

Edited by Renata Frade and Mário Vairinhos



Techno feminism

Multi and transdisciplinary
contemporary views on
women in technology



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Techno feminism

**Multi and transdisciplinary
contemporary views on
women in technology**

Title

Technofeminism: multi and transdisciplinary contemporary views on women in technology

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Collection

DigiMedia - N° 3

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Júlia Soares, Mafalda Rangel, Mariana Frazão (UG students of New Technologies of Communication, University of Aveiro). Featuring Júlia Soares.

Design

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Publisher

UA Editora

Universidade de Aveiro

Serviços de Biblioteca, Informação Documental e Museologia
1st Edition – April 2023

ISBN

978-972-789-836-7

DOI

<https://doi.org/10.48528/0wyd-p294>

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Preface

Preface

In 1986, Samus Aran of *Metroid* was the first playable female character in videogames. Nonetheless, the world in which she was inserted was still grounded upon power structures and social norms that propagated prejudice against women. Samus' first appearance was marked by her full-body armor, so that she was mainly characterized as a male figure, with her female identity only revealed when players took less than five hours to complete the game. The better the player performed, the more clothes she removed. In a 1-hour gameplay, she wore a bikini, ultimately being objectified as "the reward".

Games have been developed around the male player and the male gaze, depicting female figures as background characters, sexual objects, damsels in distress, housewives and other features that reinforce socially constructed female gender identities and stereotypes[1]. Related or not, the truth is that over the years, a tendency to "legitimize digital games as mere entertainment for women and [...] a "serious" toy that influences much more career choice for boys than for girls" has been deployed. This is explored further throughout the book by Patrícia Gouveia and Luciana Lima.

The gaming industry is just one example of how feminine participation and opinion have been left out of the conversation, with technology being considered "a defining feature of masculinity", as testified by Judy Wajcman in her Chapter "Gender and Work: A Technofeminist Analysis". By defying the notion of gender as binary and mutually exclusive, and redefining the masculine *vs.* feminine narratives, technology accommodates the multidimensionality of the human experience and behavior.

Women have long been kept in the private sphere, assuming motherhood and other domestic responsibilities and becoming associated with empathic and sentimental traits, with rationality, logic and intelligence being left solely to the realm of men. When I started my Bachelor's in Engineering at Coimbra University in the 80s, people were surprised by the atypically high percentage of women who enrolled, which was only about 10%. 40 years later, engineering courses are still dominated by men, who represent 72% of the student body[2]. As feminist movements gain power and the Internet serves as a tool for the reimagination of conventional gender roles, women's presence is growing in both the public sphere and the labor market. The work of women in technology has

gathered momentum over the years. Needless to say, this has led to important contributions in several STEAM[3] fields.

However, female STEAM professionals still face numerous challenges in this day and age. In the field of games, for instance, if a female researcher tries to contact players (the majority are men), she finds a lot of resistance and not much willingness to collaborate in comparison with her male counterpart. Moreover, according to the “Women in Games”[4] Association in 2020, women experience a representation of 22% in the industry, but only account for a presence of 16% in the executive teams of the 15 biggest gaming companies worldwide.

By delving into the following chapters and exploring women’s education in STEAM, transgender inclusion in the technology market, data gender-bias, technofeminist analysis of gender and the workplace, gender equality in games, the deconstruction of human-computer interaction as western-centered, and women in a technoscience space, I am certain that these authors’ important insights will allow you engage in the wider debate on the significance of the feminine viewpoint in the tech world.

The path towards gender equality in technology is one that is still very pertinent today and needs urgent attention. “Technofeminism: multi and transdisciplinary contemporary views on

women in technology” advances the empowerment of women in tech and elevates their voices in a male-dominated space. By sharing their work and experiences, women are raised to their true worth regardless of, and in regard to, their gender, thus reclaiming their place in technology.

Ana Isabel Veloso

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[1] <https://www.kinephanos.ca/2017/bridging-game-studies-and-feminist-theories/> 05/11/2022

[2] <https://www.pordata.pt/Portugal/alunos+do+sexo+feminino+em+percentagem+dos+matriculados+no+ensino+superior+total+e+por+área+de+educação+e+formação+-1051> 05/11/2022

[3] STEAM - Science, Technology, Engineering, Arts and Mathematics

[4] <https://www.womeningames.org> 05/11/2022



Introduction

Introduction

According to the United Nations (2022), only 30% of tech science and technology professionals are women and 57% use the Internet, compared to 62% of men worldwide. According to the institution, these data reflect the development of digital skills and interaction interruption in digital platforms and communities which will consequently translate into fewer opportunities for careers in STEM (Science, Technology, Engineering, Mathematics).

The survey “Digitally Empowered Generation Equality: Women, Girls and ICT in the context of Covid-19 in selected Western Balkan and Eastern Partnership Countries”, carried out by the International Telecommunication Union (ITU), UN Women and the EQUALS Global Partnership (2021), revealed that one third of graduates from STEM programs in Europe were female between 2009 and 2013, and 2014 and 2018. Covid-19 highlighted injustices in online learning from a gender perspective. Most students have Internet access at home: “girls receive access to digital technology at a later age than boys, and their use of digital technology is more often shortened by their parents”.

In another report about the digital divide, by the World Wide Web Foundation (WWWF,

2021), it was found that the gender gap is getting worse. In the 32 countries studied, just over a third of women were connected to the Internet compared to almost half of men. “Countries have missed out on \$1 trillion USD in GDP as a result of women’s exclusion from the digital world. Governments are not adopting the policies they need to bridge the digital gender gap. Policymakers have a \$500 billion+ economic opportunity. Closing the digital gender gap in these countries would deliver an estimated \$524 billion increase in economic activity by 2025”.

In another WWWF (2020) study on the same topic, carried out on more than 10.000 men and women from Colombia, Ghana, Indonesia and Uganda, it was revealed that a lack of skills emerged as the biggest factor keeping women offline. When women get online, they create less content.

“Three-quarters of Americans (73%) believe that discrimination against women is a problem in the tech industry. 44% of women say it is a major problem, compared with just 29% of men. A third of men (32%) say discrimination against women is not a problem, compared with 17% of women. Younger women are more likely than older women to view gender discrimination as a

major problem in the tech industry. Women who work in computer jobs are also more likely than men in these jobs to consider gender discrimination a major problem in the tech industry (43% to 31%)", says a Pew Research Center survey (2017) about tech industry discrimination and inclusion.

Whether in schools, universities and the job market, the gender gap of women in tech careers in Portugal is below the European average, according to a EUROSTAT study published by SAPOTek (2018). Of the more than 26 thousand (26,235) students in the areas of ICT in 2016, 86.7% were male, while Portuguese students were just over three thousand (3,497), a percentage (13.3%) below of the European average.

According to data from PORDATA and "Fundação Manuel dos Santos (2021)", there has been a discrepancy between higher education graduates in ICT in Portugal since 1999, when data was first collected. In that year, 1,891 men graduated but only 670 women. In 2007, 6,129 men graduated, while only 1,481 women achieved this goal. The year in which this sharp difference was most observed was 2010 and 2011: 4,426 men compared to 937 women. In 2021, 5,836 men and 1,638 women graduated.

However, there are hopes of reversing this situation in Portuguese education and the labor market. According to the World Intellectual Property Organization (WIPO/WIPO), in a report published in JPN (2022), Portugal is the third country in the world and the first in Europe with the highest number of female inventors. The same report points out that in the most recent study by Eurostat, (the European Union Statistics Office, in Portugal) more than half of the engineers and scientists in Portugal

are women (51%). This puts the country ten points above the EU average (41%).

In Brazil, a Forbes report (2022) says that from January to May 2021, the Banco Nacional de Empregos/BNE (National Employment Bank) identified 12,716 female candidates for technology jobs, compared with 10,375 in the same period last year. Other data, this time released by the Cadastro Geral de Empregados e Desempregados/Caged (General Register of Employed and Unemployed), indicate that female participation in the technology market has grown by 60% in the last five years, from 27,900 women to 44,500 in 2020. This reinforces the opportunities that women can find in the sector. Racial issues also play their role here. The #QuemCodaBr survey, carried out by the social organization PretaLab, interviewed 693 people in 21 United States states in 2018 and found that black women make up a mere 15% of those entering computing courses across the country. This is half of the 32% of students doing courses in the computing area.

According to the Instituto Brasileiro de Geografia e Estatística/IBGE (Brazilian Institute of Geography and Statistics, 2021) report, in the population aged 25 years or older, 15.1% of men and 19.4% of women had completed higher education in 2019. However, women represented less half (46.8%) of professors at higher education institutions in the country. In undergraduate courses, they are a minority among students in areas related to exact sciences and the sphere of production: only 13.3% of Computer and Information and Communication Technology (ICT) students are women, while they occupy 88.3% of enrollments in the welfare area, which includes courses

such as social work. Despite being more educated, women occupied 37.4% of managerial positions and received 77.7% of men's income.

The statistics on female diversity and inclusion in technology at a global, European and local level (Portugal and Brazil) presented above are one of the ways to attest to a reality increasingly addressed by society through the press and also on social networks and digital platforms. In the last 12 years, Portugal and Brazil have experienced a boom in the emergence and development of communities of women in technology as a consequence of the process of developing digital skills provided by the advent of the Web and the formation of online collectives (Frade, Vairinhos, 2022) (Frade, 2021). Most of these collectives were inspired by the ones that emerged in the USA, a precursor country of this attempt at an activist of female union in favor of access and development in IT, in the transition into the 2000s. The collective initiatives regarding the local cultural, economic and social characteristics have a common objective: to sensitize governmental authorities and private entities, as well as society, to the urgency of promoting educational, entrepreneurship and technological training incentives for females from childhood to adulthood.

The quantitative data expressed in the statistics makes the layers of the problem surrounding women's inclusion in technology issue very tangible. It is still a scientific domain essentially focused on data. In terms of those who manage to enter a STEM career through the Academy, or through courses, there still needs to an effort made to embrace issues considered intangible due to the human dimension, such as the exercise of feminism. One of the most

male-dominated scientific fields in recent decades - a direct consequence of the patriarchy's successful efforts to suppress work opportunities and women's consumption of devices and programs -, technology is also a scientific domain that has recently been incorporated into feminist epistemology.

Tech Feminism has yielded a wealth of production that already exists in the area of STS (Science and Technology Studies, or Science and Technology Studies) which intersects with Gender Studies. STS investigates how political and cultural values influence technological advancement and scientific research, as well as conversely, scientific and technological influences on society. One of the main contributions of STS has been to challenge the idea that science and technology are objective and neutral (D'Ignazio, Klein, p. 1, 2016). STS is an interdisciplinary field that emerged in the 60s and 70s, that examines and relates the social, cultural and historical aspects of science and technology.

Feminist Technology Studies (FTS) reinforces the need to engage technology with feminist praxis, in the search for the development of theoretical and methodological tools for the analysis of technology and gender simultaneously, in equal depth. Unlike feminist research on technology, which tends to treat technological artifacts as ready-made items, FTS see technology production as a point of political influence. The evolution of these studies is intrinsically linked to the development of feminist theories, following some discussions and concepts of the feminist waves presented above, and also in parallel with technological innovations that have emerged since the transition from the

20th to the 21st century. It can be argued that this scientific field - the feminist investigation of technology - has become one of the main fields within the study of feminism.

Technofeminism: multi and transdisciplinary contemporary views on women in technology aims to present tech feminism, based on scientific productions carried out by renowned Portuguese-Brazilian national and international female researchers. Guided in their respective investigations through the prism of social and economic diversity and inclusion - as well as innovation and creativity -, these researchers reflect aspects not only of this feminism, but of women who investigate and work professionally on different fronts in technology.

This work aims to be a scientific and editorial reference in tech feminism both in Brazil and Portugal, which is distinguished by unfolding the feminist strand in various generic themes and dimensions such as Sociology, Arts, Gender, Human-computational-interaction ranging from games to communication and transmedia, and many more. Current debates about digital citizenship, platformization, surveillance capitalism/ algorithms will also be incorporated by Portuguese-speaking authors and North American and European researchers, due to the notoriety and relevance of their research in the context of this book's proposal.

