the same time, the emergence of cinema and the development of Modernism marked a period in which technology could no longer be ignored within artistic practice. Cinema reflected the dynamics of industrial society, while Modernism sought to transform these changes into new aesthetic forms.

Concurrently, Art Nouveau (c. 1880–1914), represented by figures such as Henry van de Velde, attempted to establish a balance between the machine, art, and craftsmanship. These ideas contributed to the intellectual foundations that would later influence the creation of the Bauhaus.

At the same time, technology was becoming increasingly integrated into everyday life through electrification and the introduction of household appliances during the early twentieth century, although access to such technologies arrived later in countries such as Mexico due to their particular historical circumstances.

In 1919, Walter Gropius founded the Bauhaus in Weimar, Germany, introducing what he described as an "aesthetic machine" into modern life. This project posed two fundamental challenges: first, to unite the fine arts and the applied arts in order to transform the human environment; and second, to construct a new culture capable of reconciling art and science, as well as human beings and machines. While the Arts and Crafts Movement sought to revitalize traditional craftsmanship, the Bauhaus embraced industrial technology as a central component of its educational and artistic philosophy.

[1] Portions of the section "1.4 Background of Electronic Art" are adapted from material previously published in the author's doctoral dissertation, *Analysis of Digital Artistic Production Processes in Mexico: Mexican Digital Artists and Their Work* (Villagómez, 2017, pp. 24–35).

Founded during a period of intense sociopolitical upheaval between the two World Wars, the Bauhaus brought together an extraordinary group of European artists and designers, including Johannes Itten, Josef Albers, Paul Klee, Wassily Kandinsky, and László Moholy-Nagy, among many others.

Gropius promoted the transition from traditional handcraft production toward the integration of design and industrial manufacturing, while Moholy-Nagy incorporated influences from Russian Constructivism, particularly from the Soviet institution known as Vkhutemas. By the mid-1930s, several Bauhaus faculty members emigrated from Germany as a result of Nazi persecution and the school's closure. In 1937, Moholy-Nagy founded the New Bauhaus in Chicago—today the Institute of Design at Illinois Institute of Technology—while Josef Albers continued his influential studies of color at institutions such as Black Mountain College, Yale University, Harvard University, and the Ulm School of Design.

Similarly, artistic movements such as Futurism, Dadaism, and Constructivism played an important role in shaping the intellectual foundations that would later contribute to the emergence of electronic art.

Futurism, initiated in Italy by Filippo Tommaso Marinetti in 1909, celebrated speed, technology, energy, and the transformative power of modernity. The movement advocated a fusion of art and science while challenging traditional artistic values and conventions. Futurism emerged as a forceful reaction against established artistic traditions, fueled by enthusiasm for industrial progress, dynamism, and technological innovation.

In contrast, following the First World War, Dadaism emerged in Zurich as a radical critique of industrial civilization. Rather than celebrating the machine, Dada highlighted the absurdity of a society that had employed technological progress to produce unprecedented destruction. Dadaists rejected conventional notions of art, logic, reason, and eternal beauty, advocating instead for absolute freedom of expression through spontaneity, provocation, irony, and scandal. The movement subsequently spread to cities such as Berlin, Paris, and New York.

Artists such as Marcel Duchamp applied machine aesthetics to representations of the human body, while figures including John Heartfield, Raoul Hausmann, and Max Ernst became known for their use of photomontage and other technologically mediated artistic techniques. Through these practices, they questioned both the structures of art and its social function.

Throughout the twentieth century, the artistic avant-gardes maintained a close relationship with science and technology. In 1928, Dadaist artists became interested in the work of the Henri Poincaré Institute, where a collection of geometric mathematical models originally designed for educational purposes inspired artists such as Man Ray and Max Ernst. These models even served as the basis for works such as *Shakespearean Equations: Twelfth Night* (1948) by Man Ray.

Within Russian Constructivism, which emerged in 1913, Vladimir Tatlin advocated technical training for artists so that they could participate actively in industrial society. In 1920, Naum Gabo and Antoine Pevsner published the *Realistic Manifesto*, in which they argued that art should be grounded in space and time, incorporate kinetic rhythm, and become an active part of everyday life rather than existing merely as a sanctuary or aesthetic object.

Constructivist artists rejected traditional art forms and easel painting, focusing instead on designs that appeared functional or were intended for mass production. Although they were paradoxically influenced by artists whose work was not primarily utilitarian, such as Kazimir Malevich and Pablo Picasso, Constructivists developed an artistic language closely linked to technology and science.

Inspired by Picasso's constructions, Vladimir Tatlin created industrial assemblages that are now regarded as some of the earliest examples of abstract sculpture. Other artists, such as Alexander Rodchenko, produced works employing a visual language that anticipated scientific models and celebrated the technological rationality of the machine age.

In a different vein, the history of art has rarely been examined through the lens of materials or technologies, largely because of a longstanding cultural separation between technology—often viewed merely as a tool—and the humanities, which are commonly associated with ideas, values, and meaning. Scholars such as Pau Alsina and Bruno Latour have challenged this division, arguing that technology is not external to culture but rather participates in the co-construction of social relations. From this perspective, technology is inseparable from human existence, and its development is intrinsically linked to culture itself.

During the rise of the artistic avant-gardes of the twentieth century, technological development advanced at an unprecedented pace. The

Industrial Revolution, the emergence of radio broadcasting during the 1920s, and the technological innovations derived from the Second World War all contributed to the proliferation of electronic devices in civilian life. This context of technological innovation inevitably found expression within artistic practice. In subsequent decades, new media such as television, stereo sound systems, video cameras, and later the internet, personal computers, and mobile phones transformed everyday experience, creating an increasingly mediated and globalized environment. Within this context, artists drew inspiration from technology to imagine possible futures and to challenge conventional modes of perception.

The pioneers of technological art, such as Abraham Palatnik, Frank Malina, and Nicolas Schöffer, played a fundamental role in the development of contemporary art. Nevertheless, the history of contemporary art has often overlooked or marginalized these practices. In my view, it is essential to reconnect these works both to their historical origins and to the contemporary contexts in which they continue to be interpreted, exhibited, and discussed.

In 1948, Abraham Palatnik settled in Rio de Janeiro, where his artistic vision underwent a profound transformation after meeting the critic Mario Pedrosa and visiting the Pedro II Psychiatric Hospital. There he was deeply impressed by the spontaneous artistic production of psychiatric patients, an experience that led him to question conventional academic notions of art. Influenced by these encounters, he abandoned traditional painting and devoted the following two years to the creation of *cinechromatic devices*—artifacts that combined light, movement, and color through electrical mechanisms.

Between 1949 and 1950, he constructed his first two cinechromatic devices, each featuring complex internal structures that projected luminous effects controlled by motors and electrical consoles. By 1959, he had produced approximately twenty such devices while simultaneously experimenting with technology, industry, and new materials. Palatnik's work is widely regarded as pioneering in its integration of art, science, and technology, demonstrating an innovative approach to artistic creation.

Special mention should also be made of Frank Malina, a distinguished scientist in astronautics and a pioneer of kinetic and lumino-kinetic art. In 1967, working from his home-studio in Boulogne-Billancourt, near Paris,

he founded the influential journal *Leonardo*, which became an important meeting point for scientists, artists, and theorists interested in the intersections of art, science, and technology. Leonardo remains active today.

Malina developed the *Lumidyne System*, a complex device combining motors, lights, and painted transparent discs to generate dynamic and abstract visual effects. His first work employing this technique was *Point Counter Point* (1956), through which he deliberately blurred the boundaries between art and engineering. Between 1956 and 1963, he produced more than one hundred artworks using this system. Malina came to be recognized as a figure who successfully integrated science, art, and humanism, actively promoting dialogue across disciplines and leaving a legacy that continues to influence contemporary technological art.

Another key figure was Nicolas Schöffer, who is often regarded as a founding figure of cybernetic art and an important precursor to video art. A multidisciplinary artist educated in Paris, Schöffer worked across sculpture, architecture, and urbanism. His practice was characterized by the integration of art, science, and technology, expanding the boundaries of traditional artistic production.

In 1956, he created *CYSP I*—an acronym derived from *cybernetics* and *spatiodynamic*—one of the first interactive cybernetic sculptures. The device combined electronic components, including photocells, a microphone, and a homeostat, to generate movement in response to stimuli such as light, sound, and the presence of spectators. Developed in collaboration with engineers from Philips, *CYSP I* is considered a pioneering work of cybernetic art. By bringing together robotics, kinetic art, and Constructivist principles, Schöffer opened the way toward responsive and interactive artistic forms, anticipating many of the practices that characterize contemporary art and technology today.

It should also be noted that, beginning in the 1940s, the computer was initially developed as a scientific tool for performing complex calculations. Due to its cost, size, and technical limitations, it was not initially considered a medium for artistic creation. It was not until the 1960s that scientists and researchers began to explore its graphic capabilities. In 1963, Ivan Sutherland developed *Sketchpad*, the first software system to feature a graphical user interface and interaction through a light pen. Between 1960 and 1964, William Fetter created the first computer-generated human figure and coined the term "computer graphics."

Within the emerging field of electronic and computer art, Max Bense played a pioneering role in establishing the theoretical foundations of computational art. In 1965, Michael Noll presented in New York what is often regarded as the first exhibition of computer-generated images, while Georg Nees had already been producing computer graphics since 1964. That same year, Georg Nees, Frieder Nake, and Michael Noll were associated with some of the earliest significant exhibitions of computer-generated art, including the exhibition *Computer Art* in Stuttgart, which became a landmark event in the history of digital and computational art.

In 1968, the influential group exhibition Cybernetic Serendipity was held at the Institute of Contemporary Arts in London. During the same period, *Mind Extenders* was presented at the Museum of Contemporary Crafts. These exhibitions played a crucial role in introducing wider audiences to the artistic possibilities of computers, cybernetics, and emerging technologies. In 1969, the Brooklyn Museum organized the exhibition *Some More Beginnings*, while in Argentina the exhibition *Arte y cibernética* explored related themes. In Spain, some of the earliest exhibitions devoted to computer-generated artistic forms appeared, including *Formas computables* (1969) and *Generación automática de formas plásticas* (1970), both presented at the University of Madrid. In 1972, the Goethe-Institut presented the exhibition *Impulsos: Arte y Computador* in Madrid and Barcelona.

Particular attention should also be given to the group Experiments in Art and Technology (E.A.T.), founded in 1966 by engineers and artists with the objective of fostering collaborations between art and technology. Its members sought to expand the role of the artist while reducing the gap between individuals and technological innovation. Prior to the formal establishment of E.A.T., its founders organized the influential event *9 Evenings: Theatre and Engineering* in New York in 1966, led by Robert Rauschenberg and other collaborators. Approximately 10,000 spectators attended a series of performances in which artists worked alongside thirty engineers, demonstrating new possibilities for interdisciplinary collaboration between artistic practice and technological experimentation.

In addition, Charles Csuri was a key pioneer of digital art. Beginning in 1964, he conducted groundbreaking experiments with computer graphics and, from 1965 onward, produced a series of experimental animated films.

In 1967, he received an award at the *4th International Experimental Film Festival* in Brussels, and his work was prominently featured in the landmark exhibition *Cybernetic Serendipity*. Widely recognized by institutions such as the Smithsonian Institution and the Museum of Modern Art as one of the fathers of digital art and a pioneer of computer animation, Csuri's contribution occupies a central place in the history of digital media art.

Beginning in 2000, efforts were undertaken to develop the database of the Digital Art Museum (DAM) to document the growth and evolution of digital art. The DAM project includes an online museum, the DAM Gallery in Berlin, and the *DAM Digital Art Award*, an international distinction dedicated to recognizing outstanding artists working in the field of digital media. These initiatives have been led primarily through independent efforts associated with figures such as Wolf Lieser and other collaborators committed to preserving and promoting the history of digital art.

Likewise, the release of the Macintosh in 1984, one of the first personal computers to offer a graphical user interface accessible to a broad public, was instrumental in enabling artists to experiment more extensively with digital graphics. The subsequent expansion of the internet throughout the 1980s and 1990s further transformed artistic practice by facilitating new relationships between virtual and physical experiences. These developments profoundly influenced electronic art and contributed to the emergence and consolidation of digital art as a distinct field.

Although several pioneers have been discussed here, many other artists have employed digital technologies in their creative practices. The rapid growth of the field has been so extensive that it is impossible to examine every contributor in detail. Therefore, this historical overview is intended only as an introduction, providing a thematic and historical foundation for understanding the development of electronic art.

Electronic Art in Mexico

In Mexico, contemporary art has maintained a longstanding commitment to political, social, economic, and cultural issues, reflecting the historical contexts in which it is produced. This critical orientation has become a

defining characteristic of its genealogy and, in recent decades, has expanded to include environmental concerns as well. Mexican electronic art is no exception to this tradition. On the contrary, it has been built upon foundations of critique, resistance, and a desire for social transformation.[2]

One of the foundational moments of this critical tradition can be found in the student movement of 1968 and its visual expression through what became known as the *Graphics of 1968* (*Gráfica del 68*). This episode marked an important transition from the artwork conceived primarily for contemplation toward the artwork understood as a tool for political action and social communication. The technological resources available at the time, including mimeograph machines, were strategically employed to produce posters, flyers, and other printed materials that were distributed in the streets and displayed throughout the city on walls, poles, and public spaces. This convergence of art and technology—operating through an activist and largely artisanal logic—opened the way for new forms of expression that would eventually become incorporated into the practices of electronic art.

One of the pioneering artists in the experimentation with unconventional technologies was Felipe Ehrenberg, who, upon returning to Mexico in the mid-1970s, introduced what he called *neographics* (*neográficas*). This term refers to graphic practices that employ tools and devices outside the realm of traditional printmaking, including mimeograph machines, rubber stamps, home printers, and other alternative reproduction mechanisms. Ehrenberg not only utilized these media in his artistic practice but also theorized and promoted them among other artists as autonomous artistic languages. Through his innovative use of the mimeograph, he challenged the boundaries of traditional graphic arts and proposed a more inclusive, accessible, and reproducible artistic practice. In a country characterized at the time by limited technological infrastructure and the high cost of materials and equipment, Ehrenberg's approach drew upon what is often referred to as *Mexican ingenuity* (*ingenio mexicano*), a form of creativity

[2] The section "1.4.1 Electronic Art in Mexico" draws upon material previously published in the chapter "Genealogy of Digital Art in Contemporary Mexican Art" (pp. 60–85) of the author's doctoral dissertation: Villagómez, C. (2017). *Analysis of Digital Artistic Production Processes in Mexico: Mexican Digital Artists and Their Work* (Doctoral dissertation, Universitat Politècnica de València). La Librería UPV.

that emerges in response to scarcity and constraint. These experiences contributed to the development of an artistic mode of production grounded in adaptation, recycling, resourcefulness, and self-management.

On the other hand, during the 1980s and 1990s, photocopiers became an important tool within emerging artistic practices. Copy Art, or photocopy art—considered part of the broader concept of *neographics* (*neográfica*) discussed by the critic Raquel Tibol—became a widely used technique among students and artists. Through the manipulation of original images, experiments with movement, layering, distortion, enlargement, reduction, and contrast, artists were able to develop new visual languages and aesthetic possibilities.

Artists such as Arnulfo Aquino and collectives including Pinto Mi Raya produced significant projects using photocopy technologies, at times with support from companies such as Canon. Electrography proposed a reproducible aesthetic that stood in opposition to the notion of the unique artwork and its associated aura. In this respect, it revived certain principles found in popular printmaking traditions and graphic arts, promoting a more democratic access to artistic production and circulation.

These practices helped pave the way for the subsequent development of electronic and digital art by incorporating technology as an essential component of the artistic process rather than merely a tool for reproduction.

By the late 1970s, a number of artistic collectives emerged that radically transformed the Mexican cultural landscape. This period became known as the Generation of the Groups (*Generación de los Grupos*, 1977–1982), a movement characterized by its collective, political, and experimental approach to artistic production. Among the most influential collectives were Grupo Suma, Proceso Pentágono, and No-Grupo. These groups employed the technological resources available to them—including photocopying, mimeographs, heliographic processes, and stencils—to create works with a strong social and political dimension. Grupo Suma, for example, appropriated urban space as a site for artistic intervention, filling it with critical visual messages. Its members employed discarded materials, newspaper clippings, urban debris, and low-cost reproduction technologies, challenging the dominance of Mexican muralism while proposing a direct, popular, and street-oriented aesthetic.

Proceso Pentágono, in turn, brought conceptual art into the realm of political critique, addressing issues such as torture, censorship, state violence, and social inequality. Through its projects, the collective sought to expose the mechanisms of power operating within contemporary Mexican society. Meanwhile, the artists of No-Grupo adopted an aesthetic based on parody, irony, and critical humor. Their work challenged traditional conceptions of artistic seriousness, demystified the figure of the solemn artist, and promoted humor as a strategy of cultural resistance and dissent.

In addition to the developments already discussed, the work of Manuel Felguérez was of particular importance. Felguérez is widely regarded as the pioneer of digital art in Mexico. In the early 1970s, he began investigating the use of computers as artistic tools. While at Harvard University, he collaborated with an engineer to develop a computer program capable of generating visual compositions through mathematical calculations. The resulting images were initially produced as drawings, which he subsequently transferred to canvas and completed using oil painting techniques. Felguérez later documented this experience in his book *The Aesthetic Machine* (*La máquina estética*), where he reflected on the relationships among authorship, code, and artistic production. His proposal consisted of a combinatorial syntax that automated the generation of geometric forms frequently present in his work without abandoning artistic sensibility. Ultimately, he selected specific computer-generated line drawings and translated them into paintings through traditional artistic methods.

Another fundamental figure is Pedro Meyer, internationally recognized for his contributions to digital photography and interactive media. His work *I Photograph to Remember* (*Fotografío para recordar*, 1990), developed as a CD-ROM project, combines images, sound, and narrative to construct a personal meditation on the illness and death of his parents. This work is significant not only as a precursor to digital art but also as one of the earliest artistic projects to incorporate interactivity as a central component of the user experience. Meyer also founded the digital magazine *ZoneZero*, which became an influential platform for the dissemination of digital photography throughout Mexico and Latin America. His work demonstrates how digital language can be intimate, autobiographical, and capable of engaging some of the deepest emotional dimensions of the viewer's experience.

With regard to exhibitions, the first widely recognized exhibition of electronic art in Mexico was *Electrosensibilidad* (1988), organized by the Universidad Autónoma Metropolitana (UAM). In the years that followed, the Escuela Nacional de Artes Plásticas (ENAP) and other institutions gradually incorporated electronic art into their academic programs and cultural events.

Another foundational milestone occurred in 1994 with the inauguration of the Centro Multimedia at the National Center for the Arts (CNA), created to support projects exploring the intersections of art and technology. During this period, artists such as Fernando Camino, Andrea Di Castro, Cecilio Baltazar, Javier Covarrubias, Isaac Kerlow, and Zalatiel Vargas exhibited electronic and digital works in major venues including the Museo de Arte Moderno, the Museo Tamayo, and the Museo Nacional de la Estampa.

It is important to emphasize that electronic art in Mexico did not emerge primarily from access to cutting-edge technology. Rather, it arose from a desire to communicate, a capacity to create with limited resources, a critical spirit, and a sustained commitment to artistic innovation. These characteristics continue to distinguish much of Mexican electronic art today. On the other hand, Mexican electronic art remains a relatively underexplored field of research. While a small number of artists have accumulated more than three decades of experience working with technological media, there is now a growing generation of emerging artists entering the field of electronic art.

Despite this situation, Mexico currently possesses a growing network of spaces dedicated to artistic practices involving technology. These include both independent and institutional laboratories, museums, and cultural centers such as the Laboratorio Arte Alameda, the Centro de Cultura Digital, the Centro Mexicano para la Música y las Artes Sonoras, the Museo Universitario Arte Contemporáneo, the Centro Cultural de España en México, the Museo de Arte Carrillo Gil, the Centro Cultural Tijuana, and the Museo Tamayo, among others. These institutions either focus directly on art and technology or provide important exhibition and research opportunities for technologically oriented artistic practices. It is also worth noting that several countries have developed internationally recognized exhibition spaces and research centers dedicated specifically to the intersections of art,

science, and technology. Examples include SymbioticA at the University of Western Australia; Santa Mònica in Barcelona; the Ars Electronica Center; and the ZKM Center for Art and Media, among others.

Within this context, festivals have played a particularly important role in the dissemination of electronic art throughout Mexico and Latin America. Notable examples include Transitio_MX, events organized by the Centro Mexicano para la Música y las Artes Sonoras (CMMAS), Ars Electronica Mexico, and MUTEK.

Financial support has also been an important factor in the development of electronic art in Mexico. Contemporary and electronic artists may access funding through programs such as the Sistema Nacional de Creadores de Arte and the Sistema de Apoyos a la Creación y Proyectos Culturales. Researchers, meanwhile, may benefit from programs offered by the National System of Researchers of the National Council of Humanities, Sciences and Technologies, support without which the present research would not have been possible.

Likewise, a growing number of universities now offer undergraduate programs in Digital Art or related fields, including the Universidad Autónoma Metropolitana, the Universidad de Guanajuato, and the Tecnológico de Monterrey, among others. In addition, numerous other initiatives, institutions, publications, educational programs, and cultural resources have contributed substantially to the development, visibility, and international projection of Mexican electronic art (Villagómez, 2024, pp. 151–177).

Additionally to the developments already discussed, Mexican electronic artists have found ways to create both independently and, at times, through institutional support programs. Many have explored artistic production through obsolete technologies, DIY (Do-It-Yourself) technologies, open-source software and hardware, homemade technological systems, and other alternative modes of production. These practices are often informed by knowledge acquired through scientific communities, maker cultures, and networks of technology enthusiasts. Such experiences demonstrate that artists frequently create with the resources available to them, and that the originality of artistic ideas can flourish regardless of whether the work is produced in a laboratory equipped with advanced technologies or through materials and components obtained from second-hand markets. In this

sense, creativity is not determined solely by technological sophistication but also by the capacity to imagine new possibilities for the use of existing tools and materials.

From Spectator to Active Participant

At the same time, electronic art, as part of contemporary art, is not exempt from broader historical and cultural considerations. The historical record of artistic development has largely been constructed around European art and, later, American art. Scholars such as Terry Smith (2009) and Cuauhtémoc Medina (2010) have reflected extensively on this issue, arguing that it is necessary to rebalance power relations within the art world, where Western perspectives have traditionally occupied a dominant position. These authors suggest that the development of art theory and critical practice from the periphery—that is, from regions, communities, and cultural groups historically excluded from dominant narratives—offers a means of intervening in the centers of contemporary cultural production. Such an approach may contribute to a broader reconfiguration of the field and to the recognition of artistic practices that have remained underrepresented within mainstream histories of art.

With regard to artistic production itself, Smith and Medina further argue that contemporary art has increasingly moved away from the aesthetic alienation associated with the imitation of foreign models. Instead, artists have sought to integrate cultural, social, and historical dimensions rooted in their own contexts. This shift allows contemporary artworks to emerge from local identities, experiences, and worldviews, making visible forms of artistic expression grounded in specific cultural realities rather than in imported aesthetic paradigms (Smith, 2009; Medina, 2010; Villagómez, 2024, pp. 151–177).

On the other hand, beyond the historical origins of electronic art, there are numerous perspectives from which the field may be approached and understood. In the present research, electronic art is examined as part of the movement commonly known as Art, Science, and Technology (AST). This movement, in turn, constitutes a branch of the broader category of

visual arts, an umbrella concept encompassing a wide range of artistic practices, media, and forms of expression.

Within electronic art itself, one finds digital art alongside many other artistic forms that employ emerging technologies. In the Anglo-American tradition, these practices are often categorized and distinguished according to the specific medium, technological resource, or system through which they are created. As a result, a diverse vocabulary has emerged to describe artistic practices involving computers, networks, robotics, telecommunications, virtual environments, interactive systems, bioart, artificial intelligence, and other technological platforms.

Because of the close relationship among art, society, and technological resources, the conceptualization of electronic art remains in constant evolution. Artistic practices involving technology have developed alongside technological change itself, continuously incorporating new tools, media, and modes of interaction.