It is an innovative study that fills an editorial gap in academic publications, as well as in the Portuguese and Brazilian publishing markets by bringing relevant and current concepts and theories on tech feminism to our attention. Technofeminism has previously been overlooked, but it is a strand of feminism that lacks

accessible published sources and content for researchers and the general public alike.

In the last five years, there has been an increase in the interest of readers, researchers, academic editors and the publishing market in publishing books on feminism under various aspects (racism, sexuality, civil rights, rescue of historical role models, etc.), as well as women in science who want to acclaim pioneering women in technology who have been deliberately forgotten by the domain of patriarchy.

Tech feminism is a scientific strand which brings together a disproportionate and scarce field of academic and editorial production, compared to publications in other studies of feminism and gender. However, it stands out as a potential for publications due to several factors such as: a greater inclusion of women in academic and professional careers in STEM (Portugal stands out in the European context); the advent of hundreds of women's communities in technology, which need reliable content and sources to develop activism and fulfill their inclusion goals with target audiences; the training of new intellectuals and bringing new academic and general interest courses on this subject through the publication of national and international interest and repercussion.

This publication has the distinction of bringing together academic quality content produced by authors who are references in publications related to tech feminism and the universe "women in technology". There is a repressed demand from Brazilian and Portuguese readers from scientific communities of STEM and from all domains related to technofeminism that are present in this work, who are interested in this content.

It is a book that will serve the general public and society, due to the scarcity of content on tech feminism and women in technology under a scientific and plural perspective. It is just as interesting and relevant for governmental and private entities who already invest and intend to invest in projects of diversity and inclusion of gender and technology, and also for teachers and schools who want to develop literacy projects related to professional opportunities for future generations. It is also an interesting book for journalists and digital influencers who are also dedicated to communicating content about technology, feminism and women in technology.

Technofeminism: multi and transdisciplinary contemporary views on women in technology emerges as a reference work in technological feminism, or on contemporary issues about work, gender, economy, society, culture, education brought together by a range of authors from diverse origins. First and foremost, the relevance of this work lies in the fact that it has unique and brand-new content related to technological feminism by Dr. Judy Wajcman. She is one of the most important theorists related to this scientific field worldwide, a mandatory reference not only for academics but for people interested in promoting inclusion and diversity actions for women at work and in society. Anthony Giddens Professor of Sociology, Dr. Judy Wajcman is also a Fellow at The Alan Turing Institute (and also Principal Investigator on the Women in Data Science and Artificial Intelligence Research project), Visiting Professor at the Oxford Internet Institute and AI100 Standing Committee member. She coined one of the most important concepts in feminism studies: technofeminism.

In “Feminism and Technology: an interview with Dr. Judy Wajcman by Renata Frade” the reader will be able to get to know some of the crucial themes in the sociologist’s work, a critical view for the coming years of the future of technological feminism. It is a rare and unique opportunity to find so many fundamental concepts based around these scientific domains and being debated by one of the main thinkers on these themes such as: Feminist Science and Technology Studies (STS), technofeminism, techno-sciences, gender and technology, intersectional feminism, activism, artificial intelligence.

This book consists of six other chapters and an interview. In “*Allegro ma non troppo: How Educational traps might be predicted*”, Dr. Ana Silveira Moura explores how models and data can be used to assess the evolution of women in the fields of Science, Technology, Engineering, and Maths (STEM), and if present-day strategies to address the situation had already been predicted and could have accelerated the process towards a more inclusive educational environment. The exploratory aspects also address recent methodologies in gender studies, such as Alternative History, in a transversal approach to a complex social and educational puzzle.

In “Spaces in deconstruction”, Dr. Biamichelle Miranda explores “an experience report on transgender employability in the area of computing/technology” based on the difficulties and potentialities found for the inclusion of transgender people in the labor market in technology and she suggests reflections based on the identified indicators. Unfortunately, the researcher recently left us. We would love to

honor her work of immense value related to women in technology studies, especially black and trans women, and also social inclusion, diversity and justice by publishing her work. We believe that this is a legacy that will leave indelible marks on new generations due to the quality of her research.

Dr. Carolina Berger (ECA/USP) exposes the development of #DigitalSelfPresenceLab that investigates ways of restoring presence in works that merge the poetics of new media arts and extended reality into experiences of technology embodiment. It questions how immersive experiences, live and in real time, generate new modes of presence for the performer and the audience, creating conditions for aesthetic manifestations of subjectivity and otherness from body expression. She establishes the restoration of presence as the central axis for the experiences created in the research. #DigitalSelfPresenceLab is a project that investigates the production of presence in digital media. The method explores principles and presence modalities through the combination of real-and-synthetic performances - human-machine interactions produced by computer technology, to discover a contemporary interpretation of presence. It's a rereading and updating for the technical basis of artistic performance that is inspired by resonances of Performance Studies (restoration of presence and the study of ancestral rites) and dance techniques. On account of this experimental approach, she analyzes the production of art and technology from a perspective which considers digital transformation under circumstances enabling solutions based on embodiment: from intermedia performance, volumetric capture, 3D avatar and

meta human design, feedback sensors to interaction and multi sensoriality in extended reality projects. Finally, the #DigitalSelfPresenceLab's results prove that the centrality of the body in media and technological experiences may enhance Self Awareness and subjectivity as the core of presence restoration.

In "Gender discrimination in AI models: origins and mitigation paths", Dr. Dora Kaufman argues that society is making gender-biased decisions on a wider scale than is perceived. The purpose of her article is to address the basic foundations of DLNNs, describing the origin and effects of gender bias, and proposing some mitigation paths.

In "Convergent feminism, gaming, digital transition, and equity", Dr. Patrícia Gouveia and Dr. Luciana Lima (LARSyS, Interactive Technologies Institute, Faculdade de Belas-Artes, Universidade de Lisboa - FBAUL) suggest that gender stereotypes and stereotypes related to gaming culture, condition women's participation in the sector and legitimize digital games as mere entertainment for women and, on the other hand, a "serious" toy that influences career choices for men. Based on these results and from the perspective of speculative convergent feminism, they reflect on the relationship between digital games and technological and artistic skills in the emerging context of the digital transition.

In "Cultural Diversity as a design precedent: A (Feminist) Angle to HCI/d Expansion", Dr. Sai Shruthi Chivukula discusses cultural history, knowledge, interactions, and the roots of researchers and designers as a design precedent. She talks through this concept as she

presents various case studies, where researchers have built their research agenda by heavily drawing on their various cultural backgrounds. She discusses how framing their research agendas using cultural precedents has enabled the expansion of the power of design, especially in the field of Human-Computer Interaction. She highly relates to this space due to her personal researcher position as a “foreign cultural entity” in the westernized HCI theory. The case studies presented showcase how researchers and designers have used cultural knowledge to frame their research methods, tools, outcomes, and philosophies. She further discusses this intake of cultural perspectives as a precedent for HCI research and design practice: 1) For expanding the scope of criticality in HCI design spaces and in turn, 2) Promoting Feminisms of thought through the diversity cultural knowledge and background entails in design work, with the risk of multiple perspectives fighting with each other; and 3) Encouraging the cross-pollination of ideas to build the larger research agenda for HCI design. She also intends to use her chapter as a self-reflection and an avenue to represent young researchers who have excelled in the space of connecting HCI and design spaces to various dimensions through their cultural underpinnings.

“How to be a Woman in Science: An interview with Dr. Ana Viseu by Renata Frade about Feminism, Gender and Technoscience perspectives” intends to be a documentary and historical record for current and future generations about the path of a female role model in Academia. It covers issues related to diversity,

social inclusion, feminism and technoscientific culture. The work explores theoretical contributions in the field of ‘science and technology studies’ (STS), feminist technoscience; pioneers in studies of emerging technologies such as wearable computers, care and nanotechnology. The interview highlights some of the challenges of being both a female and a Portuguese researcher that must be overcome and consecrated in funded studies and awards. It also discusses gender issues in general, and particularly those pertaining to technoscience and presents Dr. Ana Viseu’s innovative qualitative (mostly ethnographic) methods to study how emergent information and communication technologies are developed. Furthermore, she has an article published in *Nature* which is one of the most renowned scientific publications in the world.

Acknowledgements

In the memory of Biamichelle Miranda.

Renata Frade:

This book is dedicated to Pedro. I would like to thank Bruno, Elizabeth, Custodio, Daniele, Marcelle from the bottom of my heart for all their support and love.

My tech feminism PhD investigation is sponsored by Fundação para a Ciência e Tecnologia (FCT) doctorate scholarship (2020.06640.BD reference) and so I would like to thank FCT for supporting my research.

Mário Vairinhos:

To Mafalda. One day the world will be *hers*.

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Feminism and
Technology:
an interview with
Dr. Judy Wajcman
by Renata Frade

“I never am really satisfied that I understand anything; because, understand it well as I may, my comprehension can only be an infinitesimal fraction of all I want to understand about the many connections and relations which occur to me, how the matter in question was first thought of or arrived at, etc., etc.”
— Ada Lovelace

Feminism and Technology: an interview with Dr. Judy Wajcman by Renata Frade

Dr. Judy Wajcman

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Abstract:

This is an unprecedented document with Dr. Judy Wajcman. She is one of the main voices in the Academy on technological feminism in the world, author of memorable works and still so important in these scientific fields, such as Technofeminism and Feminism confronts Technology. For over 25 years, her scientific production has covered topics such as sociology of work and employment, science and technology studies, gender theory, temporality and organizational analysis. Dr. Judy Wajcman is Anthony Giddens Professor of Sociology at The London School of Economics; she is also a Fellow at The Alan Turing Institute (and also Principal Investigator on the Women in Data Science and Artificial Intelligence Research project), Visiting Professor at the Oxford Internet Institute and

AI100 Standing Committee member. This interview with Renata Frade covers aspects related to feminist technoscience, artificial intelligence, activism nowadays, gender equality and the present and future of technofeminism.

Keywords: technofeminism; feminism; technoscience; Science and Technology Studies; gender studies; activism.

In addition to Ada Lovelace's curiosity and interest in deciphering scientific phenomena (the first person to be considered capable of programming a precursor computer machine, in the 19th century), Dr. Judy Wajcman has other similarities with the programmer, such as rigor, creativity in the focus of her objects of study, being a beacon to illuminate issues about the human and the social condition that are so pertinent and relevant today.

This interview is a privilege for me, as a researcher of feminism and the impact of technology on human relationships, and certainly for you, the reader. This is an unprecedented document produced together with one of the main voices in the Academy on technological feminism in the world, author of memorable works and still so important in these scientific fields, such as *Technofeminism* and *Feminism confronts Technology*. For over 25 years, her scientific production has covered topics such as sociology of work and employment, science and technology studies, gender theory, temporality and organizational analysis.

In the biography published on the The London School of Economics and Political Science website¹, where she works as Anthony Giddens Professor of Sociology, it is stated that Dr. Judy Wajcman is a Fellow at The Alan Turing Institute (and also Principal Investigator on the Women in Data Science and Artificial Intelligence Research project), Visiting Professor at the Oxford Internet Institute and AI100 Standing Committee member.

She was also the Professor of Sociology in the Research School of Social Sciences at the Australian National University. She has held posts in Cambridge, Edinburgh, Manchester, Sydney, Tokyo, Vienna, Warwick and Zurich. She was formerly a Centennial Professor at LSE, a Visiting Fellow at All Souls College, Oxford, and a Visiting Professor at the Centre for Women in Business at London Business School. In 2017-18 she held a Mellon Foundation fellowship with the Center for Advanced Study in the Behavioral Sciences at Stanford

University, focusing on the politics of artificial intelligence.