As discussed in the section on the historical background of electronic art, the technological advances of the nineteenth and twentieth centuries were fundamental to the emergence of the field. Innovations such as the steam engine, the telegraph, electrical power, and photography, among many others, contributed to the construction of the technological framework upon which art involving technological media would later develop. These innovations not only transformed everyday life but also expanded the possibilities available to artists, providing new materials, processes, and conceptual models through which artistic creation could be imagined and realized.

> According to the researcher Bruce Wands [...] the changes that ultimately led to the emergence of digital art began with the development of the electrical and mechanical processes associated with photography, cinema, and video. Wands argues that this perspective forms part of a broader historical continuum in which photography itself evolved from drawing and painting; cinema represents a logical extension of photography, and so on, culminating in the development of art created through the use of technology. (Villagómez, 2017, p. 22)

This helps explain why contemporary electronic art maintains a close relationship with technologies that have become part of everyday life. Today, it is common to encounter artworks that employ resources such as mobile devices—including laptops, smartphones, tablets, smartwatches, and e-readers—along with locative technologies such as GPS systems, tracking devices, and geolocation sensors. Artists also make use of infrastructural locative technologies, including motion sensors, surveillance and security systems, and home automation devices such as smart lighting systems and electronic locks. In addition, electronic artworks frequently incorporate computers, the internet, social media platforms, virtual reality, augmented reality, artificial intelligence, software environments, and many other contemporary technological resources.

Likewise, access to scientific knowledge and technological innovation has given rise to a wide range of artistic practices, including bioart, genomic art, neuroart, nano art, eco-art, SciArt, data art, cognitive art, and astronomical art, among others. These practices emerge from the intersection of artistic inquiry and scientific knowledge, often exploring questions that transcend traditional disciplinary boundaries.

Access to such knowledge is sometimes facilitated through what is known as *citizen science*, that is, forms of knowledge production generated by individuals and communities outside formal scientific institutions who engage in self-directed learning and collaborative research. As a result, artists working in these fields frequently consult scientific articles, research publications, laboratories, and specialist communities as part of the development of their artistic projects.

Nevertheless, electronic art and artistic movements that draw upon scientific knowledge often overlap and intersect in multiple ways. While acknowledging these points of convergence, the present research focuses specifically on electronic art as its primary field of study.

Contributing to a definition of the field, Pau Alsina (2011), a professor at the Open University of Catalonia, argues that electronic art encompasses, on the one hand, the media of communication and information made possible through electronic and digital technologies and, on the other, artistic practices developed through new media whose defining characteristics include interactivity, computation, and connectivity (Alsina, 2011, as cited in Villagómez, 2017).

After more than twenty years of researching electronic art, digital art, and artistic creation and production processes, I have come to the conclusion that the definition of electronic art may be understood as an extension of the definition of art itself. That is, it constitutes a manifestation of its time and a reflection of the idiosyncrasies of the historical moment in which it is produced, with the particular distinction that never before has technology formed such an integral part of both the creative process and the artwork or artistic development itself.

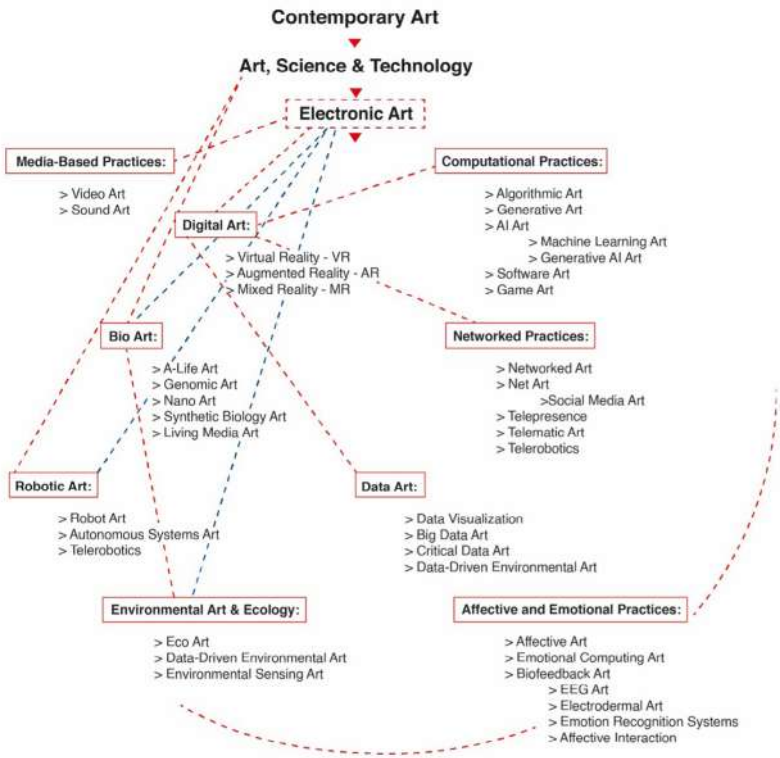
Electronic art presents a rich and diverse landscape characterized by alternative modes of transmitting ideas, communicating meanings, and fostering reflection, as well as multiple forms of participation. Individuals who were once merely spectators may now become active participants in the artwork, with the capacity to influence its evolution and, in some cases, its outcome. Such participation may vary according to factors including the moment, manner, location, and duration of interaction, as well as whether the work is conceived as a finite production or as an open-ended system that allows for multiple interpretations, outcomes, and forms of engagement.

In addition, this branch of contemporary art encompasses a broad range of artistic practices, including computer art , net.art, sound art, robot art, software art, media art, A-life art, hacker art, game art, digital art, generative art, video art, virtual reality art, augmented reality art, artificial intelligence art, among many others.

Electronic artists employ both cutting-edge and, at times, obsolete technologies, as well as a wide variety of digital tools, software applications, and electronic devices to explore new aesthetic possibilities that facilitate communication among artists, their messages—whether themes, concepts, or critical concerns—and their audiences.

Electronic art, through its dynamic and evolving nature, reflects the intersection of art, science, and technology as an expression of contemporary culture (Villagómez, 2024, pp. 151–177).

Figure 3.1. *Classification Map of Art, Science, and Technology and Selected Resources*



Source: Pau Alsina (2011) and DigiArts UNESCO Knowledge Portal. Author's own elaboration.

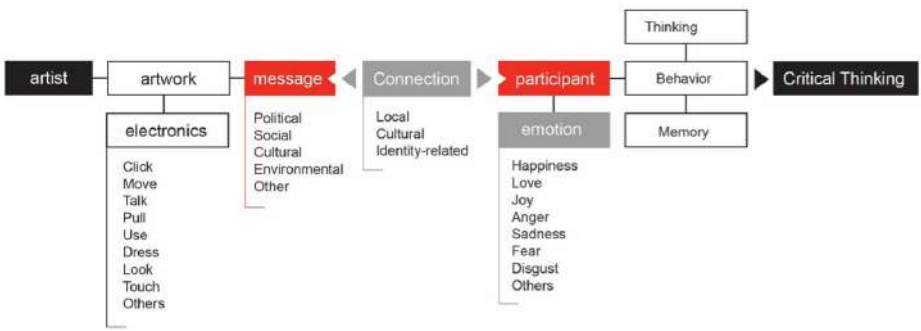
ASD-I and Electronic Art: Meaningful Connections

Within the present research, I have deliberately chosen not to overlook the use of elements that generate strong connections between artworks and their audiences, particularly emotions. In this regard, Frank Popper argues that electronic artists have made a special effort to create new conditions for eliciting emotions in viewers through works that draw upon principles of experimental psychology to stimulate mental faculties. "Electronic artists approach technology as a tool not only of the hand but also of the mind, one capable of changing our mental processes and enhancing our sensitivities" (Popper, 1993, p. 180).

The role played by emotional induction is fundamental to effective communication processes. According to researchers Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon (2017) of the Michigan Technological University, imagination, films, sound, music, images, certain forms of reading and writing, embodiment, virtual reality, feedback, self-referential statements, social interaction, physiological manipulations, motivated performance tasks, and combined techniques are all capable of eliciting different emotional responses. These authors likewise agree that autobiographical memory constitutes one of the most powerful mechanisms for evoking emotions. Emotions can undoubtedly foster reflection and awareness regardless of the specific content of a message because past experiences emerge within the mind, increasing the likelihood that received stimuli and information will persist in memory. In this regard, the electronic artist Iván Abreu explains that his objective is precisely for participants to retain both the artwork and the social or political issues it addresses in their memory. In doing so, he seeks to generate a space for long-term reflection through artistic experience (Villagómez, 2017, pp. 173–184).

Of course, the foregoing is not a *sine qua non* condition for the successful communication of messages in every case, nor for effective communication between technological artistic developments and their audiences. Nevertheless, it constitutes an important methodological reference that may be useful for artists working with technology.

Figure 3.2. *Conceptual Map of the Communication and Creation Process of an Electronic Artwork*



Source: Author's own elaboration.

Emotions in the Contextof Electronic Art

One of the key premises of this research is that, in most cases, electronic artworks require some form of participation from the viewer. Consequently, the interaction between audiences and artworks constitutes a fundamental area of inquiry for understanding art created through the use of technology. Paradoxically, however, there remains insufficient research devoted specifically to this subject.

At the same time, contemporary psychology generally regards emotions as observable phenomena that are expressed behaviorally. From this perspective, several important questions emerge: Is it possible for electronic artists to intentionally design works that facilitate the elicitation of specific emotions in audiences? Can an electronic artwork not only evoke emotional responses but also contribute to the quality of life of individuals with ASD-I while simultaneously transforming the ways in which neurodivergent inclusion is understood? The following discussion reflects on both questions.

Furthermore, it may be inferred that advances in contemporary psychological research concerning the identification, understanding, and development of emotions make it possible to propose a model for emotional induction in electronic artworks. Accordingly, this section examines a number of electronic art projects in which specific emotions have been identified, as well as the ways in which artists employ interactive technologies to evoke particular emotional responses. The objective is to propose a practical model that may contribute to artistic creation and production. It is important to emphasize that this model does not seek to predict emotional responses. As Jonathan Frome observes, emotional responses to artworks depend upon: "…the variety of contexts from which a work is viewed, and the diverse individual histories and cultural backgrounds [that] make this impossible. [There is an] enormous influence of historical and cultural factors on emotional response." (Frome, 2007, p. 831). Rather, the model seeks to provide an approach to basic emotions such as fear, anger, sadness, joy, happiness, surprise, calmness, and related emotional states, among others.

An Approach to Emotions

It is well recognized that the study of emotions is a complex undertaking. According to Rafael Bisquerra, emotions are reactions produced by the organism in response to personal experiences that are perceived in an immaterial manner, which makes them difficult to understand and study within a society characterized by the materialization of experience. "For example, love is often expressed by materializing it through a gift. We need to see and touch things in order to understand them better." (Bisquerra, 2021, p. 15)

Emotional response derives from the concept of emotion itself, a term that remains highly ambiguous and subject to multiple interpretations. Consequently, emotions have been classified in a variety of ways. According to Paul Ekman (as cited in Frome, 2007, p. 830), the basic emotions include joy, sadness, disgust, fear, anger, surprise, interest, and contempt. For Andrew Ortony, Gerald L. Clore, and Allan Collins (as cited in Frome, 2007, pp. 830–831), emotions may be categorized as either positive or negative. Meanwhile, both Antonio Damasio (2016) and Rafael Bisquerra (2021) emphasize the vast diversity and complexity of emotional experience (Frome, 2007, p. 831). It is important to note that emotions, in general, are oriented toward the well-being of the organism, including those commonly perceived as negative. Even when certain emotions may sometimes contribute to undesirable actions or outcomes, their primary function is adaptive and protective. Emotions are generally understood as responses to stimuli that involve an associated phenomenological feeling and are designed to promote the well-being and survival of the organism (Frome, 2007, p. 832). From the perspective of cognitive psychology, thoughts give rise to emotions, and emotions, in turn, generate behaviors. These processes are essential for fostering awareness and understanding of the many issues that electronic artists often seek to address through their work.

The following reflections were proposed by the neurologist Antonio Damasio (2016, p. 65) as an approach to defining emotions:

1) A genuine emotion, such as happiness, sadness, shame, or sympathy, is a complex set of chemical and neural responses that together form a distinctive pattern.

2) These responses are produced by the normal brain when it detects an emotionally competent stimulus (ECS), that is, an object or event whose presence—whether real or mentally recalled—triggers an emotional response. These responses are automatic; however, this aspect may operate differently in neurodivergent minds.
3) Through evolution, the brain has become prepared to respond to certain emotionally competent stimuli with specific repertoires of action. Nevertheless, the range of emotionally competent stimuli is not limited to those prescribed by evolution. It also includes many others acquired through a lifetime of experience and learning.
4) The immediate result of these responses is a temporary change in both the state of the body and the state of the brain structures that map the body and support thought.
5) The ultimate result of these responses, whether directly or indirectly, is to place the organism in circumstances conducive to survival and well-being.

The foregoing helps clarify the physiological and evolutionary nature of emotions. In other words, the study of emotions falls primarily within the domains of neurology and psychology.

Emotions, Electronic Art, and Inclusion

It is necessary to establish a working definition of neurodivergence, even though there is no universally accepted definition of a "normal brain." Given the broad spectrum encompassed by neurodivergence—and as previously discussed—the present research focuses specifically on autism, and more precisely on ASD-I. This decision is based both on the personal motivations previously described and on the fact that ASD-I frequently goes unnoticed due to the social adaptation strategies developed by autistic individuals themselves. In addition, this condition is often associated with high cognitive abilities, which can sometimes make it difficult to identify or diagnose.

As previously noted, many individuals with ASD-I are therefore exposed to elevated levels of stress, anxiety and, in some cases, depression. These

factors can contribute to complex clinical situations that may ultimately place both personal independence and quality of life at risk.

The term *neurodiversity* was coined in 1998 by the Australian sociologist Judy Singer to recognize that no two brains are exactly alike and that each develops and functions in its own unique way.

> Neurodivergent is a non-medical term that describes individuals whose brains develop or function differently for some reason. This means that a person may possess strengths and challenges that differ from those of individuals whose brains develop or function in a more typical manner. Although some neurodivergent individuals have medical conditions, neurodivergence may also be present in people who do not have a medical condition or a formal diagnosis. (Cleveland Clinic, 2022)

According to the Cleveland Clinic (2022), neurodivergent profiles include individuals with Autism Spectrum Disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), Down Syndrome, dyscalculia (difficulty with mathematics), dyslexia (difficulty with reading), dyspraxia (difficulty with coordination), intellectual disabilities, a variety of mental health conditions, bipolar disorder, obsessive-compulsive disorder, among others.

With specific regard to Autism Spectrum Disorder, as discussed in the previous chapters, the spectrum is commonly described in terms of three levels of support needs. Individuals with ASD-I generally require fewer supports from other people or external accommodations than those at Levels II or III.

To recapitulate, according to the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5) (2014), some characteristics associated with Autism Spectrum Disorder include stereotyped or repetitive movements, inflexibility regarding routines and behavioral patterns, restricted interests, hyperreactivity or hyporeactivity to sensory stimuli in the environment, and difficulties in social communication. It is important to emphasize that: "Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning" (DSM-5, 2014, p. 50).

The points of intersection between Level I Autism Spectrum Disorder and electronic art are diverse. One of the most significant is rooted in the distinctive sensory profiles often associated with autistic individuals. Sensory stimuli may be experienced with greater intensity, a characteristic that commonly creates challenges in social interaction and communication. At the same time, however, this heightened sensitivity may also function as an advantage when engaging with electronic artworks and technological environments, whether virtual or physical.

Likewise, emotions elicited through electronic art may be perceived differently by autistic individuals. If artists are capable of designing works that facilitate the elicitation of specific emotions, then such emotional experiences could potentially be directed toward particular audiences, including autistic individuals, with the possibility of supporting emotional regulation and fostering emotional states that may be beneficial in specific situations, such as calmness, tranquility, or inner peace.

In this regard, it is worth recalling that some shopping centers in various countries already provide sensory and emotional regulation spaces for autistic individuals. These environments are designed to minimize noise, intense colors, and sensory overload while offering soft textures, dim lighting, and other resources that help autistic individuals regulate their sensory systems in potentially overwhelming settings such as malls and commercial centers. Nevertheless, the possibilities offered by electronic art may extend considerably beyond such environments.

Consider, for example, artworks that incorporate biofeedback[3], such as *Huipil Defense* (2015) by Daris Rubio. In an interview conducted for this research (Villagómez, 2024), the artist explained that she returned to her hometown of La Palma after studying art in Mexico City and surviving an express kidnapping. Following this traumatic experience, and as a means

[3] Biofeedback is a technique that enables individuals to learn how to modify their physiological activity to improve health and overall functioning. It relies on highly precise instruments capable of measuring various physiological responses, including brain-wave activity, cardiac function, respiration, muscle activity, and skin temperature. These instruments provide rapid and accurate feedback to the individual regarding their physiological state. The provision of this information—often in conjunction with changes in thoughts, emotions, and behavior—can facilitate desired physiological changes. Such changes may subsequently be maintained without the continued use of the instruments themselves (Carrobles, 2016).

of recovering a sense of calm and emotional balance, she resumed the traditional embroidery techniques that had been taught to her by her mother and grandmother.

It was in this context that she created *Huipil Defense*, a work consisting of an electronic system integrated into a traditional hand-embroidered Indigenous garment known as a *huipil*, a textile form whose symbolic motifs and techniques vary among communities. The system is activated by the wearer's physiological indicators of stress: a sensor embedded within the huipil detects elevated heart rate levels and triggers visual and auditory signals. These signals serve both as a warning for the wearer to relax and as an alert to surrounding individuals when a potentially risky situation is detected.

The principles underlying this artwork may have potential applications for individuals on the autism spectrum. For example, biofeedback systems could be employed to monitor physiological signals and indicate when an ongoing activity is becoming a source of excessive stress, thereby encouraging the individual to pause or modify the activity. Such systems could also provide alerts to caregivers or support persons when appropriate. In addition, autistic individuals may experience a direct connection between bodily states and the surrounding environment, facilitating emotional regulation through artistic and technological interaction.

Figure 3.3. *Huipil Defense (2015). Daris Rubio*

Source: Courtesy of the artist.

Another relevant example is *Mind Scape* (2016–2022) by the Colombian artist Claudia Robles Angel, particularly in its performance version. By chance, and at the artist's request, I assisted her by placing the EEG electrodes on her head during the preparation for her presentation in Gwangju at the ISEA2019.

In this performance, the artist interacts with a structure composed of electroluminescent light, cables, sound, and an interface that measures brain-wave activity. These signals are used to control both the lighting and an octophonic sound environment. The work functions as a metaphor for the digital age: like many individuals in contemporary society, the artist appears simultaneously isolated and connected to a computer, while her body is surrounded by cables that create a physical and symbolic distance between herself and the surrounding environment. This arrangement evokes the desire to become a machine or cyborg (Robles, 2022).

The system detects variations in her emotional states—primarily calmness and excitement—through the sensors attached to her head. These signals determine the movement and transformation of the audiovisual environment, creating a dynamic relationship between physiological activity and artistic expression.

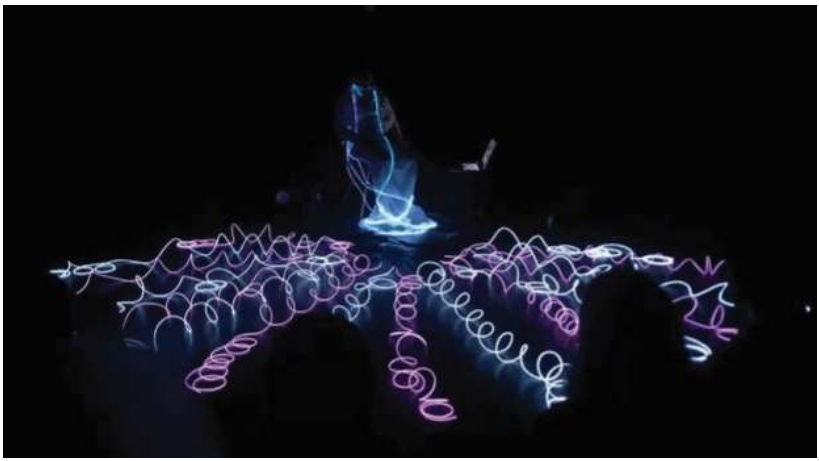
The technological and conceptual foundations of works such as these could potentially be applied to artistic projects designed for individuals with Level I Autism Spectrum Disorder. Such applications might facilitate self-awareness of emotional states and support emotional regulation processes through artistic interaction.

This possibility is particularly relevant given the interoceptive differences frequently reported among autistic individuals. Interoception refers to the process through which sensations originating within the body are integrated and interpreted, gathering information from multiple bodily systems, including the gastrointestinal, visceromotor, cardiovascular, respiratory, genitourinary, thermoregulatory, chemosensory, and autonomic systems.

The regulation and interpretation of interoceptive processes constitute an important adaptive mechanism that contributes to emotional balance (Kano & Fukudo, 2010). Although it is important to reiterate that every individual and every case is unique, differences in interoceptive processing have been widely discussed in the autism literature. Examples include reduced

awareness of pain, diminished perception of satiety while eating, or difficulties recognizing sensations of heat and cold, among others.

Figure 3.4. *Mind Scape (2016–2022). Claudia Robles-Angel*



VG Bild-Kunst. Photograph by Léa Abaz – ADAF 2018. Spurce: courtesy of the artist.

Audience Participation in Electronic Art

The use of technology in art has given rise to new artistic forms in which audiences cease to be mere spectators and instead become participants. As Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon observe, experiences involving physiological changes can lead to emotional sensations, making it reasonable to consider that audiences may use bodily movements as a means of evoking emotional responses (2017, p. 245).

Given the wide variety of technological resources available, electronic artworks offer multiple forms and levels of participation. These may include the use of specific devices such as virtual reality headsets, tablets, joysticks, keyboards, microphones, software applications, smartphones, and other digital interfaces. Participation may also involve bodily movement, facial gestures, or the performance of particular actions; speaking in a certain manner or through specialized devices; typing on a keyboard; wearing specially designed garments; interacting through social media platforms;

engaging with another living being; or even creating sound compositions, among many other possibilities.

Part of the significance of studying electronic artworks, their modes of interaction, and their capacity to elicit emotions lies in the contrast they present with the role traditionally assigned to audiences in conventional art. In traditional artistic contexts, the viewer's role has generally been that of an observer, and interaction with the artwork has occurred primarily as an internal mental process—except in situations where viewing takes place collectively, such as in pairs or groups. Memories, interpretations, and emotions emerge largely through the act of observation itself.

Even today, visitors to museums and galleries are typically expected to engage with artworks quietly and, in many cases, to follow a prescribed route through the exhibition space. Electronic art, by contrast, often invites active engagement and direct participation. Through interaction, a stronger connection and greater degree of engagement between the artwork and its audience may be anticipated.

Naturally, it must be acknowledged that the universe of artistic production is immeasurably vast and that numerous exceptions exist. Not every artwork generates the same level of interest in every individual, nor does every person respond to a particular work with the same intensity. Nevertheless, participation expands the possibilities for engagement and opens new avenues for communication between artworks and their audiences.

Emotional Induction

At this point, it may be inferred that electronic artists are capable of eliciting a wide range of emotions through their work. However, the development of a model designed to facilitate the elicitation of specific emotions could be useful for both emerging and experienced artists, enabling them to explore the possibilities of generating particular emotional responses, whether positive or negative.

In order to develop a model for emotional induction in electronic art, this section examines and connects different approaches from the fields of art, technology, and emotional appraisal. The objective is to contribute

to the practice of electronic art by providing a framework through which artists may intentionally consider the emotional dimensions of their work.

As previously discussed, according to researchers Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon (2017), emotions may be elicited through a variety of mechanisms, including imagination, film, sound, music, images, reading passages, writing passages, embodiment, virtual reality, feedback, self-referential statements, social interaction, physical stimulation, motivated performance tasks, and combined techniques.

In the following pages, several emotional induction methods will be examined, together with a number of strategies specifically oriented toward the field of electronic art and illustrated through selected examples. It should be kept in mind that multiple emotional induction strategies may converge within a single electronic artwork, often operating simultaneously to shape the participant's experience.

Formal Emotion or Artistic Appreciation

Within the field of electronic art, it is possible to distinguish, in broad terms, two types of emotions. According to the researcher Jonathan Frome, one category consists of *artifact emotions*, which in the present study will be referred to as *formal emotions* or *emotions of artistic appreciation*. These emotions arise from an individual's response to the artwork as a deliberately constructed artistic object, recognizing that all emotional responses to art may be elicited by the artwork itself.