Dr. Judy Wajcman scientific production has been translated into Chinese, French, German, Greek, Italian, Korean, Japanese, Portuguese, Spanish and Russian. She has been President of the Society for Social Studies of Science (2009-2011). Professor Wajcman is a Fellow of the British Academy. She has an honorary doctorate from the University of Geneva. She is the recipient of the William F. Ogburn Career Achievement Award of the American Sociological Association (2013). In 2018, she received the Oxford Internet Institute's *Lifetime Achievement Award* 'in recognition of her contributions to the field of the social study of science and technology'. In 2021, she was awarded the John Desmond Bernal Prize by the Society for the Social Studies of Science.

I would like to make a second and final analogy of Dr. Judy Wajcman's relevance work to everyone who is dedicated to inclusion, diversity and gender equality in technology studies. In the literature review carried out for this interview, I discovered that the interviewee (Dodd, Wajcman, 2016) had produced a work inspired by the work of sociologist Georg Simmel, to address the acceleration of social relations. At the beginning of my academic career, I felt a strong impact with Simmel's work to understand what the change of time in people's lives represented, from a new economic and industrial order capable of transforming everyday life, new modern institutions to even shaping the expression of affection between people at the beginning of the 20th century. One of the main canons of sociological studies, Simmel was also original and visionary in addressing gender issues. In a

1 <https://www.lse.ac.uk/sociology/people/judy-wajcman>

very summarized way, it can be said that, according to the theorist, gender equality would only be possible when society honored the differences of female and male cultures (Allan, 2005).

When confronting the works of Wajcman and Simmel I feel that I am faced with a firm and broad theoretical ground on the directions of life in society, or going a little further, of Humanity and its relationship with time. They are important and defining canons of different times, marked by extreme and crucial transformations guided by technological advance. Starting to read the work of Dr. Judy Wajcman is to be able to have a safe and coherent roadmap on feminism and technology, gender identity from the relationship with technological and computational artifacts and programs, in the change of interactions between people mediated by digital intermediaries and in the use of artifacts technological in everyday life that should give us more time to live, and not for the accumulation of 24x7 work in an increasingly onlife (Floridi, 2015).

In this interview, the reader will be able to get to know some of the crucial themes in the sociologist's work from a perspective that goes beyond the review of positive points that could have been better, a critical view for the coming years of the future of technological feminism. It is a rare and unique opportunity to find so many fundamental concepts around these scientific domains being debated by one of the main thinkers of these themes. It is a privilege for you and me, dearest reader, to debate and learn, in this conversation, about topics such as feminist Science and Technology Studies (STS), technofeminism, techno-sciences, gender and technology, intersectional feminism, activism, artificial intelligence.

Renata Frade: On April 2021, Donna Haraway and Banu Subramaniam, two foundational feminist technoscience scholars, had a conversation in Catalyst's 5 Year Anniversary Celebration: The Foundations and Futures of Feminist Technosciences. Haraway was asked by Subramaniam about the explosion of feminist Science and Technology Studies (STS) in the last 30 years, its success and challenges. Haraway's response was:

"I think that were feminist scientific studies a success would be a definition of its failures. I think it's an ongoing grappling that has achieved certain very important things. Some of them are small in the larger scope of things. But not so small really. Which are things like foregrounding the fact that women are scientists. And that the conditions of women who do science are intolerable. And that the conditions of women in science who come in from working class backgrounds, who are different, differently abled or racially stigmatized or, that these conditions are yet harder. That women scientists suffer the double day as women do in general. So on and so forth. I think feminist science studies, in which I include a history of science and philosophy of science and ethnographic socially, including a whole range of inquiries that are visible in universities, but I'm also including the activist dimensions of this. The people who have worked in clinics, or in labor organizing like SEIU, who have understood the issues of repetitive stress injury and digital workplaces and so on. The ongoing gender division of labor, even as it is denied. I do believe that feminist science studies in large has put these issues on the agenda forcefully with action and scholarship of many kinds. Boom. That feminist science studies has been profoundly an important part of post-colonial and decolonial

thinking and action. It has refused to allow questions of sexualities and genders, not to be in the tang will – I'm avoiding the metaphor 'center of attention' although I think foregrounding and backgrounding is an important tool.

We can look at the whole current generation of young scholars and feel we are connected. We are in this together. There is a continuity here. I think feminist science studies has failed also in a range of ways. I'm speaking only for myself for the moment. I think that I fell out of deep engagement with practicing scientists, because I didn't take enough care with language or with politics or with the material conditions that separated us. I think a huge amount of damage was done in the social text moment that accused all of us, particularly those of us involved in feminist science studies, of relativism and of anti-science ideology, which has subsequently been taken up and developed with great skill. I think that many of the things that we proposed have been used as weapons against us. And I feel like my work bears some of that responsibility. I also think people like me have been intentionally anti-racist, but in practice most of my networks remain white.

I think there are profound issues – there's still so much yet to be done. I think that women like us in feminist science studies have understood that something like food justice, for example, is an unbelievable feminist issue. I think I and my peers knew this back in the 1970s and '80s when we looked at questions of seed justice in west Africa as the commercialization of agriculture for export in west Africa was beginning to take off and the women who grew food for people were marginalized and seeds standardized. I think we understood a long time ago that seeds are feminist

objects. And I think that contemporary work has really deepened that. I also think we've understood that water is a feminist issue. I feel proud of feminist science studies, and acutely aware that we are part of a really multifaceted struggle in a time where fascism is resurgent globally".

Do you agree with Haraway's opinion about feminist technoscience advances and failures and challenges to be faced, especially in times of artificial intelligence advances? Could you please cite some of the most important female researchers that are really taking a fresh look at these scientific fields and why these choices are being made?

Judy Wajcman: I very much agree with Haraway that the rich legacy of feminist STS remains highly relevant. Like her, I identified myself as a socialist feminist during second wave feminism and we were responding to the microelectronic revolution as it was then known. We were showing then, as we are now, the role that science and technology plays in the construction of gender, how masculinity and femininity are formed, and the effects that technologies have on men and women. Central to that idea has always been the notion of skill and how skill is defined, rewarded and paid for. Exposing gender division of labour in both paid work and unpaid housework was key. This is still so relevant today as a critique of the idea that the paucity of women in STEM is a 'pipeline problem' rather than the result of gender structures, gender stereotyping, and engrained cultures of masculinity that are ubiquitous within tech industries.

Feminist STS crucially explored the gendered character of science and technology, putting the spotlight on the artefacts themselves. We contributed to the broad acceptance of a social shaping or 'co-production' framework, and the critique of

technological determinism. It is no longer controversial to argue that technological innovation is itself shaped by the social circumstances within which it takes place. Objects and artefacts are no longer seen as politically neutral and separate from society; rather, they are designed and produced by specific people in specific contexts. As such, artefacts have the potential to embody and reproduce the values and visions of the individuals and organisations that design and build them. We demonstrated that the marginalisation of women from the technological community has a profound influence on the design, technical content and use of artefacts. In sum, the key insights of feminist STS on issues such as the gendering of skills and jobs; the conception of technology as a sociotechnical product and cultural practice; and the critique of binary categories of female/male, nature/culture, emotion/reason, and humans/machines are still foundational resources for contemporary research on gender and technology.

In recent years, feminist STS has been strengthened by its engagement with intersectional feminist analysis, critical race theorists and post-colonial theory (Crenshaw et al. 1995; Collins 1998; Benjamin 2019; Noble 2018; Sandoval 2000). There is increasing recognition of the ways in which gender intersects with other aspects of difference and disadvantage in the societies within which these technologies sit. Women are a multifaceted and heterogeneous group, with a plurality of experiences. Gender *intersects* with multiple aspects of difference and disadvantage involving race, class, ethnicity, sexuality, ability, age and so on. For instance, women who are poor or belong to racial minorities experience the negative effects of digitalisation and automation more acutely (Buolamwini and Gebru 2018).

Such an intersectional lens is particularly important as attention has expanded beyond the sexism and racism of the internet and digital cultures to the growing body of work on AI systems. Feminist scholars, like D'Ignazio and Klein in *Data Feminism* (2020) and Criado Perez in *Invisible Women* (2019) have not only exposed the glaring gender data gap, but have also been part of a growing literature showing how the data that feeds algorithms is biased. Echoing STS texts on the politics of scientific knowledge production, they highlight the epistemic power of classification systems and the values and judgements they encode (Bowker and Star 2000). Every dataset used to train machine learning systems contains a worldview, reducing humans to false binaries and implied hierarchies, such as the artificial distinctions between men and women. In other words, the very process of classifying data, a core practice in AI, is inherently political. Noble's *Algorithms of Oppression* (2018) and Benjamin's *Race After Technology* (2019) have become key texts showing the ways in which algorithms can reflect and amplify existing inequities such as those based on gender and race.

Finally, picking up on Donna's point about feminist activism, I have to say how delighted I am that there is a whole new wave of activism about the politics and ethics of AI. It is striking that many of the political organizations that have been set up are led by women - for example, *Data & Society*, *AI Now Institute*, and the *Distributed AI Research Institute*. These groups have been leading the field in critiquing current developments and assumptions about the widespread use of automated decision-making and they are having a major impact.

Personally, I am also pleased that there is a renewed interest in the working conditions, as well as the environmental impact, that go into making so-called intelligent machines. I'm thinking of books like Gray and Suri's (2019) *Ghost Work* about the vast, 'invisible' human labour force, often women in the Global South, who carry out work such as labelling data to feed algorithms, cleaning codes, training machine learning tools and moderating and transcribing content. And how Crawford's (2021) book *Atlas of AI* argues that AI is both embodied and material, made from natural resources, human labour, infrastructures, histories, and classifications. To me this book reads as applying an STS approach with a Marxist inflection - not so far from our early socialist feminist lens!

Renata Frade: You coined one of the most important feminist, technoscience concepts, technofeminism (2006): "My own technofeminist approach conceives of technology as both a source and a consequence of gender relations (Berg 1996; Faulkner 2001; Oudshoorn et al. 2004; Wajcman 2004). In other words, gender relations can be thought of as materialized in technology, and gendered identities and discourses as produced simultaneously with technologies. Several empirical studies have demonstrated that the marginalization of women from the technological community has a profound influence on the design, technical content and use of artefacts (Lie 2003; Lerman et al. 2003; Oudshoorn 1994, 2003)

You also wrote "If society is co-produced with technology, and imperatives explore the effects of generic power relations in design and innovation, such as the pact of technological change on the sexes. We can imagine that gender relations

materialize in technology, and that masculinity and femininity instead acquire their meaning and character through working machines and their integration conception in themselves. In order to renegotiate the cultural equation between masculinity and technology, technofeminism insists that we have to deal with the concrete sociotechnical practices of women and men" (2006).

We are currently living in an era marked by a new time and space relationship with technology, influenced by artificial intelligence devices and software advances, quantum computing, and a platform society (van Dijck, J., Poell, T., & Waal, 2018) consolidation. What would technofeminism be nowadays? Have you ever thought about updating the concept, or do you believe that it is still "valid"? You've been researching about Artificial Intelligence and Sociology of Speed with more emphasis over the past few years. How do these scientific domains contribute to new paths in feminist technoscience?

Judy Wajcman: To some extent, I have already answered this question in what I said before above. Technofeminism has perhaps morphed into 'Data Feminism'. I like that term data feminism, as data science and AI are the major technological developments since I first wrote about the relationship between gender, power and technology. To me technofeminism is still a useful approach from which to extend our analysis to think about how gender is being embedded in code and software, as well as in hardware and material machinery. We have a broader sense of what technology means, such as machine learning systems and infrastructure, as well as artefacts. My current project at The Alan Turing Institute is on Women in Data Science and AI (<https://>

www.turing.ac.uk/research/research-projects/women-data-science-and-ai) shows how the dominance of men working in and designing AI results in a feedback loop whereby bias gets built into machine learning systems. Although algorithms and automated decision-making systems are presented as if they are impartial, neutral and objective, we show how bias enters, and is amplified through AI systems at various stages. Crucially, we stress that algorithmic bias is not solely the product of unconscious sexism or racism, nor bad training data, but the end result of a techno-culture that has systematically excluded women and people from marginalised groups from positions of leadership and power.