Formal emotions are related to the manner in which a work represents its content. In other words, they are emotions associated with artistic and aesthetic evaluation. Jonathan Frome (2007) argues that we often think of these emotions as artistic judgments or preferences that do not possess the same intensity as other emotional responses. Nevertheless, they remain genuine emotions—that is, aesthetic evaluations capable of generating frustration, amusement, surprise, and other affective responses, much as a narrative can do (p. 833). Examples include the colors, textures, forms, or visual imagery of an electronic artwork that evoke admiration or aesthetic fascination.

With respect to formal emotion or artistic appreciation, themes such as historical truths, social inequality, racism, and related issues may generate emotions including hopelessness, anger, sadness, or concern, according to electronic artists who seek to encourage reflection on such subjects through their work (Villagómez, 2017).

However, the work *Étude taxonomique-comparative entre les castes de la Nouvelle Espagne et celles du Mexique Contemporain* (*Taxonomic-Comparative Study Between the Castes of New Spain and Those of Contemporary Mexico*), also known as *Las Castas* (*The Castes*) (2010), by Erick Meyenberg, provides an interesting example of the distinction between formal and conceptual responses. The work addresses a multimillion-dollar governmental investment aimed at identifying the genetic composition of the Mexican population. From the artist's perspective, this initiative reinforces existing social distinctions among Mexicans based on factors such as skin color, cultural background, social status, and economic position.

According to Meyenberg, viewers' initial reactions are often characterized by wonder and fascination when confronted with the bright colors and illuminated floating rings that comprise the installation. Within the framework of the present research, such responses are considered examples of formal emotion or artistic appreciation. Yet, as Meyenberg himself explains, this reaction was not the principal objective of the work. Its central intention was to provoke reflection on racism and social stratification, a dimension that many viewers failed to discover because they did not read the accompanying explanatory texts (Villagómez, 2014).

This type of formal emotion may be particularly relevant when addressing neurodivergent audiences. Aesthetic appreciation can function as an initial point of connection between participants and an artwork, encouraging engagement with the work itself and, potentially, with other participants. Given the social communication challenges that many autistic individuals encounter, the possibility of facilitating such interactions through artistic experience may be especially valuable.

Figure 3.5. *Étude taxonomique-comparative entre les castes de la Nouvelle Espagne et celles du Mexique contemporain (Las Castas), 2010. Erick Meyenberg*

Source: Artist's website.

Another example of a formal emotion, or emotion of artistic appreciation, is *Nomadic Plants* (*Plantas Nómadas*, 2014) by Gilberto Esparza. In this case, however, the formal emotion experienced by viewers served only as a point of departure and subsequently gave rise to other emotional responses.

Works addressing environmental themes often encourage audiences to reflect upon humanity's relationship with nature. Many electronic artists are deeply committed to environmental concerns, resulting in artworks that address issues such as water pollution, waste production, technological obsolescence, and ecological degradation. In the case of *Nomadic Plants*, the work invites reflection on the environmental and social consequences of human activity, including the exploitation of natural resources, resistance to energy transition, and the lack of awareness surrounding more empathetic ways of coexisting with the natural world.

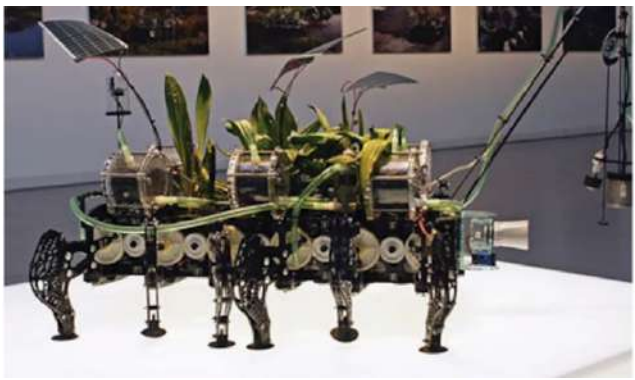
According to the artist, technology possesses enormous potential to generate meaningful transformations. *Nomadic Plants* is a living organism composed of a robotic system, a living plant, and a set of microbial and photovoltaic fuel cells. The project represents the convergence of different forms of intelligence into a stronger hybrid entity with the capacity to restore environmental damage on a small scale.

The robot collects contaminated water and processes it through fuel cells containing colonies of bacteria native to those waters. These microorganisms feed on nutrients present in the polluted water, transforming them into electricity that is stored by the robot's energy-harvesting system. Through this biodegradation process, water quality improves and subsequently nourishes the plant, which also generates electricity through its own metabolic activity. The oxygen released becomes the by-product of this energetic cycle. Consequently, the system is not only adapted to a transformed environment but also contributes to restoring available energy within ecological systems (Esparza, 2013).

The robot operated in the Lerma River near Salamanca. Residents living along the riverbanks, many of whom faced significant economic hardship, approached the artist during the several days he remained at the site. Community members expressed curiosity and interest in the robot, and this engagement enabled the artist to initiate conversations about bioremediation—that is, the possibility of using technology to help restore polluted environments. According to Esparza, these discussions generated surprise and interest among local residents who had long experienced the consequences of living in a highly contaminated environment.

As with *Las Castas*, electronic artworks may function as facilitators of social interaction. Such works therefore possess potential to be employed in projects directed toward neurodivergent audiences and, in the specific context of this research, toward individuals on the autism spectrum.

Figure 3.6 *Nomadic Plants (Plantas Nómadas), 2014. Gilberto Esparza*



Source: https://elpais.com/diario/2010/04/08/ciberpais/1270693471_850215.html

Immersive Emotions or Perceived-Reality Emotions

A second category consists of what Jonathan Frome calls *ecological emotions*, which in the present research will be referred to as *immersive emotions* or *perceived-reality emotions*. These are emotional responses in which a profound connection is established between the participant and the represented environment, to the extent that the boundaries between fiction and reality become blurred.

According to Frome, such emotions arise when participants respond to a stimulus as though it were part of a real environment. Although Frome's research focuses primarily on video games, his framework is also applicable to various forms of electronic art, particularly interactive installations, *net.art*, and other participatory media environments. As Frome explains: "...while an artifact emotion [formal emotion] responds to a video game at the level of representation, an ecological emotion [immersive emotion] responds to what the video game represents and does so as if it were real" (2007, p. 833).

An example of immersive emotion can be found in *Kauyumari, The Blue Deer* (*Kauyumari, El Venado Azul*, 2016) by the Mexican artist Arnold Abadie. Abadie first created an animated film that won the EcoFilm Festival in 2013 and later developed a virtual reality version of the project.

The work presents several animals associated with the sacred region of Wirikuta, a territory of profound spiritual significance for the Indigenous Mexican people known as the Wixárika (Huichol), who undertake an annual pilgrimage to this region. In Abadie's work, the animals are beautifully covered with small colorful beads in the traditional Wixárika style. The narrative centers on Kauyumari, the Blue Deer, a sacred figure regarded as a deity within Wixárika cosmology. Kauyumari functions as a spiritual messenger and guide between the human and spiritual worlds and is also associated with fertility, abundance, and the path toward enlightenment.

According to ancestral tradition, the Blue Deer guides the Wixárika people through a pilgrimage across the desert in search of the mysteries of existence and the balance of the planet (EcoFilm, 2014). In Abadie's short film, Kauyumari undertakes this journey between the human and spiritual realms and ultimately, as dictated by tradition, is sacrificed and transformed

into peyote (*Lophophora williamsii*), the small cactus known for its psychoactive properties. Through peyote, ancestral Mexican cultures establish connections with their forebears, fulfill their will, and assume responsibility as guardians of the Earth (EcoFilm, 2014).

The emotional experience generated by observing these animals moving and flying through the landscape is one of freedom, wonder, and joy, while simultaneously encouraging environmental awareness and reflection.

At first glance, immersive emotion may appear synonymous with emotions elicited through virtual reality. However, this is not necessarily the case. Immersive emotion is a broader category that may emerge through virtual reality experiences, but it can also be generated through interactive installations, game art, immersive caves and projection environments, and other forms of participatory electronic art.

Figure 3.7. *Kauyumari, The Blue Deer (Kauyumari, El Venado Azul), 2016. Arnold Abadie*

Source: Artificio.

Furthermore, virtual reality has been widely employed as a means of eliciting emotional responses. According to Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon: "It has been demonstrated that a computer can replicate a real or imagined environment and allow the user to interact with it. Through virtual reality, participants can artificially experience situations as if they were interacting with people, objects, scenes, and events from the real world" (p. 246).

Virtual reality opens the possibility for artists and scientists to recreate both real and imagined environments, giving rise to a new realm—the virtual world—which can feel as vivid and compelling as imagined experience itself.

An example of an artistic work employing virtual reality is *G.-360°VR* (2017–2018) by the Mexican artist Adrián Regnier Chávez. According to the artist: "*G.* illustrates a phantasmagorical torrent of words, images, and endless cycles—the tides of change and their consequences [...] showing how all things ultimately submit to the most basic of natural laws: the principle of diminishing returns..." (Regnier, 2018).

The work reflects the artist's affinity for abstract visual language and translates it into the realm of virtual reality through the interactive experience of navigation. Participants move through the animation by exploring a 360-degree visual environment, creating a dynamic experience in which different portions of the animated space may be observed according to each participant's interests and choices.

Although the work shares certain characteristics with animated cinema, its immersive and interactive qualities generate a distinct experience capable of eliciting emotions such as interest, joy, fear, and surprise.

Figure 3.8. *G.-360°VR (2017–2018). Adrián Regnier Chávez*

Source: Artist's website.

Similarly, drawing inspiration from Wixárika culture, the artist Marcela Armas created *Tsinamekuta* (2016–2021), a ritual reinterpretation and rewriting of the magnetic field of a mineral sample that explores the relationship

among ancestral Wixárika culture, the sacred, and environmental devastation, particularly that caused by foreign mining companies operating in Mexico.

Through this work, the artist adopts a critical stance toward extractivism—the large-scale exploitation of natural resources. This position is exemplified through the case of Cerro del Fraile, a mountain located in the Mexican state of San Luis Potosí. For approximately 150 years, a mining company has extracted resources from this mountain, which is rich in copper and pyrrhotite. At the same time, the Wixárika people continue to undertake pilgrimages to the site, where they perform sacred ceremonies and rituals.

Within the mythological narratives recited by ceremonial singers, a dialogue is established with the deities, and events from sacred time are reenacted. These chants communicate models of social conduct, ritual responsibilities, and symbolic explanations for natural phenomena and earthly events. Such traditions are intimately connected to *Tsinamekuta*, which incorporates elements of Wixárika cosmology and ways of understanding the surrounding world through ritual practice and ceremonial song.

The installation consists of an instrument designed to read magnetic fields and a second analog device through which those fields may be heard; a three-dimensional map of the magnetic field of pyrrhotite created using plaster and colored beads through traditional Wixárika craftsmanship techniques; digital photographic prints; pen-and-watercolor drawings; and a 13-minute, 38-second HD video recording of a Wixárika ceremony produced specifically for the project.

In an interview conducted for this research with one of the gallery attendants at the Museo de Arte e Historia de Guanajuato, observations were shared regarding visitors' reactions, particularly within the gallery space where *Tsinamekuta* was exhibited. The attendant remarked: "...as soon as they enter, they calm down, they become more relaxed..." Visitors entering the gallery frequently slowed their pace and devoted greater attention to observing the installation. This response was attributed to the dim lighting of the room, its black walls, the presence of all the components of the artwork, the sound installation based on the sonification of pyrrhotite's magnetic field, and the video documenting the ceremony performed by a Wixárika family in collaboration with the artist. Together, these elements created an immersive atmosphere characterized by a hypnotic and captivating ritual chant (Villagómez, 2024).

In this regard, Marcela Armas considered the exhibition design to have been successful because it allowed visitors to enter a more contemplative state of mind upon entering the gallery space. However, she noted that this effect had not been intentionally planned (M. Armas, personal communication, 2022).

Figure 3.9. *Marcela Armas, Tsinamekuta (2016–2021)*

HD video recording, 13 min 38 sec. Source: Courtesy of the artist.