In terms of my writing on the sociology of speed, again it is informed by STS and feminism. My books *Pressed for Time* and the *Sociology of Speed* are about our current obsession with speed and acceleration and how digital technologies seem to be at the heart of this problem. The idea that digitalization has wrought a new temporality of speed, instantaneity, and time pressure has been widely taken up in social theory. In my view, this important conversation about the changing social character of time has only begun to understand how time is *co-produced* with and through machines: that time is a socio-material practice. So, by adopting a science and technology studies lens, I highlight the ways in which sociotechnical systems mediate and are active participants in the production of time. My research on the design of digital calendars and scheduling software shows that the ideology of optimization is embedded in these systems.

In terms of feminism, I stress that the logic of temporal optimization encoded in calendars reifies

time as data or events thereby rendering other forms of time use questionable and invisible. Non-productive forms of time use (that is, care work, play, pottering) don't fit this paradigm, and indeed there are some things that can't be or shouldn't be scheduled in a calendar. This is especially the case with paid and unpaid care work. There is great feminist writing on care and how it can't be rationally planned and controlled. Care involves the erratic, time as a relational process that is based on contextual, situated knowledge, that has a large non-verbal component, makes it difficult to carry out planned activities. Yet, calendars are principally about planning. So, in my work on AI and temporality I argue that the 'ethic' of care as performed in everyday embodied practices cannot be codified into procedural algorithms.

Renata Frade: My PhD investigation is researching for women in tech empowerment and social inclusion "solutions" or new perspectives from technofeminism, activism, transmedia, and interaction design mainly scientific domains having technological female communities as case studies. HCI Feminist is one of the central concepts in this research. Due to this, I want to come back to something you mentioned before, namely the relation of technofeminism and design. You wrote:

"The central premise of feminist technoscience is that people and artefacts co-evolve: the materiality of technology affords or inhibits the doing of particular gender power relations. Crucially, such a perspective redefines the problem of the exclusion of groups of people from technological domains and activities. Whereas policy-makers and researchers explain the problem in terms of the deficiency of users, such as women,

technofeminism exposes how the concrete practices of design and innovation lead to the absence of specific users.

While it is impossible to specify in advance, the desirable design characteristics of artefacts and information systems that would guarantee more inclusiveness, it is imperative that women are involved throughout the processes and practices of shaping technological innovation. Drawing more women into design – the configuration of artefacts – is not only an equal employment opportunities issue but is also crucially about how the world we live in is designed, and for whom”.

Despite the original connection with the social sciences of both scientific domains, the historic moment of the third phase of the HCI represents the phase of a major awakening in the evolution of theories of technological feminism. Both are marked by the consequences arising from the emergence and expansion of the web, in the popularization of the use of technologies in desktop, mobile, internet of things computing devices and programs. An opening for cultural analysis at HCI was to meet already existing themes in feminism, such as identity, subjectivity, sociability, experience, cultural difference and social change and activism. HCI has borrowed and innovated in research and design epistemologies and methodologies such as the humanities. In the last two decades, feminism has also become part of the discourse in the areas of computer-supported cooperative work and sociotechnical design (Bardzell, S., Bardzell, J., Forlizzi, J., Churchill, E., Grinter, B., Tatar, D., & 29th Annual CHI Conference on Human Factors in Computing Systems, 2011).

These are some theoretical efforts in the search of technologies development with less gender

bias, more inclusive for women from the design conception in the last 15 years. Do you believe it is possible that one day there will be a feminist or feminine technologies knowledge and development, without gender bias and racist or prejudiced data? Do you follow the studies related to HCI and feminism? If so, do you believe that they are a way to promote responses for women in STEM inclusion? Are proposals such as design prototypes for feminist technologies still seen as minority niches by large companies?

You researched domestic technologies and their impact on society and speed of time a long time ago. Would you please comment on whether their secular design development by men may influence digital and tech tools and programs with non-inclusive designs?

Judy Wajcman: I have not been following the debates about the relevance of Feminist STS for HCI research and design practices closely enough to comment. However, I like the recent article by Wagman and Parks (2021: 9) where they frame the problem as being one of designing relationships embedded in the social and material world, and not simply as about the design of neutral or functional objects. ‘To design a social machine, informed by feminist STS research, is to also build a mutual relationship’. They draw on both feminist STS and HCI to conceptualize different models of human-machine relations in robotics. As they say, there is no one answer, but they emphasize the importance of mutuality, of machines as partners. It’s an interesting perspective.

In relation to your question about the possibility of unbiased knowledge, as you note there is growing field within the AI/HCI community discussing how to design ‘fairer’ algorithms.

While I welcome this development, I would argue that technical bias mitigation (including algorithmic auditing) and fairness metrics for models and datasets are by no means sufficient to resolve bias and discrimination. Notably, since ‘fairness’ cannot be mathematically defined, and is rather a deeply political issue, this task often falls to the developers themselves – the very teams in which the diversity crisis lies. Miceli et al. (2022: 4) express the issue well when they say that efforts to design tools to mitigate data, algorithmic, and workers’ biases, framing the problem as one of ‘bias’, risks encoding the premise “*that there is an absolute truth value in data and that bias is just a “distortion” from that value*”. Feminist STS has long demonstrated that the notion of scientific objectivity as a ‘view from nowhere’ is both androcentric and Eurocentric. It is therefore highly attuned to the privileged and naturalised epistemological standpoints or worldviews inscribed in data and systems that reproduce the status quo. Their article is entitled ‘Studying Up Machine Learning Data: Why Talk About Bias When We Mean Power?’ and that captures my point.

Renata Frade: In ‘Genre, Technologie et Cyberfeminisme’ (2013) you said “The first feminist analyses of technology were therefore often marked by pessimism. Technology appeared as a characteristic element of masculinity, perpetuating and producing gender occupational segregation in organizations.

The rise of new technologies and biotechnologies has led many contemporary feminists to review this position to conclude that the traditional link between technology and male privilege was finally broken. These upheavals would herald the

advent of an exhilarating post-traditional society, based on networks.

Cyber-feminists claim that the Internet lays the technological foundations of a new society, liberating for women. However, research conducted at the intersection of feminist studies and the sociology of science and technology has greatly enriched these two disciplines, focusing on the joint evolution of people and objects”.

We currently live in an era marked by a new relationship of time and space with technology, with people increasingly fused with machines in 24x7 interaction, the creation of new spaces for personal and professional interaction, such as metaverse. In parallel, attempts by governmental organizations and institutions and private companies to seek regulations to maintain the privacy and security on mobile and web data sharing, as well as to punish users who practice violent, prejudiced acts.

I would like to revisit some themes present in recent articles published by me for the Cátedra Oscar Sala (Oscar Sala Chair)/ Instituto de Estudos Avançados (Institute of Advanced Studies) of Universidade de São Paulo (University of São Paulo). One of the harmful effects of technology and artificial intelligence that reinforce prejudice, pointed out by Benjamin (2020) is code-switching: when people change the way they speak or act to conform to dominant norms. A reflection to be made is whether and how feminist technological activists are aware of how much their struggles - mediated and carried out mainly on digital platforms, created by companies that use AI and the abundance of data to obtain profits and business objectives are not always revealed - may be contaminated by machine learning and the servers of these social media companies. According

to Crawford (2021) AI is based on technical and social practices, politics, culture, the structures that support it, as well as private and public institutions. It works in the formation of knowledge, communication and power and has also provoked reconfigurations at the level of epistemology, principles of justice and social organization. In surveillance capitalism (Zuboff, 2018), big data is fundamental in a new logic of accumulation, in a social engineering that projects social and individual capacities, for good or for bad (Frade, 2021).

I started some research to find out, on a global level, what there was in relation to feminism and the metaverse. I found a recent initiative called the Feminist Metaverse (2021), an autonomous decentralized organization whose goal is to build a feminist metaverse. According to the collective, none of the four feminist waves, including the fourth (cyberfeminist), resolved the fundamental social problems of women in education, gender discrimination, unequal pay for equal work, domestic violence, trafficking and child marriage (Frade, R., 2022). I would like to bring a design and communities concept in this contextualization: "Design justice is a framework for analysis of how design distributes benefits and burdens between various groups of people. Design justice focuses explicitly on the ways that design reproduces and/or challenges the 'matrix of domination' (white supremacy, heteropatriarchy, capitalism, ableism, settler colonialism, and other forms of structural inequality). Design justice is also a growing community of practice that aims to ensure a more equitable distribution of design's benefits and burdens; meaningful participation in design decisions; and recognition of community-based, Indigenous, and diasporic design traditions, knowledge, and practices."

I would like to know your opinion if we are living a fifth tech-feminism wave, with these new challenges posed and the emergence of strong initiatives in the fight against the suppression of freedoms such as The Algorithmic Justice League and black tech-feminism. What do you think of the activism carried out by thousands of women's technological communities around the world, especially in emerging countries? Could the virtual spatial occupation of these entities in virtual spaces like metaverse be a new exercise in feminism in the 21st century?

Judy Wajcman: As I said above, I am very enthusiastic about new waves of feminist activism around the harmful effects of technology and AI. Design justice is an excellent framework and there is much more awareness now of both the international context and the need for intersectional analysis to take account of women's diverse situation and experiences. I would be cautious, however, about the possibilities of the Metaverse, as it immediately reminds me of our earlier hopes for cyberfeminism and the cyberspace being somehow a gender-neutral space. Remember how the internet was initially viewed as a democratising platform, and now we see that a small group of large technology corporations based in the Global North has emerged as a dominant force in the new global economy. These 'tech giants' monopolise markets and wield power over digital data, as major online platforms are found complicit in the spread of misinformation, hate speech and misogynistic (and racist) online abuse and harassment. In particular, there are unprecedented levels of data mining, or 'data extra-activism', algorithms and predictive risk models that entrench existing inequalities and power dynamics.

As I wrote in *Technofeminism*, there is a danger of encoding—and amplifying—offline inequities into online structures, as these technologies carry over the social norms and structural injustices of the offline world into the virtual one. After all, romanticised ideas of virtual voyages echo the gendered division of human activity in which the male life of the mind is valued over women’s confinement to the visceral body. As feminists have long pointed out, the embodied and situated nature of knowledge has been denied precisely because it is based upon the invisible work of women. Rather than dreaming of a flight from the body, feminism has argued for men to be fully embodied and take their share of emotional, caring and domestic work. To express this in computer jargon, an emancipatory politics of technology requires more than hardware and software, it needs wetware - bodies, fluids, human agency.

Renata Frade: “Existing data is sparse (about gender diversity in the AI and the data science workforce is severely limited). Diverging career trajectories (There is evidence of persistent structural inequality in the data science and AI fields, with career trajectories of data and AI professionals differentiated by gender, women are more likely than men to occupy a job associated with less status and pay in the data science and AI talent pool). Industry differences (women in data and AI are under-represented in industries which traditionally entail more technical skills, and over-represented in industries which entail fewer technical skills. Furthermore, there are fewer women than men in C-suite positions across most industries, and this is even more marked in data and AI jobs in the tech sector; patterns in AI and data science are similar

to gender gaps in the overall workforce). Job turnover and attrition rates (Women working in AI and data science in the tech sector have higher turnover and attrition rates than men. Like other studies, we have found persistently high turnover and attrition rates for women as compared to men working in data science and AI in the technology industry. Our data shows that, on average, women spend less time in each role than men do. This holds for every industry, with the biggest gap in the Industrials and Manufacturing, and Technology/IT sectors. Furthermore, looking at the total years of experience spent in each industry by gender, we find that on average women spend more time than men in every industry except for Industrials and Manufacturing, and crucially, the Technology/IT sector, where they spend almost a year and a half less). Self-reported skills (Men routinely self-report having more skills than women on LinkedIn. This is consistent across all industries and countries within our sample. Women are more likely to self-report fewer skills than men).