The artworks discussed above, whether through the use of virtual reality or through the combination of light, sound, and imagery in the creation of immersive environments, invite participants to enter alternative realities capable of enveloping and absorbing their attention. Such environments may be particularly valuable when everyday experiences become overwhelming or exceed the sensory profile of a neurodivergent individual.

Both physical and virtual environments are capable of providing spaces that the brain may experience with remarkable immediacy, often responding to them in ways that reduce the perceived distinction between physical and virtual experience. This highlights the significance of immersive emotional experiences as a resource that may be incorporated into models of emotional induction designed for autistic audiences.

In this regard, the work of the British artist and theorist Roy Ascott is especially relevant. His research focuses on the impact of digital environments and communication networks on human consciousness, contributing to an understanding of immersive emotions in contexts where individuals move between physical and virtual worlds.

In his efforts to investigate these emerging dimensions of experience, Ascott proposed the concept of *double consciousness* and explored its relationship to art. Double consciousness refers to a state of being that allows simultaneous access to two distinct fields of experience. In Ascott's words:

> To investigate this apparent parallel between shamanic space and telematic space, and the double consciousness that appears to be part of both fields of experience, I spent time immersed in the virtual reality of advanced computer systems and in the traditional reality of an Indigenous tribe; that is, under the influence of both the computer and the plant, although in this case an exceptionally powerful computer and a particularly potent plant (ayahuasca, the 'vine of the soul'). My access to virtual reality took place at locations on both sides of the United States, at the Human Interface Technology Laboratory in Seattle and at the Virtual Reality Laboratory of the University of North Carolina at Chapel Hill. My introduction to the psychic world occurred in the heart of Brazil, with the Kuikuru pagés (shamans) of the Xingu River region in Mato Grosso and through my initiation into the ritual practices of the Santo Daime community in Brasília. (Ascott, 2003, p. 358)

During his experiences with ayahuasca—a plant with hallucinogenic properties that has traditionally been used by shamans in South America for healing purposes—Roy Ascott became aware of what he described as a state of double consciousness. This condition refers to the capacity of the human mind to remain aware of itself while simultaneously experiencing a state that appears entirely separate from ordinary reality.

In other words, Ascott found parallels between his experiences with virtual reality and with ayahuasca, insofar as in both situations the mind adapted to the conditions presented and experienced them as real. This characteristic of human consciousness can also be observed today in video game players, particularly as contemporary games offer increasingly realistic and immersive experiences.

Players remain consciously aware of the location of their physical bodies—perhaps seated in a gaming chair within a room—while simultaneously experiencing the emotions associated with the virtual environment. For example, they may feel fear while being pursued by a wild animal in a

simulated jungle or experience tension and excitement while participating in a virtual battle against an opposing army. Although they know that these events are not physically occurring, the emotional responses generated by the experience may nevertheless be genuine and intense.

Ascott describes his experience with ayahuasca in the following terms:

> I was able to move more or less freely between these two states. Similarly, with my body, I was simultaneously aware of inhabiting two bodies: the familiar phenomenology of my own body, enveloped, so to speak, within a second body composed of a mass of multicolored particles, a million molecular points of light. My visual field, my double gaze, alternated at will between the coherent space of everyday reality and a fractal universe consisting of a thousand repetitions of the same image, or forming a tunnel in space through which I could voluntarily pass with urgent acceleration. At any moment I could stop and examine these states, moving in and out of them more or less at will. [...] In many respects, this ancient ritual mirrors our contemporary artistic aspirations involving digital technology, such as virtual reality, hypermedia, multimedia installations, and—with their superimposition of cognitive frameworks onto real-world situations—the rapidly developing field of augmented reality. (Ascott, 2003, pp. 358–359)

Several reflections emerge from Roy Ascott's findings. For the purposes of the present study, the most significant concerns the capacity of the mind, in conjunction with electronic art, to connect two states of experience—the virtual and the real—and to experience both as valid and "existing" realities. The mind is capable of responding meaningfully to each of these states, acting within and reacting to both. This observation is particularly relevant because the implications of such ideas have been extensively explored by electronic artists through a wide range of artworks and technological developments in the decades since Ascott first proposed them. In this regard, the architect and cultural critic Paul Virilio anticipated the following: "We are entering a world where there will not be one reality but two: the actual and the virtual. There is no simulation, only substitution" (Rush, 2005, p. 181).

Autobiographical Memories

Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon (2017) consider autobiographical memory to be one of the most powerful tools for eliciting emotions. The evocation of emotions within a collective context can undoubtedly encourage reflection and the development of awareness. As a result, past experiences emerge into consciousness and, in some individuals, may contribute to processes of emotional healing. Similar principles are employed in support groups such as Alcoholics Anonymous and Adult Children of Alcoholics, where personal recollection and shared testimony play a central role in self-understanding and recovery.

An example of this emotional mechanism can be found in the work of the electronic artist Rafael Lozano-Hemmer, who has consciously incorporated autobiographical memory into his artistic practice. In *Voz Alta* (*Loud Voice*, 2008), a memorial created to commemorate the fortieth anniversary of the 1968 student massacre, residents of the Plaza de las Tres Culturas in Tlatelolco, Mexico City, were invited to recall the events that had taken place at that very location.

Figure 3.10. *Rafael Lozano-Hemmer, Voz Alta (Loud Voice), 2008*

Plaza de las Tres Culturas, Mexico City. Source: https://www.lozano-hemmer.com/voz_alta.php

The result was an intense and deeply moving artwork constructed from the memories and testimonies of local residents who had either witnessed or learned about the events of October 2, 1968. Participants shared their recollections in the square through megaphones, while their voices were simultaneously retransmitted by Radio UNAM. These spoken memories were also translated into powerful beams of light projected into the night sky by long-range robotic searchlights, transforming the urban landscape and interrupting the routine experience of the city.

Through this process, emotions such as sadness, anger, and hopelessness emerged among both participants and audience members, many of whom listened attentively to the testimonies being shared. The artwork demonstrates how autobiographical memory can function as a catalyst for emotional engagement, collective remembrance, and social reflection.

An essential example within this category is *Spherical Memory* (*Memoria Esférica*, 2019) by Leslie García. The work is an artistic installation that releases scents and edible spheres derived from the smell of damp earth. The piece recreates the distinctive aroma produced when dry soil is touched by rain; subsequently, a bioprinter generates edible spheres based on this phenomenon, utilizing compounds associated with the natural oils released from the ground.

According to the artist, these spheres dissolve in the mouth, releasing aromas that travel from the pharynx to the olfactory bulb, where neural pathways are strongly associated with emotion and memory. Through this sensory process, the work explores the intimate relationship among smell, recollection, and affective experience.

The project ultimately incorporated a collection of more than one thousand testimonies from participants who shared the memories evoked by the experience. According to García, the response was so enthusiastic that visitors formed long lines extending onto the sidewalk outside the gallery in order to taste the spheres. Many participants reported that the experience triggered autobiographical memories and emotions such as joy and sadness (García, 2014).

Figure 3.11. *Spherical Memory (Memoria Esférica), 2019*

Leslie García. Source: https://lessnullvoid.cc/content/portfolio/

The artworks discussed in this category contribute to the recollection of past events stored within individual memory. The techniques and concepts presented above may also contribute to the development of a model of emotional induction for autistic individuals.

People on the autism spectrum are sometimes described as experiencing *emotional blindness*, a term used to indicate difficulties in interpreting or recognizing the emotions of others. However, the fact that an autistic person may not respond to others' emotions in expected ways does not mean that they lack emotions or emotional experiences. On the contrary, autistic individuals experience emotions, although these may at times be expressed in ways that appear atypical, occur at socially unexpected moments, or vary considerably in intensity. Consequently, experimentation with autobiographical memories through electronic artworks directed toward autistic audiences may prove particularly enriching and potentially beneficial for those who engage with such experiences.

Images

Historically, art has been created primarily through images. According to Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon (2017), people routinely seek emotionally evocative images in magazines, on the internet, and through social media. Although images are unimodal visual stimuli—that is, they stimulate only the sense of sight—they nevertheless possess the capacity to express and evoke emotions (p. 242). The authors note that many researchers employ images as tools for emotional induction, one of the most widely used resources being the *International Affective Picture System* (IAPS), a database containing more than one thousand systematically classified images designed for emotion research.

In electronic art, artists frequently employ still images, often combined with movement, interaction, or projection within specific environments. An example of this approach can be found in *Level of Confidence* (*Nivel de Confianza*, 2015) by Rafael Lozano-Hemmer, a work that commemorates the disappearance of forty-three students from the Rural Teachers' College of Ayotzinapa in Iguala in 2014.

In this work, Lozano-Hemmer uses black-and-white photographs of the forty-three students who disappeared during the events that involved organized crime groups, police forces, and state actors. At the time of writing, the case remains unresolved and continues to occupy a central place in contemporary Mexican collective memory (Villagómez, 2025).

Faced with this tragedy, the artist chose to work with the only images that were initially made publicly available: the identification photographs submitted by the students during their enrollment at the Raúl Isidro Burgos Rural Teachers' College. These small black-and-white photographs, approximately 2.5 × 3 centimeters in size, were originally intended for school records and identification cards. They depict young faces—predominantly Indigenous students—looking directly at the camera, with little indication of personal expression beyond the solemnity of official documentation.

Regarding the project, Lozano-Hemmer explains that it consists of a facial-recognition camera trained to search continuously for the faces of the missing students. When participants stand before the camera, the system uses biometric algorithms to determine which student their face most closely resembles and generates a corresponding "level of confidence" expressed as a percentage. The biometric systems employed—Eigenfaces, Fisherfaces, and Local Binary Patterns Histograms (LBPH)—are technologies commonly used in military and law-enforcement contexts to identify suspects. In this case, however, they are used to search for victims.

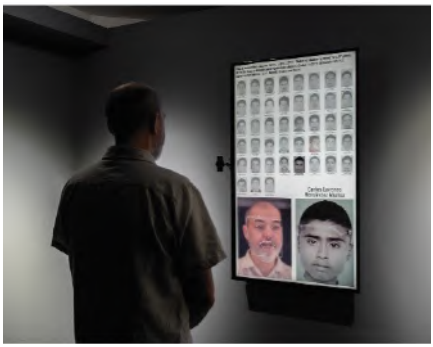
The work is intentionally designed to fail in producing a true match, since the artist assumes that the students were likely murdered. Nevertheless, the commemorative dimension of the project resides in its persistent and unending search for the missing students and in the superimposition of their images onto the faces of members of the public (Lozano-Hemmer, 2015).

I had the opportunity to experience this artwork personally at the gallery of the University of Guanajuato during the 2019 edition of the Festival Internacional Cervantino, shortly before the global COVID-19 pandemic. The emotions evoked by the work included hopelessness, sadness, anger, and resentment.

The contemporary overexposure to images through multiple forms of media creates opportunities for their use within a model of emotional induction in electronic art directed toward neurodivergent audiences. Lozano-Hemmer's work represents only one example of the potential implementation of this resource.

It is important to note that a static image can communicate powerful and unequivocal positions regarding a wide range of issues related to neurodiversity. The strategic use of imagery may therefore serve as a valuable

Figure 3.12. *Level of Confidence (Nivel de Confianza), 2015*



Rafael Lozano-Hemmer. Source: Artist's website.

tool for raising awareness, encouraging reflection, and articulating perspectives on topics such as the discrimination and social exclusion experienced by neurodivergent individuals.

Images possess the capacity to condense complex ideas into accessible visual forms, making them particularly effective for communicating social, political, and cultural messages. Within electronic art, their impact can be further amplified when combined with interaction, projection, animation, data visualization, or other technological resources. Consequently, images constitute a significant emotional and communicative resource that may contribute meaningfully to the development of artistic projects aimed at fostering understanding, inclusion, and dialogue around neurodiversity.

Moving Images

In addition to still images, cinema combines visual and auditory stimuli, enabling viewers to empathize with or identify with characters and situations. Through film, audiences may experience emotional situations as though they were real, making cinema one of the most effective techniques for emotional induction when representing realistic contexts (Fakhrhosseini & Jeon, 2017, p. 236).

Jonathan Frome proposes another way of understanding how emotions develop within an artwork. According to Frome, cinema, literature, and other forms of narrative art can generate what he calls *narrative emotions*, which are among the most common emotional responses experienced when engaging with a work of art (2007, p. 832). These emotions emerge as audiences become involved with the events, characters, and situations presented through a narrative structure.