These were the 5 Gendered careers in data science and AI findings in *Where are the Women? Mapping the Gender Job Gap in AI*. Policy Briefing: Full Report (Young, E., Wajcman, J. and Sprejer, 2021). Recently a new feminist technoscience concept came out to fight against situations cited in this research: “The work of data feminism is first to tune into how standard practices in data science serve to reinforce these existing inequalities and second to use data science to challenge and change the distribution of power. 21 Underlying data feminism is a belief in and commitment to co-liberation: the idea that oppressive systems of power harm all of us, that they undermine the quality and validity of our work,

and that they hinder us from creating a true and lasting social impact with data science. Data feminism can help to remind us that before there are data, there are people – people who offer up their experience to be counted and analyzed, people who perform that counting and analysis, people who visualize the data and promote the findings of any particular project, and people who use the product in the end. There are also, always, people who go uncounted – for better or for worse (D’Ignazio, C., Klein, L., 2020).

Studies in the exact sciences have increasingly found “answers” or more questions in the trans and interdisciplinary intersection with social and biological sciences, in the face of the challenges of human-machine hybridity, artificial intelligence posed in reports like this, for example. Could you talk a little bit about your current research work and what the research prospects are in the coming years, please? Are they related to these themes? Do you believe that, in addition to data feminism, it would be possible to have some theoretical field that would strengthen technological feminism?

Judy Wajcman: The study quoted above is from my current research – the *Women in Data Science and AI* project within the Public Policy program at The Alan Turing Institute. It conducts data science and social science research to inform policy measures aimed at increasing equity in the data and AI fields, in the UK and globally. We address these complex challenges through a three-tiered approach:

Mapping the participation of women in data science and AI in the UK, and globally. Our aim is to increase the number of women in these fields.

Investigating diversity and inclusion in online and physical workplace cultures. We explore the ‘chilly’ organizational cultures of tech

companies and institutions that result in persistent structural divergence in women’s and men’s career trajectories.

Exploring how the gender gap shapes scientific knowledge and technological innovation. The lack of diversity in the AI sector results in harmful feedback loops of social bias being built into AI and machine learning systems. We promote responsible, gender inclusive AI design.

The team members would all describe themselves as taking an intersectional feminist STS approach. We have worked with several companies to improve women’s representation and we have various other projects exploring the masculine cultures in high-tech corporations. Next year, I am hoping to explore why there are so few women in venture capital and how this might shape the innovations that are funded.

In this sense my current research continues some longstanding techno-feminist themes: how do we intervene and remake a world designed by men. Whereas there were relatively few of us involved in the 1980s and 1990s, there is now a vast field of feminist STS research and activism and I am happy to continue to play a part and learn from the next generation how to do our work more effectively. There are lots of emerging areas of scholarship, such as critical algorithm studies, critical race theory, and post-colonial theory, and a host of fresh political issues that have arisen as the result of new developments in technoscience, and I am confident that building on these new insights from younger scholars, we can meet the challenges.

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Allegro ma non troppo:
How Educational traps
might be predicted

Allegro ma non troppo: How Educational traps might be predicted

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Abstract

Education is one of the most controversial fields which has constantly polarized opinions since records began. Questions such as: Who should study? Where? When? How (a particular mine-field theme)? And the most complex question of all: Was it worth it? And if so, for whom was it worth it? Closely attached to this body of interrogation is the subject of assessment, which includes and always has included the aspect of social and moral/citizen values and student behavior. Nowadays, another nuance has been added, as seen in the plethora of reports from alarmed parents and the general public alike about the use of drugs, such as Ritalin, to improve mental activity, even when there was no medical indication to use them. And, as usual, the alarm bells only ring when numbers reach a critical stage.

In recent years, publications have proposed an intersection between predictive models using data gathered from speculative literary works and educational puzzles. We were particularly

interested in the use of drugs to promote normative student behavior or to help students in high pressure courses like medicine to cope with gargantuan higher education demands. These novel models bring together creativity, logic, mathematics, and social sciences, and might provide a tool, alongside the many others, to help to avert problems before they become socially and individually critical.

In this work, we explore how those models and data can be used to assess the evolution of women in the fields of Science, Technology, Engineering, and Maths (STEM). We also look at present-day strategies to address the situation to see if it had already been predicted and could have accelerated the process towards a more inclusive educational environment. The exploratory aspects will also address recent methodologies in gender studies, such as Alternative History, in a transversal approach to a complex social and educational puzzle.

Keywords: Education; STEM; Gender Equality; Alternative History; Speculative Data

1. Starting over²: Introduction

A story has no beginning or end: arbitrarily one chooses that moment of experience from which to look back or from which to look ahead.

— Graham Greene, 'The End of the Affair'

Being Human and becoming a person can be interchangeable or juxtaposed, but are they really the same? Whatever the side one takes and defends in the attempt to answer this question, one thing is inescapable of the context: Education. Education is a structural process, imposed by society to families and individuals, within a specific framework, of objectives and outputs, adjusting the process of raising the young, something that happens in many animal species, through the lenses of social paradigms or zeitgeist (Pessoa, Coelho, & Fernandes, 2015).

By no means does this definition intend to undermine the value of Education. Human beings are gregarious, and social values are something that is a staple in groups and a part of the feasibility of individual survival. There is nothing wrong in being appreciated *per se*. However, what you do in order to gain that appreciation, what is imposed on you so that you may be able to reach the minimum levels of social value, and above and foremost, what is curtailed from you within educational context for posterior social recognition is a more controversial matter. And controversies, past, present, and future (in our estimation), not only bring knowledge but also change. Of course, the value of change is something that

is also open to debate and provides more than its share of controversy.

Education has meant different things throughout its history, which is human history as well. That meaning has been repeatedly adjusted to what a given society regarded as important and quite often, 'important' is based on utility purposes. Mandatory education for everyone came with the need for personnel that could read, write and do basic arithmetic in industries and commerce. But it was mandatory only up to a certain level of education, not because you cannot impose professional paths on an adult (you can do that still today with compulsory military service in many countries, for example), but because of the prevalence of the discriminatory character of education, that has been present since the school of scribes of Ancient Egypt or Classical Greco-Roman Age.

Education is power.

This has to be one of the most used clichés that has been proven again and again to be more factual than just a cliché. And power is connected with perception, namely the perception of social organisms and values. The triumvirate of education, clichés, and social organisms are among the most permanent issues in the field of the education of women. Broadly speaking, educating half of humanity still seems to be a complicated matter in a world that has stated education as an absolute staple for the last one hundred years, at least. The disputes are many, but there is a particular aspect that is rather interesting. Science, Technology, Engineering and Mathematics (STEM) are fields of expertise where the male/female ratio is still very much

² Reference to Jonh Lennon' song (*Just Like*) *Starting Over*.

estranged from the male/female educational ratio. This is a global scenario, with few exceptions (the European country of Portugal is one of those, for example).

There are explanations, of course. There is absolutely no subject in the world where one cannot present explanations, and sometimes these explanations are even supported by facts. Facts, nevertheless, must be retrieved from reality (through measurement, for example). The data gathered should be checked for its soundness, then assessed and the testing tools pre-calibrated, properly framed within former and obtained knowledge, and even transversally analyzed for a clearer understanding of its meaning per context and per whole. The limits of science are the limits of data retrieving and insightful probing, while the limit of the scientist relies on being able to understand the fine line between data and facts.

Recent years have witnessed new proposals for data retrieving and research, namely regarding the use of data gathered from speculative creation (literary, for example), as a first step in developing models to predict socio-educational scenarios or even assess the degree of concern that present day situations should arise (Moura et al, 2018a; Moura et al, 2018b; Moura et al., 2019; Moura et al., 2020a; Moura, Barreiros, & Cordeiro, 2020b). In the present work we set out to explore the current STEM situation regarding the education of girls and women, resourcing these models, and cross-referencing them with recent Alternative History (AH) methodological approaches for detecting the

key factors that might have eluded us through other methodologies (Frade, 2021). Through this investigative strategy, we aim to determine, in a prospective approach and through a case study, how to address the present-day issues within the problematic and narrow down the situations to divergent possibilities that intersect the status quo, the past, and a more balanced future from an inclusive perspective regarding women and STEM.

The present work is structured in the following manner: **Starting over:** Introduction, where the general approach, objectives and context are presented; **Clio, Thália, and Melpomene:** methodological approach and resources, where a detailed explanation of the models, its development and the input materials are described; **Beware of the ides of March:** a quantic model for STEM assessment, with the implementation of the model for the chosen case study of speculative input versus the present state of STEM regarding women and girls; **Chaos is a ladder:** solutions and recommendations where we explored possibilities regarding both the development and implementation of these models and their contribution for preventing situations, namely resourcing to Alternative History; **As Tears in the Rain:** Conclusions, which summarizes the main aspects of this work.

As far as we know, it is the first time that not only these types of models have been applied to the STEM context regarding Female Education, but also cross-referenced with AH techniques.

2. Clio, Thália, and Melpomene³: Methodological Approach, Resources and Data

[...] it is the mark of an educated person to search for the same kind of clarity in each topic to the extent that the nature of the matter accepts it

— Aristotle, 'Nicomachean Ethics' 1 1094a.181

As already stated, this work will resort to novel methods, not only in terms of the prediction and assessment models, but also regarding the gathering, selection, and classification of input data for those models. These proposals have a background in other models (namely educational), and several postulates to sustain their development. In addition, the models also propose specific tools and input data that is not a household name in scientific data. As such, a brief summary of these aspects is made, before elaborating the resources and data retrieval for the STEM assessment and prediction regarding the situation of both women and girls.

2.1 Adding a New Partner to Logic and Experimental Testing

The purpose of this work is not to get into a deep discussion about the foundations of science and of more than proven methodologies, but to approach some probing aspects with new perspectives. We are doing this so that we can explain the novel methodologies that can add new assessment, measurement, and

predictive tools to the investigative domain. As such, examples will be detailed within the context, not elaborated for an epistemological discussion.

Even a casual browsing will give us a reasonable definition of what science is in a way that can be accepted in general terms, both by scholars and anyone else. The online Oxford Learners Dictionary will state that science is "knowledge about the structure and behavior of the natural and physical world, based on facts that you can prove, for example by experiments"⁴. And as such, the key terms regarding what is scientific are defined, i.e., facts, testing, and the logical coordination between the previous two, in a manner that allows insights into reality that are the basis of science. As is the case with most definitions, this one is fluid and can also evolve. But logic construction (inductive, deductive, etc.) added or versus experimental data are the two main routes for gaining this insight, through a structure that can be assessed by anyone, anywhere, anytime.

As it is obvious and is also acknowledged both by the academic and scientific community, logic and experimentation have their limitations. For example, experimentation is largely dependent on the measurement apparatus, as these can provide the reliable data regarding independent and dependent variables. If one cannot directly or indirectly measure a variable, other techniques need to be added to the research. Logic, namely classic logic, in broad and by no means absolutely inclusive terms, is limited by the true/false quality of assumptions and statements, and

³ Reference to the Greek muses of History, Comedy and Tragedy respectively.

⁴ https://www.oxfordlearnersdictionaries.com/definition/american_english/science

how these affect the relationship one can establish between these statuses. In both, we have the human aspect. The physical and natural world and the insight we gain regarding how events, macro or micro, social or inanimate, of matter or energy, or whatever, work at their core and correlate with the surrounding reality are mixed with human perception (Peterson, 1968). By language and symbols, if one does not want to go much further.

So, one can consider that the neuro-capacities of humans and the intelligibility they have regarding the natural and physical world are interconnected with scientific and academic research and research methodologies. And neuro-capacities can go a long way. And some tend(ed) to be discriminated when regarding others, such as logic and mathematical abstraction *per se* that have a long-time span of social appreciation. Imagination is one of those capacities.

At present, it is becoming more and more accepted that the imagination is building a strong case in becoming a serious subject, albeit the playfulness associated to its nature and outputs. In fact, as a survival capacity that allows the cognitive advantage of preventing and correcting real situations, i.e., the matter-of-fact multivariable ontological condition for a given state of the physical and natural world (Fuster, 2013). More recent works strengthen this, indicating that the imagination can be two-fold in neurocognition as far as involuntary and voluntary imaginative ability are concerned and that these differences might be able to explain elusive aspects of its internal mechanisms (Vyshedskiy, 2020)

And it is in, by and through the imagination that Moura et al. (Moura et al., 2020) built a theoretical

framework for the novel prediction models. The authors assume several postulates, which can be broken down and expanded in the following manner:

1. Imagination, as logic and observation, interacts with (at least) parcels of the physical and natural world.
2. Imagination integrates those parcels into hypothetical scenarios and reorganizes their causality and/or correlation (voluntarily, via creativity, or involuntary, via dreams (Vyshedskiy, 2020)).
3. Imagination provides insight via these hypothetical scenarios, which allows identification, classification, prevention, or correction of parcels of the natural and physical world.

So far, these seem obvious and even commonplace. But the authors pick these postulates to propose the following: that imagination and its tangible outputs (e.g., literary and artistic works) can be used as material to begin data gathering and selection in predictive models. Furthermore, this assumption declares that the prescient nature of many literary works relates to the neuro-capacity of the writers not only in imagining plausible scenarios, but also in being akin with social minutiae around them. Therefore, by being incorporated in these scenarios anticipates its crescendo until it becomes a new paradigm in the social and even natural world (Moura et al, 2018a; Moura et al, 2018b).

A particular field where this could be tested is the science fiction genre, namely dystopias. Subsequently, they proposed this type of work to probe data from independent and dependent variables on a particular aspect that was extracted and then integrated into models that

would allow them to assess how close or far off the present-day status quo would be from the dystopic proposal.

Moreover, added value could be given to the predictive models by incorporating the time-variable by resourcing to networks and graph theory, and even a possible measurement tool for the critical mass of a system regarding a given variable through quantum chemistry models (Moura et al., 2019; Moura et al. 2020a; Moura et al., 2020b).

However, for the purpose of the present work, we will focus on the basics of the methodology, i.e., the extraction of data from speculative/literary fiction works, and the principles for the status quo versus dystopia evaluation.

2.2 Extracting Data

There are three phases in the extraction of data from speculative fiction stories. First, one defines the theme that is going to be investigated. For example, the theme can be the use of drugs, such as Ritalin, to obtain normative behavior in classrooms (Moura et al., 2020b; Moura et al., 2018a). With this as guiding axis of selection, the speculative fiction body of work is surveyed and the works that approach the use of drugs explicitly and/or implicitly to gain normative behavior are chosen (e.g., *Brave New World*, of Aldous Huxley (Huxley, 1932), or *Beyond Bedlam*, by Wyman Guin (Guin, 1951), which are two classics).

The selected works are read and analyzed.

INTERNATIONAL CONFERENCE
PATHOLOGIES AND DYSFUNCTIONS OF DEMOCRACY IN THE MEDIA CONTEXT II

UI UNIVERSIDADE BEIRA INTERIOR

EDUCATIONAL SUPERAVIT: Humana Rights versus Education policies

MATERIAL & METHODS: Collecting data from the Imaginary

Story	Substance Effect	Individual Effects	Social Effects
Beyond Bedlam	Elimination of agressiveness	Schizophrenia	Absolute conformity to ruling institution
Metaquine	Emotional inhibition vs. brain performance	Deterioration of individual personality	Cyberaddiction, refusal for physical existence
Fast Times at Fairmont High	Cognition enhancers	Addition	Creation of new social outcasts

Ana S. Moura, João Seixas, M. Natália D. S. Cordeiro, João Barreiros
5/28

Presentation Overview

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Conclusions and Future Perspectives

Table 1: Example of data extraction from three speculative fiction works: Fast Times at Fairmont High, Metaquine, and Beyond Bedlam (Vinge, 2001; Rouiller, 2016; Guin, 1951). The variables extracted are substance effect, individual effects of the substance in the dystopia, and the social effects of this dystopian status quo (either intended or side effects). Note: The table presented here is as it was originally viewed by the audience in the 2nd International Conference on Pathologies and Dysfunctions of Democracy in Media Context, Covilhã, Portugal, November 12th-14th 2018 (Moura et al. 2018a; courtesy of the authors).

According to the theme/scope of the investigation, categories of descriptors are established in the second of the three phases of the data extraction process. For example, in the theme of drugs versus normative behavior, the descriptors were substance effect, individual effects and social effects. The three works had material that provided data for these descriptors, as one can see in Table 1.

It should be noted that the categories of descriptors may vary according to the theme of the research. For example, and contrasting with the descriptor categories in Table 1, Table 2 presents other descriptor categories within the context of a different research resourcing to data from speculative fiction. In this case, the theme is the definition of the ethical boundaries of human

enhancement (e.g., exoskeletons, super-brains through drug enhancement, etc.).

In addition, and still concerning the second phase of the data extraction process, the same literary/creative work can be the source for data in different themes and for different descriptors. For example, one can extract data in *Brave New World* (Huxley, 1932) either for the theme of drug use for normative social behavior or the theme of the construction of social castes systems.

The third phase corresponds to the organization of the data extraction in appropriate displaying tools (tables, graphs, schemes, etc.) in order to proceed with the analysis. In Table 3 one can see the summary and connection of the three phases.

INTERNATIONAL CONFERENCE
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Material & Methods

Selected Story	Distopia Premises	Ethics Involved
The Genius Plague, David Walton	Bioorganism increases neurocapacity in exchange of mind dominance	➤ Individual freedom vs. Increased abilities ➤ Individual freedom vs. Mental health
Nexus, Ramez Naan	Nanodrug which links minds together	➤ Racism vs. Integration ➤ Colectivity vs. Individual
Flowers for Algernon (Short story abd novel), Daniel Keyes	Operation increases mental capacity of mouse/disabled man	➤ Emotional maturity vs. Mental capacity ➤ Happiness vs. Ignorance

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Table 2: Example of different descriptor categories (i.e., the descriptors are the premises of the dystopia and the dystopian ethics in this work) for data from speculative fiction, as presented in the 2nd International Conference on Pathologies and Dysfunctions of Democracy in Media Context, Covilhã, Portugal, November 12th-14th 2018 (Moura et al. 2018b; courtesy of the authors). Note: Moura et al are aware that there are typos in the image, but they firmly believe that mistakes and typos are part of the scientific truth and authorized for the reproduction as it was originally presented.

PHASE	OBJECTIVES	TASK(S)	METHODS	EXAMPLE*
1	Selection	Research theme Literary/ creative works	Define perimeter of context/story elements versus research theme — Cross-reference literary/creative works with perimeter r	Perimeter: dystopias where the use of drugs is for inducing normative social behavior
2	Extraction	Definition of descriptors Extraction of data	Define the categories of descriptors versus research theme - Select data for the descriptors per characters and per social context	Main descriptor category: Effects Effects descriptors: substance, individual, social
3	Organization	Selection of displaying tool Organization according to displaying tool	Define the methodological approach Organize according to the research choice of methods	Table displaying the data per descriptors for reduction ad dystopia approach

Table 3: The three phases of the data extraction process from literary/creative works. *For all rows, the literary/creative work considered was *Brave New World* (Huxley, 1932).

2.3 *Reductio ad dystopia*: Testing the Hypothetical

As mentioned above, there are already several possibilities, i.e., methodological tools, to assess social aspects and issues through speculative data retrieved from literary and creative works, including those with time-dependent predictive character (Moura, Barreiros, & Cordeiro, 2020a; Moura et al., 2020b). Notwithstanding, this work will focus on only one, the *Reductio ad dystopia*, the first to be developed, and also the most user-friendly, if one considers the first steps of literary/creative data extraction and its use in social predictive and/or assessment models.

As with everything in knowledge, the new methodological tool did not come from nothing. Starting with the name, it is homage to the mathematical method from which it was inspired, *Reductio ad absurdum*. This is a very well-known method to address situations where more 'direct' mathematical approaches (e.g., deductive, or inductive) might not solve the problem. Given a specific mathematical scenario where its successful conclusion is presented when certifying

if the mathematical statement for solution is true or false, this can be achieved by probing the mathematical solution path through a 'ridiculous', i.e., absurd, hypothetical counterpart solution. As such, you assume the absurd solution to be true and test it in the problem. If the hypothetical absurd statement is proven to be impossible within the mathematical context of the problem, that is, if it is proven to be FALSE, then its counterpart, which will be non-absurd, will be considered to be TRUE and the answer to the problem. So, one has the definition of the problem, the perimeter of the context (not all math problems can resource to *reductio ad absurdum* in practical terms), and the validation of FALSE implies the validation of TRUE.

Reductio ad dystopia considers that some present and future scenarios may be hard to be proven likely or possible through direct approaches (e.g., statistics). As such, one assumes that there is a likelihood of a given dystopia from a literary/creative work (or body of works). One departs from the premises of the chosen dystopia, which is the analogous of the 'ridiculous', i.e., absurd, hypothetical counterpart prediction

of present and future social scenarios. Operate mathematical functions (e.g., logic constructions or statistics) within the model, and it outputs a scenario that can be compared with reality. Reality itself, within the context, must have

proposes that using this matrix and approach one could understand and even predict which would be the most likely scenario in Higher Education. The matrix is displayed in Figure 1.

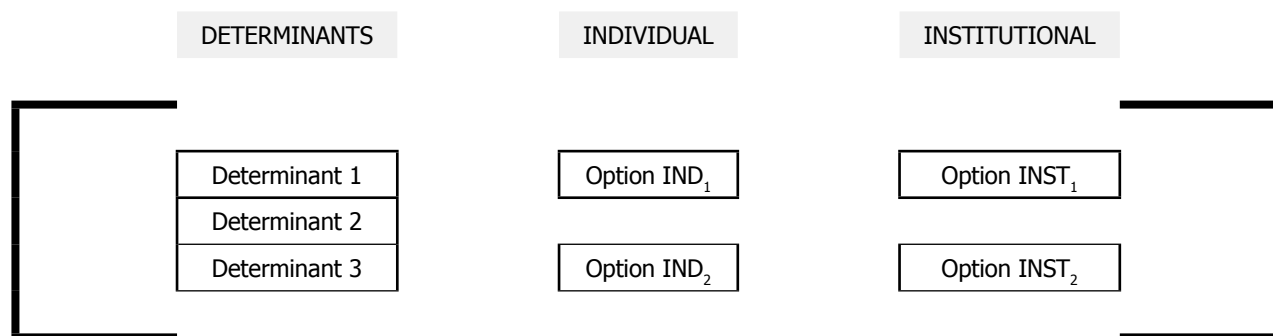


Figure 1: Higher Education Quantum Model Basic Matrix (original image for a reformulated matrix, based in Figure 1 from Marquez-Ramos and Mourelle (Marquez-Ramos & Mourelle, 2018) and Figure 3 from Moura and team (Moura et al., 2020b). In the column of Determinants, there can be as many variables as the research theme implicates. In the column INDIVIDUAL, Option IND1 and Option IND2 indicate the two mutually exclusive options that the variable INDIVIDUAL can choose. In the column INSTITUTIONAL, Option INST1 and Option INST2 present the social/collective consequences or desired/intended scenario that the institutions may present to the individuals.

been reduced to the variables that are the output of the data extraction and treatment of the literary/creative works. Juxtaposing the model versus reality, the closest this juxtaposition may be between model and reality implies that the dystopian scenario is closer to be TRUE. In fact, one can say it implies one is already living in the ‘ridiculous’ scenario.