Electronic art frequently extends beyond conventional narrative forms. Nevertheless, pioneering works such as *I Photograph to Remember* (*Fotografío para recordar*, 1990) by Pedro Meyer explored this type of structure. Although the work is not strictly a film, it makes extensive use of cinematic language and storytelling techniques.

Originally conceived as an interactive CD-ROM, the piece recounts the lives and deaths of the artist's parents, functioning as a kind of family album that reflects upon the body, aging, illness, and loss. Today, the work is available on YouTube, where it no longer retains the interactive dimension offered by the original CD-ROM format. However, it has not lost its effectiveness as a vehicle for emotional communication.

I recall screening the work for graduate students enrolled in the Master's Program in Design and Interaction at University of Manizales during a seminar I taught in 2023. At the conclusion of the viewing, six of the seven students were visibly moved and in tears as a result of what they had seen and heard. The work also elicits emotions through autobiographical memory, demonstrating how personal narratives can foster powerful emotional responses and empathetic engagement among audiences.

Figure 3.13. *I Photograph to Remember (Fotografío para recordar), 1990*

Pedro Meyer. Source: Artist's website.

Embodiment

More broadly, a concept that encompasses many of the emotional induction strategies discussed above is *embodiment*. According to Seyedeh Maryam Fakhrhosseini and Myounghoon Jeon (2017), embodiment is related to the theory of William James, who proposed that the experience of physiological changes gives rise to emotional feelings (p. 245).

In many electronic artworks, those who were once merely spectators become participants who experience the artwork through their own bodies. Bodily movement, posture, balance, gesture, speech, and even breathing may influence how a work is perceived and experienced. The body is no longer a passive observer of the artwork but an active component of the artistic process.

Similarly, immersive installations often involve sound, light, and spatial environments capable of eliciting physical responses from participants. Such works generate profound sensory experiences in which the participant's body may become an integral part of the artwork or even determine its outcome. In technological installations that employ motion sensors, for example, the system responds directly to bodily movement, transforming the participant into a co-creator of the artistic experience.

From this perspective, embodiment may be understood as a conceptual framework that intersects with formal emotions, immersive emotions, autobiographical memories, images, moving images, and many other emotional induction strategies. Rather than functioning as a separate category, embodiment frequently serves as the mechanism through which emotional experiences become physically and perceptually meaningful.

The following table summarizes the electronic artworks discussed throughout this chapter, their corresponding emotional induction methods, and some of the elements involved in eliciting emotional responses. The identification of these emotions is based on direct experience with the artworks in exhibition contexts, documentation videos of the works in operation, interviews conducted with the artists (Villagómez, 2011–2013), as well as reviews and descriptive texts consulted during the course of this research.

Table 3.1. *Emotional Induction Methods in Mexican Electronic Art*

Electronic Artwork	*Emotional Induction Method*	*Tyoe of Interaction*	*Emotion*
1. "Mind Scape" 2016-2022 Claudia Robles-Angel	Formal Emotion (Artistic Appreciation)	Brain–Computer Interface (BCI) that reads brain activity / Biofeedback	Excitement and calmness
2. "Huipil Defense" 2015 Daris Rubio		Monitoring bodily signals / Biofeedback	Excitement
3. "Las Castas" (The Castes) 2011-2013 Erick Meyenberg		Observation of the artwork and reading of exhibition texts	Aesthetic appreciation and surprise after reading the exhibition texts
4. "Plantas nómadas" (Nomadic Plants) 2014 Gilberto Esparza		Dialogue between the artist and the community	Interest and curiosity
5. "Kauyumari, The Blue Deer" 2016 Arnold Abadie	Immersive Emotion	Use of a virtual reality headset	Environmental concern
6. "Tsinamekuta" 2016–2021 Marcela Armas		Observation and active listening	Interest, calmness, peace, and tranquility
7. G.-360°VR 2017-2018 Adrián Regnier Chávez		Use of a virtual reality headset. Participants click four directional arrows to navigate the 360° environment	Interest, joy, fear, and surprise
8. "Voz Alta" (Loud Voice) 2008 Rafael Lozano-Hemmer	Autobiographical Memories	Speaking and sharing personal narratives through a loudspeaker	Sadness, anger, and hopelessness
9. "Memoria Esférica" (Spherical Memory) 2014 Leslie García		Eating / Tasting edible components of the artwork	Joy, sadness, curiosity, and nostalgia
10. "Nivel de confianza" (Level of Confidence) 2015 Rafael Lozano-Hemmer	Images	Performing bodily movements and specific actions	Hopelessness, sadness, anger, and resentment
11. "Fotografío para recordar" (I Photograph to Remember) 1990 Pedro Meyer	Moving Images / Autobiographical Memories	Clicking and navigating through a CD-ROM	Profound sadness and hopelessness

Source: Prepared by the author.

Chapter 4. A Model of Emotional Induction for Neurodivergent Individuals

Some of the factors that make emotional induction feasible within an electronic artwork, and which are considered in the present research, include the use of biofeedback techniques and the detection of stimuli designed to elicit specific emotional responses. As illustrated in several of the artworks discussed in previous chapters, biofeedback can be used to assess and respond to the emotional state of a participant interacting with an artwork through sensors that capture physiological signals associated with emotional processes. Technologies such as heart-rate sensors, electroencephalography (EEG), and electrodermal activity sensors can translate bodily responses into visual and auditory outputs.

As previously discussed, autistic individuals may experience difficulties in identifying and expressing emotions. Nevertheless, biofeedback devices are capable of monitoring physiological variables associated with emotional states, including in individuals who experience communication challenges. Examples include heart rate and heart rate variability (HRV), which are frequently associated with states of stress or calm. An increase in }heart rate may be related to anxiety or heightened arousal, whereas a stable heart rhythm may indicate relaxation.

As described in *Huipil Defense*, electrodermal activity—also known as galvanic skin response—measures changes in perspiration associated with activation of the sympathetic nervous system and may therefore be useful for detecting emotional states such as surprise, excitement, or agitation. Electroencephalography (EEG), another important biofeedback tool, records

brainwave activity (alpha, beta, and theta waves) and may be used to infer states such as concentration, relaxation, or frustration, as demonstrated in *Mind Scape* by Claudia Robles-Angel. Similarly, peripheral body temperature, particularly in the hands and extremities, may provide information about stress or relaxation through physiological processes such as vasoconstriction and vasodilation (Carrobles, 2016).

It is also worth noting that HRV biofeedback is currently being explored with promising results among autistic adolescents. In these interventions, participants practice slow, rhythmic breathing while observing their heart rate in real time, with the goal of increasing vagal tone and improving emotional self-regulation (Thoen, 2024).

Consequently, experimenting with the visualization of these physiological signals within an electronic artwork may contribute to the creation of therapeutic environments for situations involving sensory overload, anxiety, or interoceptive difficulties, among other challenges. Such environments may provide opportunities to support emotional self-awareness and self-regulation, potentially contributing to an improved quality of life for individuals on the autism spectrum.

Moreover, it is important to recognize that there is no universal stimulus capable of producing a single, predictable response. Nevertheless, the present research suggests that certain combinations of stimuli may be more likely to encourage particular emotional states. For example, dim lighting, soft rhythmic sounds, gentle textures, and biosensory feedback may facilitate states of calm and relaxation. Conversely, vivid colors, playful interactivity, and multisensory experiences that incorporate memory and active participation may encourage states of excitement and heightened engagement.

In the model of emotional induction proposed here, several considerations must be taken into account. First, autistic individuals do not respond uniformly to sensory stimuli. Some may exhibit heightened sensitivity to colors, textures, sounds—including certain types of music—tastes, smells, or other sensory inputs. For this reason, it is essential that measurement thresholds and system responses be adapted to individual sensory profiles whenever possible. A second consideration concerns the historical, social, and cultural factors that influence the interpretation and expression of emotions.

Emotional experiences are never entirely independent of the contexts in which individuals live and develop. As discussed previously, personal history and cultural background may significantly shape emotional responses to artistic experiences.

Finally, ethical considerations must be incorporated into any artwork that utilizes biometric information. Projects involving neurodivergent participants should include informed consent procedures that clearly explain the collection, processing, storage, and use of physiological data. Respect for privacy, autonomy, and participant well-being should remain fundamental principles in the design and implementation of such systems.

Model of Emotional Induction in Electronic Art for Individuals with ASD-I

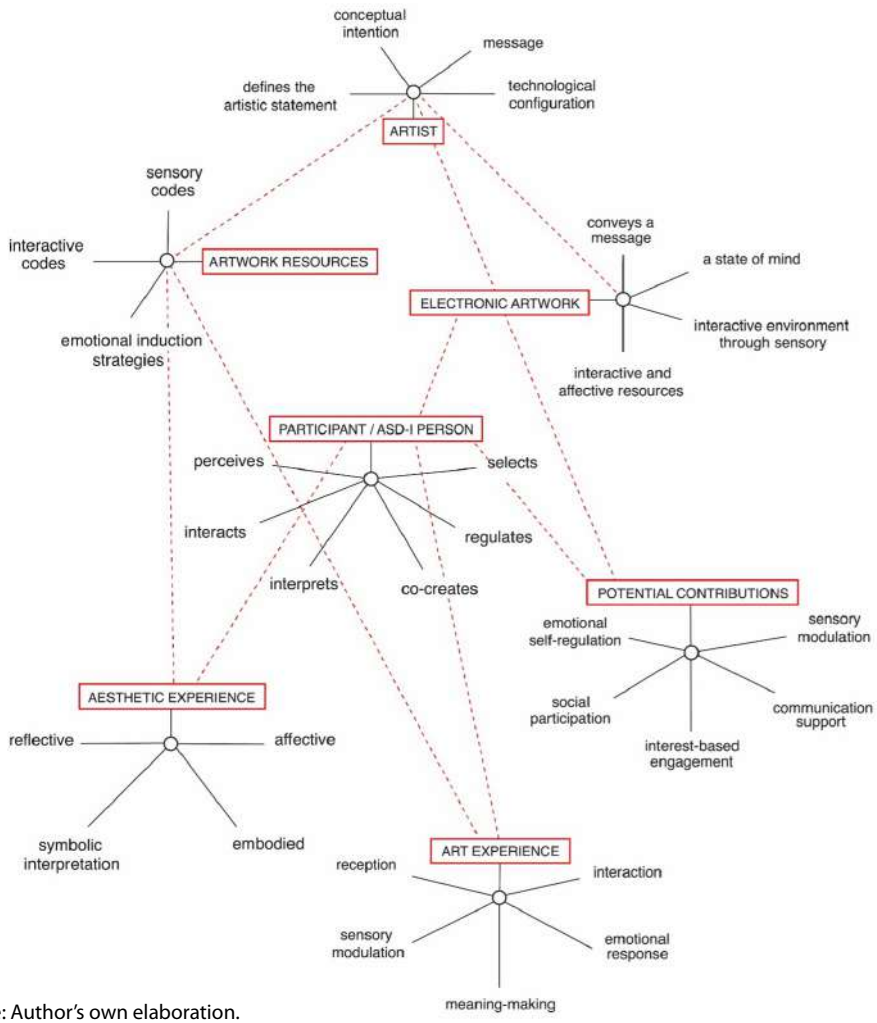
This model has evolved over the years since the beginning of the present research. Its current version is based on a form of cartography that I originally developed for the visual maps produced as part of my study of Mexican digital art production processes (2017). Those maps were inspired by the rhizome theory proposed by Félix Guattari and Gilles Deleuze.

In the present case, I have chosen to represent the model from a non-linear and non-hierarchical perspective, since the principal elements that constitute it may change their order of appearance throughout the process. For example, when a participant interacts with an artwork, that individual simultaneously becomes an *in situ* co-creator of the work itself. The experience is therefore not structured according to a fixed sequence but rather through a dynamic network of relationships that emerge through interaction.

At the same time, the model draws upon the classical communication framework of sender–message–receiver as its initial conceptual structure. However, unlike traditional communication models, the roles within electronic art are often fluid and interchangeable. Participants may receive, interpret, transform, and even generate content, thereby blurring the conventional distinction between creator and audience. Consequently, the model seeks to account for the complexity, reciprocity, and multidirectional nature of communication within electronic art experiences.