The displaying of the dystopian and reality scenarios within the sheer *Reductio ad dystopia* is inspired in the Marquez-Ramos and Mourelle Quantum Model for assessing distance learning scenarios (Marquez-Ramos & Mourelles, 2018). This model proposes the reduction of the student’s choices to two options versus two higher education institutions offers, in a 2 x 2 matrix of scenario options, with an added column for the determinants influencing the choices. The model

To explain how the matrix works in practical terms, we will turn again to the work of Moura and co-workers regarding the use of drugs to induce good behavior in education contexts (Moura et al, 2020b). The authors focused specifically on the case of Ritalin for developing the matrix regarding the ‘reality’ scenario. In this situation, the theme is: **achieving good behavior in school**. The individuals are the **parents** (with two mutually exclusive choices: *chemical solution*, i.e., using Ritalin; and *non-chemical solution*, i.e., long-term human intervention – dialogue, therapy, etc), and the institutional has two consequential outcomes, *conformity* (that is, behaved children without human effort), and *empathy* (where the Education environments proposes different possibilities to different social growth rhythms, i.e., incrementing good behavior without simple conformity). The

authors explained that the choice of summarizing the latter institutional option with 'empathy', was not casual. Being the educational context one of a free and democratic society (other types of society were not explored in the model by the authors), the presumption of such societies implies that a majority acknowledges and respects minorities, i.e., there is no conformity in absolute (with exception of fringe situations, as the respect for human life, for example) in values, opinions and behaviors, as these variabilities are integrated in the social tissue. As the characteristics that allow for this feature are respect and tolerance, they summarized it by the global term 'empathy' (though empathy has additional aspects beyond respect and tolerance). On the other hand, the absolute need for conformity erases respect for the difference and ignores empathy. The authors therefore considered the approximation adequate to contrast the institutional options for the matrix purpose.

To complete the matrix for this research theme, one needs to identify the determinants, i.e., the reasons/ underlying causes for the INDIVIDUAL choice. The determinants are not skewed *per se* regarding the choices. One example is the ECONOMIC Determinant. In fact, the INDIVIDUAL, i.e., the parents can choose Option IND1, i.e., resorting to Ritalin, which is a faster way to solve the bad behavior and the parents consider that the economic implications are harder if the solution takes more time, as it would be if Option IND2 were chosen. However, the parents may also consider that by choosing the non-chemical approach to their child's bad behavior at class, the long-term economic implications will be positive for them and the child because non-conformity and slower and empathetic development of good behavior

might foster the capacity to think outside the box, which can be a professional asset. It is clear that this determinant may overlap or be affected by familiar reasons (e.g., low, or high, income). One can see how the matrix will look like for this scenario in Figure 2.

After developing the matrix for the 'reality' scenario, then one constructs the matrix for a 'dystopian' scenario from one or more literary/ creative works. The authors used several works, *Beyond Bedlam* (Guin, 1951) being one of them. This speculative story explores a society in the future where aggressiveness, as well as all negative impulses of human beings are eliminated through drugs. There are two consequences for this achievement through that chemical solution. Socially, one has a permanent state of peace. Individually, all human beings become schizophrenic. In fact, every physical human body is shared by two distinct personalities, the hyperalter and the hypoalter, that have a schedule to assume prominence for five-days shifts. As long as the hypo and hyper alters maintain this balance, there is peace (and conformity) in the world. The story was analyzed, data extracted and the matrix for the dystopian scenario is displayed in Figure 3.

The authors unfolded the INDIVIDUAL options in two columns, for better visualization of detail, and one has two individual options (choosing to maintain conscious aggressiveness; choosing to eradicate conscious aggressiveness), two individual consequences directly related with those choices (schizophrenia as consequence for choosing the chemical solution; non-schizophrenia for choosing the non-chemical solution), and the INSTITUTIONAL, or social/

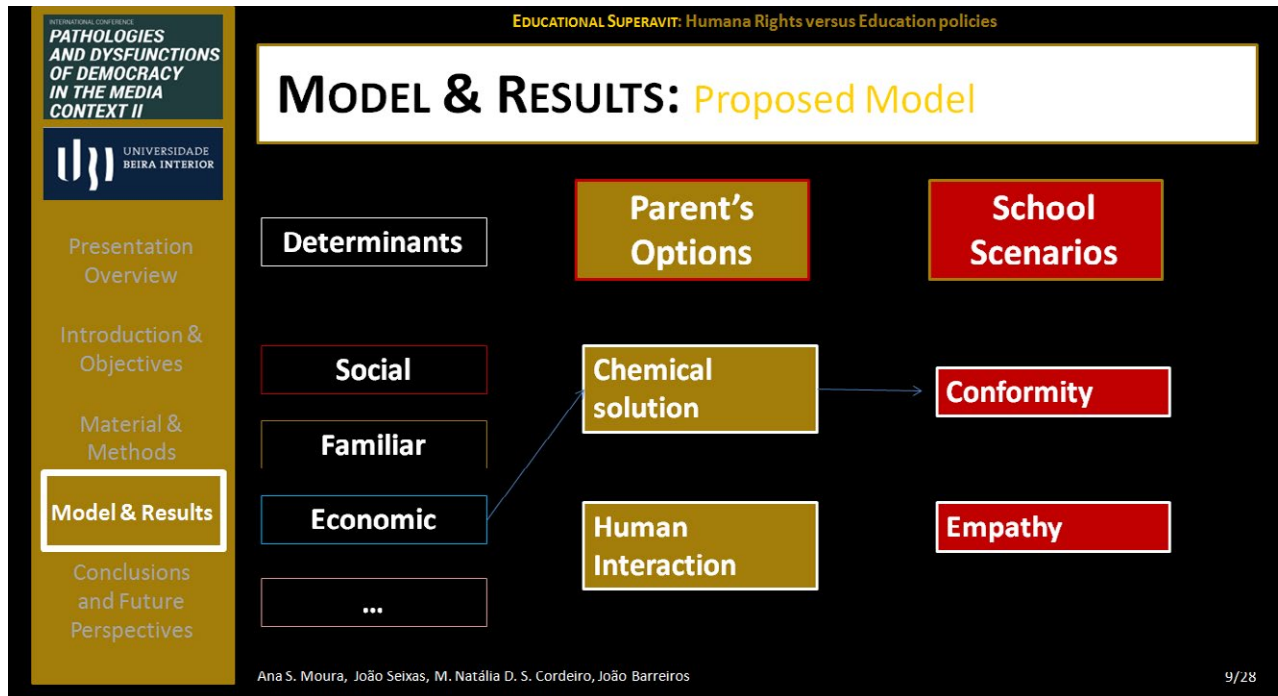


Figure 2: Example of the reality scenario within the Quantum model matrix, as presented in the 2nd International Conference on Pathologies and Dysfunctions of Democracy in Media Context, Covilhã, Portugal, November 12th-14th 2018 (Moura et al. 2018b; courtesy of the authors).

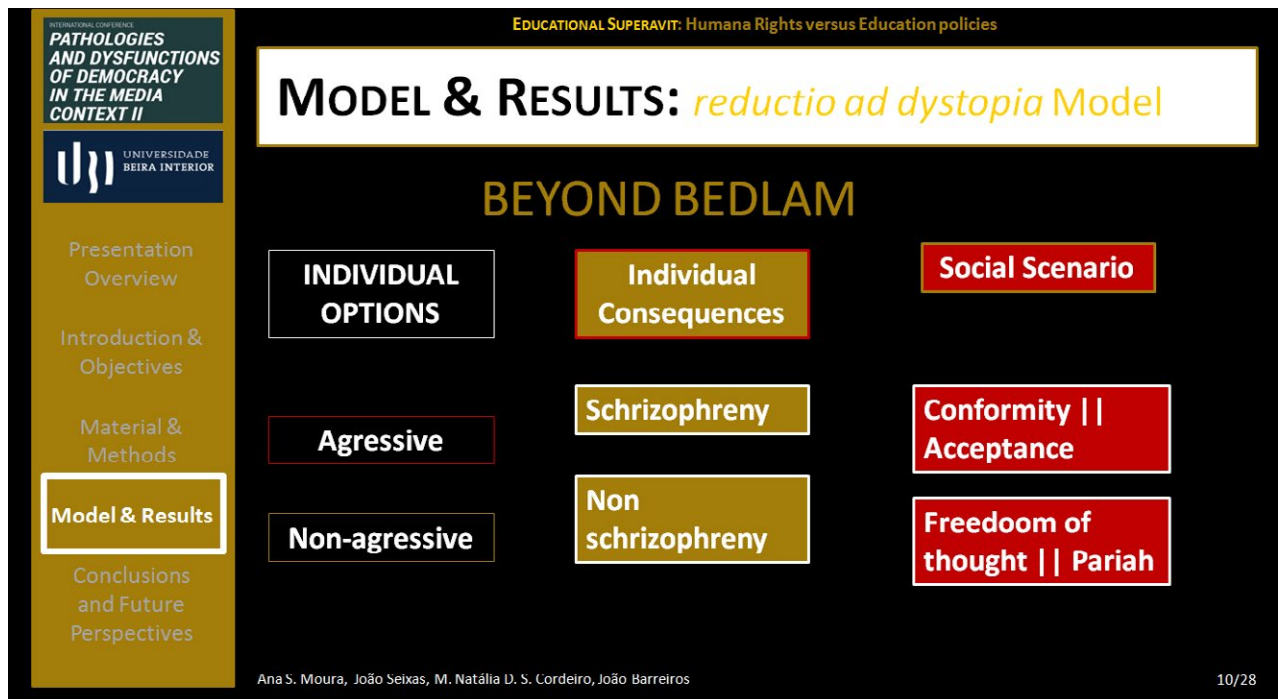


Figure 3: Example of the dystopian scenario, with data extracted from Beyond Bedlam (Guin, 1951) within the Quantum model matrix, as presented in the 2nd International Conference on Pathologies and Dysfunctions of Democracy in Media Context, Covilhã, Portugal, November 12th-14th 2018 (Moura et al. 2018b; courtesy of the authors). Note: Moura et al are aware that there are typos in the image, but they firmly believe that mistakes and typos are part of the scientific truth and authorized for the reproduction as it was originally presented.

collective, options are conformity (and being accepted by society), or freedom of thought (and become a pariah). It should be noted that the INDIVIDUAL options could be aggregated as in the case of INSTITUTIONAL, i.e., the options could be Aggressiveness Maintenance (and non-schizophrenia), for the non-chemical solution, and Aggressiveness Eradication (with consequent schizophrenia), for the chemical solution, while one could unfold the INSTITUTIONAL column as was the case for the INDIVIDUAL. However, in fact, a more objective manner would be simple to state the INDIVIDUAL options as chemical versus non-chemical solution, though what in fact was at stake regarding the intention of drug administration and its individual consequences could be lost. And that is the point of the matrix and the *Reductio ad dystopia* approach, to probe the intentions behind the choices, the individual consequences, and the social framework for the outcomes and the determinants for influencing the INDIVIDUAL options.

Having done this data introduction in the quantum model matrix, the *Reductio ad dystopia* approach juxtaposes the two matrix and analyses the similarity between them. For instance, there is a clear similarity in the social pressure to achieve normative behavior, and that drug use can be a solution for this outcome (though in the dystopian universe it may be generalized as social compulsory and in reality, it is a more 'look in the other direction' generalized social attitude). There are clear psychological consequences in both, albeit that the dystopian story imposes a one hundred per cent mental

consequence for everyone resorting to the drugs, and physical and psychological consequences in the children that had Ritalin administered for normative and calmer behavior may vary from child to child. Interestingly, in both situations, the positive advantage of opting for a solution (and it is a solution, not only letting the problem be) of non-chemical path, is the freedom of thought or possible outside the box thinking capacity.

Of course, there is room for criticism regarding the model, and many of its aspects need improvement. Notwithstanding, and as the authors put it "reality, either physical or social, has a complex nature, which is ungraspable by approximations - but the key in valid models is approximations that can make reality perceivable and forecastable" (Moura et al., 2020b). As such, the *Reductio ad dystopia* approximation, as a risk assessment tool for detecting patterns with alarming consequences (and which) seems an interesting one.

3. Beware of the Ides of March⁵: A Quantic Model for STEM Assessment

The beginning is always today.
— Mary Shelley, dedication in 'Short Stories', vol.2

Reaching the core of this work, i.e., the probing, through *Reductio ad dystopia*, of how far or how close the present STEM girls and women status is from dystopian scenarios, one cannot help but say how appropriate it is, that the examples used in the explaining of the methodological

⁵ Reference to Shakespeare's famous expression said by a soothsayer to Julius Caesar in the eponymous play.

approach regard the use of drugs towards social normative behavior. STEM fields have always been regarded as logical, analytical, and objective fields and women and girls are regarded as a far cry from these fields throughout the ages. And when we as human species have reached a global life expectancy of approximately seventy-three years, that implies that we, as a whole living body of walking memories, are not very far from the times where women were classified in many cases as hysterical, due to emotional attitudes, and drugs were one of the social accepted resources to induce normative behavior.