Conceptual Premise: As I said, this model adapts the classical communication scheme to electronic art. However, instead of understanding the autistic person only as a receiver, it places the participant as an active interpreter, user, and potential co-creator of meaning. The artwork does not simply transmit a message; it organizes sensory, interactive, and affective conditions that may shape the art experience and the aesthetic experience.

Figure 4.1. *Model of Emotional Induction in Electronic Art for Autism Spectrum Disorder Level I (ASD-I)*



Source: Author's own elaboration.

Conclusions

The present research is the result of more than two decades of continuous work, initially focused on creativity, later on the production processes of digital artists, then on emotions induced through artworks, and ultimately on electronic art and neurodivergence, particularly autism. Bringing together these disciplinary frontiers—electronic art, emotions, and autism—was therefore the logical outcome of studying these fields. It is within autism research that I believe I will continue to concentrate my future efforts, as knowledge about the condition continues to expand while these lines are being written. This ongoing growth in research will enable more accurate approaches to the application of criteria that may contribute to improving the quality of life of this population, in this case through electronic art.

In light of these findings, several future lines of research are being considered. One involves the development of a practical digital art project, whose first phase received support in 2025 through the Institutional Scientific Research Program of the University of Guanajuato. Another line of research concerns the development of an application designed to facilitate communication and interaction between autistic and neurotypical individuals. This process would be mediated by artificial intelligence with the aim of helping address the social communication challenges experienced by people on the autism spectrum.

More importantly, one of the principal findings of the present research is that, according to the sources consulted, the autistic brain is part of the natural evolution of the human brain rather than an anomaly. This perspective is further supported by the fact that neurological normality remains an unresolved

concept; that is, there is no single, universal, and definitive definition of a "normal brain." Rather than constituting a problem—as it has sometimes been portrayed—the autistic brain has contributed to social development through characteristics unique to the condition, many of which have also contributed to the evolution of the human species itself. This perspective challenges ableist views and discriminatory attitudes toward disability.

The study has also examined several myths and realities surrounding the autism spectrum based on scientific research, the perspectives of autistic advocates and communicators, and other relevant sources, while recognizing that autism is a spectrum in which every individual case is different. In doing so, it contributes to a more informed understanding of the condition, promotes the dissemination of knowledge about autistic characteristics, and highlights the importance of autistic traits for both art and science, with the aim of establishing a foundation for linking autism spectrum conditions and electronic art.

The research further found that the autistic population is substantial; however, available statistical data continue to focus primarily on autism during childhood. Consequently, many autistic adults live with significant challenges, comorbidities, and difficulties arising from a lack of awareness of their own neurodivergence. It should be noted that although diagnostic procedures have advanced considerably, it was not until the 1990s that diagnostic criteria began to be refined, particularly with regard to ASD Level I, formerly known as Asperger syndrome. Due to its characteristics—especially among women—it frequently goes unnoticed. Additional challenges include limited access to diagnosis, delayed diagnoses, and the fact that many diagnostic instruments were originally developed primarily for Anglo-American boys, creating cultural barriers to accurate assessment in other populations. These challenges are compounded by a shortage of institutions and professionals with expertise in autism, persistent social stigma, the masking of autistic traits when individuals are able to conceal them, and insufficient resources for support and care. Together, these factors complicate both the understanding of autism and the study of the phenomenon examined in this research.

Similarly, throughout the course of the research, the study of Autism Spectrum Disorder was approached through progressively deeper layers of inquiry. This process began with my personal experience as a neurodivergent

individual and the concise descriptions provided by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) of the American Psychiatric Association and gradually expanded through engagement with a wide range of authors, autistic advocates, autistic communities, specialists, and presentations delivered at academic conferences. This process contributed to the construction of an introductory yet robust body of knowledge on autism.

A similar approach was adopted in relation to electronic art. The research began with an examination of both the international and Mexican historical development of the field, as well as its classifications and principal characteristics. This foundation made it possible to identify and analyze a series of electronic artworks—predominantly by Mexican artists—that possess characteristics capable of being meaningfully connected to neurodivergence. These two areas, autism and electronic art, constitute the central pillars of the present study.

As a result of this investigation, and considering the characteristics commonly associated with autistic individuals, emotions and emotional induction emerged as particularly valuable resources. When combined with developments in electronic art, they offer opportunities to contribute to reflection on the autistic condition and to the promotion of quality of life. Challenges frequently associated with ASD-I—including emotional self-regulation, sensory hyper- and hypo-reactivity, social communication difficulties, and social isolation, among others—may be addressed through electronic artworks specifically designed with the potential to mitigate some of these everyday difficulties.

In addition, the electronic artworks discussed throughout this study, among many others, demonstrate that the interests of electronic artists extend beyond the communication of beauty or spectacle. Rather, many artists display a genuine commitment to addressing social, cultural, environmental, and political concerns and, in the context of this research, issues related to health, inclusion, and neurodiversity. This capacity to combine aesthetic experience, technological innovation, and social engagement positions electronic art as a promising space for the development of meaningful interventions that foster awareness, participation, and inclusion.

In addition to the above, an initial model for emotional induction in electronic art for participants with ASD-I was proposed. Nevertheless, much

remains to be explored. These ideas may be adapted and expanded to create artistic experiences that are more accessible and meaningful for neurodivergent individuals. The present research should therefore be understood as the beginning of a necessary conversation, one in which the transformative potential of electronic art lies in its capacity to foster social inclusion and, as reiterated throughout this study, contribute to improving the quality of life of neurodivergent people.

Within this context, the development of knowledge concerning emotional content, emotional appraisal, and neurodivergence represents an innovative contribution to the field of electronic art. Furthermore, the influence of electronic artists could be expanded through the incorporation of theories and concepts derived from neuroscience and the behavioral sciences, opening new avenues of research that emerge directly from the present study. It is therefore proposed that artists and art students can intentionally design artworks with a specific range of emotional responses in mind. This does not imply that such practices have not been undertaken previously; rather, it suggests that the process may become more systematic, reflective, and informed by existing knowledge concerning emotions and human behavior.

It is also suggested that electronic art would benefit from the development of methodologies for emotional induction. Contemporary environmental, economic, social, and political realities demand forms of communication capable of conveying meaningful messages that encourage critical reflection on the world around us. As a society, we need influential artists who contribute to tangible social change—as envisioned by Bruno Munari (2020)—particularly in areas related to health, accessibility, and social inclusion. As demonstrated throughout this research, electronic artists have consistently shown a strong commitment to addressing social concerns and contributing to the improvement of their communities and environments.

This leads to an important question: How might artists collaborate with neurodivergent communities to co-create electronic artworks that respect, support, and celebrate their unique experiences? Such collaborations could enrich both artistic practice and the lived experiences of participants, generating new forms of knowledge and inclusion.

Finally, although emotions are complex, multifaceted, and influenced by historical and cultural contexts, a substantial body of scientific research

has examined emotional processes and human behavior. For this reason, the efforts presented in this study have focused on establishing meaningful connections between these fields of knowledge and the domain of electronic art. It is hoped that this interdisciplinary dialogue will contribute not only to the advancement of artistic practice and research but also to the creation of more inclusive, empathetic, and socially engaged cultural experiences.

Moreover, emotions are induced through interaction, and electronic artworks offer diverse forms of participation. Artists recognize that audiences influence the artwork itself, and that each participant may guide the experience toward a unique development and outcome. This is made possible through interaction, which may invite participants to use specific devices, move their bodies, speak or shout, click on a keyboard, wear special garments, write messages, publish content on social media, or engage in numerous other forms of participation. For this reason, electronic art provides an extraordinary medium for stimulating new ways of thinking, feeling, and acting.

At the same time, further research is needed at the intersection of electronic art and neurodiversity. One promising avenue would be the development of a database capable of documenting specific emotional responses generated by autistic individuals when interacting with electronic artworks. With the emergence of portable electroencephalography (EEG) technologies, such initiatives are now increasingly feasible. The resulting body of evidence, derived from field research, could serve as a valuable resource for artists interested in inclusion and neurodiversity, supporting the creation of artworks informed by empirical knowledge of neurodivergent experiences. Such efforts could contribute to greater acceptance of neurodiversity and promote forms of coexistence that recognize the richness inherent in human differences.

Finally, in May 2014, the Sixty-seventh World Health Assembly adopted the resolution entitled *Comprehensive and Coordinated Efforts for the Management of Autism Spectrum Disorders*, which was supported by more than sixty countries. The resolution called upon the World Health Organization to collaborate with Member States and partner agencies in strengthening national capacities to address Autism Spectrum Disorder and other developmental disabilities. More than a decade has passed since the adoption of this resolution, and progress has remained gradual in areas such as early

detection and diagnosis, understanding the development and manifestations of autism, and promoting meaningful inclusion within society. While the responsibility for addressing these challenges cannot be assigned solely to art—nor is it the role of artists to solve them—art, and electronic art in particular, can serve as an important agent of change. Electronic art has the capacity to draw attention to areas where society must continue to improve, fostering reflection on inclusion, accessibility, and the creation of a more neurodiverse world in which different ways of perceiving, thinking, and experiencing reality are recognized, valued, and respected.

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About The Author

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Dr. Cynthia Patricia Villagómez Oviedo holds a Ph.D. in Aesthetic Theories from the University of Guanajuato (2025), graduating with honorable mention and cum laude distinction. She also holds a Ph.D. in Visual and Intermedia Arts from the Polytechnic University of Valencia, Spain (2015), where she received cum laude honors and the Extraordinary Doctoral Thesis Award; a Master's Degree in Visual and Intermedia Arts from the same university (2009); a University Specialist Degree in Visual and Intermedia Arts (2007); a Master's Degree in Creativity for Design from the National Institute of Fine Arts (INBA) (2002); and a Bachelor's Degree in Graphic Design from the INBA School of Design (1993).

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Her main research areas include media and electronic art production processes; interaction, emotions, and aesthetic experience; ancestral and environmental roots in Mexican electronic art; and electronic art focused on neurodiversity and inclusion.

Her most recent publications include the book Electronic Art and the Autism Spectrum: Creation, Emotion, and Interaction (2025) and the article "Electronic Art for Neurodivergence: An Approach to an Emotional Induction Model" (2025).

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Designing Interaction:
Electronic Art and the Autistic Experience, by
Cynthia Patricia Villagómez Oviedo by Ediciones
Comunicación Científica, S.A. de C.V., located at Centeno
162-1, Granjas Esmeralda, 09810, Mexico City.
The digital edition is available in open access in PDF, EPUB,
and HTML formats.

Designing Interaction: Electronic Art and the Autistic Experience explores the potential of electronic art to foster experiences of participation, expression, sensory regulation, and social connection for autistic adults, particularly those with Level I Autism Spectrum Disorder (ASD). From an interdisciplinary perspective, the book brings together studies of neurodiversity, emotion, interaction, aesthetics, and digital technologies.

The research adopts a qualitative, exploratory, and descriptive approach, combining documentary review, interviews with autistic people and specialists, and analysis of electronic artworks and projects. Rather than presenting autism as a condition to be corrected, it understands diverse sensory, cognitive, and emotional experiences as a starting point for designing more accessible, meaningful, and respectful spaces.

One of the book's principal contributions is its model of emotional induction in electronic art, which makes it possible to analyse how resources such as light, sound, image, embodiment, interactivity, and participation may shape aesthetic experience. It also positions autistic people as active participants, interpreters, and co-creators of meaning.

Written in accessible language and grounded in academic research, this work opens a necessary dialogue among artists, designers, researchers, educators, families, and neurodivergent people. Rather than attributing therapeutic effects to art, it invites readers to recognise its potential to support self-regulation, inclusion, communication, and well-being.

Cynthia Patricia Villagómez Oviedo She holds a PhD in Visual Arts and Intermedia from the Polytechnic University of Valencia, where she received the Extraordinary Doctoral Thesis Award, and a PhD in Aesthetics from the University of Guanajuato. Her research focuses on artistic production, electronic art, and neurodivergence. She has lectured in Colombia, Ecuador, Brazil, South Africa, South Korea, Japan, Spain, Australia, Canada, and the United States. She is a Professor at the University of Guanajuato and an SNII Level II researcher.

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DOI.ORG/10.52501/CC.470

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ISBN 978-968980326-3