This approach will follow these consecutive steps: choosing a piece of work (as a case study) or a body of works of speculative fiction from which data will be extracted; construct the dystopian matrix, based on those speculative fiction works; construct the reality matrix, based on OECD reports regarding STEM; juxtapose the matrix; analyze the juxtaposition; conclude.

3.1 Dystopian Classic and Data Extraction Case Study: *Brave New World*

There is abundant and diverse material to choose a speculative / creative work (or works) to approach the STEM theme from. However, we must take into account that as the *Reductio ad dystopia* is a new methodological tool, it is likely to provoke unease in the first moments of interaction and the focus in a single work, and a classic will be more effective. And by classic, we mean in time and in mainstream perception.

Brave New World (Huxley, 1932) fits perfectly into this reasoning. It is a familiar classic for

several generations and controversial from the publication to the present and it even had a recent audiovisual adaptation in the Peacock streaming service in 2020. Moreover, it was written in a period where technology and totalitarian states were intersecting and social paradigms, as the role of women was being increasingly questioned.

The story premises are simple: *Brave New World* is set in a society that has peace and order and where everyone is happy. Everyone is happy because they have no repression to instincts, as religious institutions and families no longer exist (e.g., babies are developed in incubation and conditioning centers by nurses), and they all enjoy what they are assigned to do in life (e.g., if they belong to the Delta caste, they are conditioned, through electric stimulation, to abhor books and botanics, and to appreciate what they will have to carry out as profession), which, as stated by the director of the London facility for incubation and conditioning, is the secret to happiness and virtue, to make people appreciate the social destiny they cannot escape from. And, in the eventuality that people might feel sad or depressed, there is an inexhaustible supply of drugs to counter that. In fact, to avoid the slightest possibility for those states of mind, a specific drug is continuously available and encouraged on a daily basis, the soma. And to guarantee there will never be cause for disruptive thinking, history does not exist. Or is not taught, which ends up being the same in practical terms. As Mostapha Mond (one of the leaders) says, stability is the ultimate need. There is no civilization without social stability and there is no social stability without individual stability. And stability is achieved also

through a caste system. There are the Alphas and the Betas, which retain intellectual and leadership capacities, and the other remaining castes that do not. Where do STEM and women appear in the *Brave New World* context?

It is where they do not appear that can allow us to extract data for the matrix. There are no Alpha women that are noticeable, and one of the female characters that is given more room and importance, Lenina Crowne, is a Beta. Women can take on many roles that are associated with STEM education, such as laboratory technicians, but they do not become leaders. They are praised, but do not rise beyond a certain level in the chain of command. At least, not in so much that you can find it relevant to affect and direct the institutions. The STEM education in girls and women context is therefore directed towards specific professional ends that are allocated to them before they are even born. Though this happens to everyone in that society, and there are male Beta laboratory technicians in the story, the fact is that there are several (literal) Alpha male characters, one of which will free himself of the conditioning of this society, Bernard Marx, who take on leadership and intellectual roles, while also being associated with STEM education. One is unable to find that type of status for any woman in the story. There is no explicit reason in the story for this, but there are several studies regarding the minor and/or secondary status that women have in the *Brave New World*, something that goes beyond simple aspects of STEM education and professions (Eylem, 2018; Madden, 1992). As the particulars of women education and

STEM *per se* are not the focus of the story, one must allocate the same consequences to women trying to achieve different professional and social paths regarding the Beta or lower caste definition they are destined to, which includes the education that they are provided with. As such, in this dystopia, an individual, regardless of its gender, can submit to the premises of the totalitarian society, i.e., accept the caste systems, the life path it is attributed while the individual was still an embryo, and the resource to drugs to maintain a happy and subservient state to the social indications of normative behavior. If the individual chooses to rebel, the consequences would be exile in harsh conditions, and social ostracization. Applying this to the analysis made regarding STEM education, that would mean that if a woman would refuse to stay in a subordinate role in the STEM path (e.g., would aim for leading the laboratory instead of being the technician), then exile would follow.

Therefore, one can construct the dystopian matrix as displayed in Figure 4.

The main determinants in *Brave New World* are social factors, which starts before the individual come into being, and the dependence one gains from the pleasure that soma gives, i.e., a hedonistic motivation.

3.2 Thou shall not pass⁶: the present status of STEM

The context of STEM education and gender gap have been object of study and research for many years, and one has a lot of data available

⁶ Pop culture catchphrase used in reference to Gandalf's defiance when facing a Balrog in J.R.R. Tolkien's *The Lord of the Rings* trilogy.

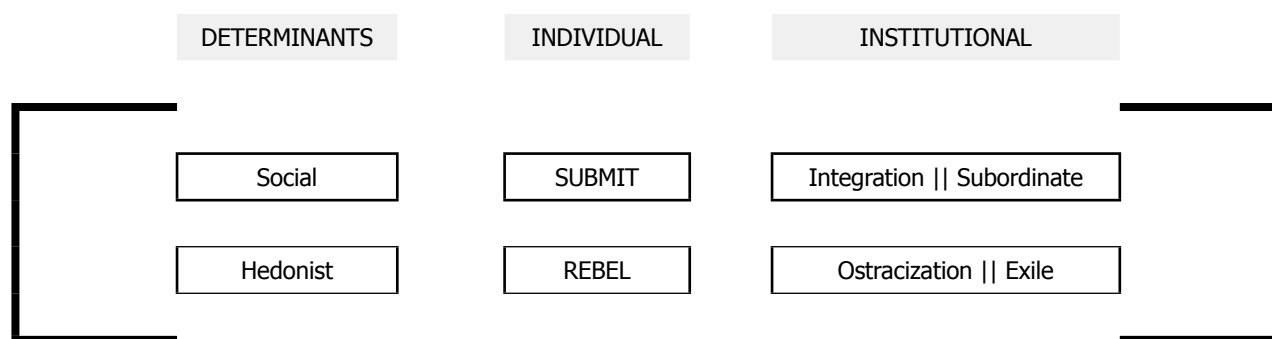


Figure 4: Dystopian matrix for *Brave New World* regarding women and STEM education.

to extract the input for the reality matrix. For the purposes of this work, we will focus on one publication (Stoet & Geary, 2018) that analyses why girls do not choose to pursue a science career, based on the results of the OECD Program for International Student Assessment (PISA) (OECD, 2016; OECD, 2019). In addition, some recent statistic data will also be considered. However, it should be noted that there is not an absolute answer to this question at present. The matrix will be constructed by cross-referencing the reasons for the gender gap in undergraduate students and the current state of affairs regarding women in STEM careers.

67 countries participated in the PISA 2015 and gender differences with statistical significance were found in 41 countries. In particular and regarding outperformance in science, girls were prominent in 19 countries, while boys surpassed girls in the remaining 22. However, girls consistently excelled in comparison with boys in reading, compared to their all-subjects average, while boys were stronger in mathematics and sciences when comparing with their all-subjects average. This aspect is pointed as one of the reasons for girls not choosing STEM, as they would focus on what they excel at by comparison, i.e., their specific strengths, instead of

simple outperformance, something that could offer analogous explanation for the choice for STEM studies regarding boys.

Interestingly, the countries with greater gender equality were those where boys expressed self-efficacy, enjoyment of and broader interest in science than girls, though the authors noted that the percentage of girls in the pool of the high performers with likelihood to complete a STEM degree was higher than the actual percentage of STEM female graduates (41%). This percentage shrank when the authors cross-referenced the high performers with good expectations of success in STEM graduation with the relative strength in science and mathematics (which was statistically where boys had higher percentage), reaching a third of the girls. In other words, though there is a percentage of 41% of girls with high performance in science and math indicators and with a good expectation to succeed in graduating in STEM courses, only 34% are expected to do so when cross-referencing it with their relative academic strength where there is consistent evidence that girls consistently outperform boys at reading. Even so, this expectation percentage is still higher than the actual percentage of women graduating in STEM courses. The fact that girls excel

at science and non-science subjects, but particularly outperform by comparison with the non-science subjects, might explain in part the gap. If boys performed better at reading, it could mean that they would choose a higher percentage of non-STEM courses as well (Stoet & Geary, 2018).

The small percentage of actual women could help explain the low percentages of women in board positions in STEM-related industries, namely as CEOs and in the research workforce, if it was not for the fact that the percentage is not proportionate, rather much smaller. In fact, it is even smaller if you consider the percentage of worldwide STEM researchers, approximately 29% (UNESCO, 2019) versus the percentage of women in board positions and as CEOs in STEM-related industries, which are 19,2% and 3% respectively (CSRI, 2021; MSCI, 2020). As such, it is likely that the professional prospects beyond graduation can affect the choice of girls when choosing STEM courses in higher education institutions.

Thus, as far as determinants go, it is difficult to narrow them down to a range as small as in the dystopian matrix. One has the social and

familiar factors, but also the economic factors that a successful professional path brings and the hedonistic aspect of choosing courses that you can enjoy and feel fulfilled in. Not to mention having a good state of mental health; something that can not only be achieved by avoiding problematic or toxic work environments, but also by pursuing what you feel passionate about. As one can see from this last determinant, they are unbiased, as the same determinant can imply different choices.

As far as INDIVIDUAL options are concerned, one has the 'safety' of a course/professional path where you have strengths by comparison, or the 'risk' of taking the other exclusive route. The INSTITUTIONAL (being INSTITUTIONAL understood as the professional environment after a Higher Education graduation) options are the integration of women with STEM graduation in the present status quo, i.e., with mainly subordinate positions, or a solitary path either for prominence or irrelevance.

Therefore, one can construct the reality matrix as displayed in Figure 5.



*According to the percentages

Figure 5: Reality matrix for the STEM-related careers and studies context of women.

3.3 We're not in Kansas anymore, Toto⁷: applying *Reductio ad dystopia*

Once you have constructed the reality and dystopian matrix, you must juxtapose them and critically compare similarities and differences and then extract a juxtaposition matrix. The more similar the juxtaposition matrix is to reality, the closer one might be to the dystopian scenario. The visual juxtaposition is displayed in Figure 6.

The easier part of extracting the juxtaposition is the sheer similitude identification, as in the case of determinants 'Hedonist' and 'Social', and INSTITUTIONAL Option 'Integration ||

Subordinate'. In these cases, there is an exact match. As such, one can place them as result in the first and third column, as displayed in Figure 6. However, the remaining variables imply a closer look in order to understand how to extract the juxtaposition results.

To complete the column of INSTITUTIONAL option, the common ground of the dystopian 'Ostracization || Exile' and the reality 'Solitude || Irrelevance' must be probed deeper before being established. One does not get exiled or downright ostracized by society, for most of countries, if you are a woman and choose a STEM career, and therefore those dystopian

	DETERMINANTS	INDIVIDUAL	INSTITUTIONAL
Dystopia	Social	SUBMIT	Integration Subordinate
	Hedonist	REBEL	Ostracization Exile
Reality	Social	SAFETY	Integration Subordinate
	Hedonist	RISK	Solitude Irrelevance
	Health		
	Economic		
	Familiar		
<hr/>			
Juxtaposition	Social	NORM	Integration Subordinate
	Hedonist	EXCEPTION	Solitude

Figure 6: Juxtaposition of the reality and dystopia matrices and extraction of the juxtaposition matrix, presented below the line (in a visual analogous to a 'sum' operation).

⁷ Reference to the famous quote by Dorothy in the film *The Wizard of Oz*.

aspects do not apply to reality (in some countries, at least). Nevertheless, ostracization and exile imply solitude, social in the first case and geographical/cultural in the second, and that can meet the 'Solitude' aspect in the reality

choice of a group, is the juxtaposed element to be added in the second column. With these, the juxtaposition matrix is completed and is displayed in Figure 7.

The juxtaposed matrix matched in sheer sim-

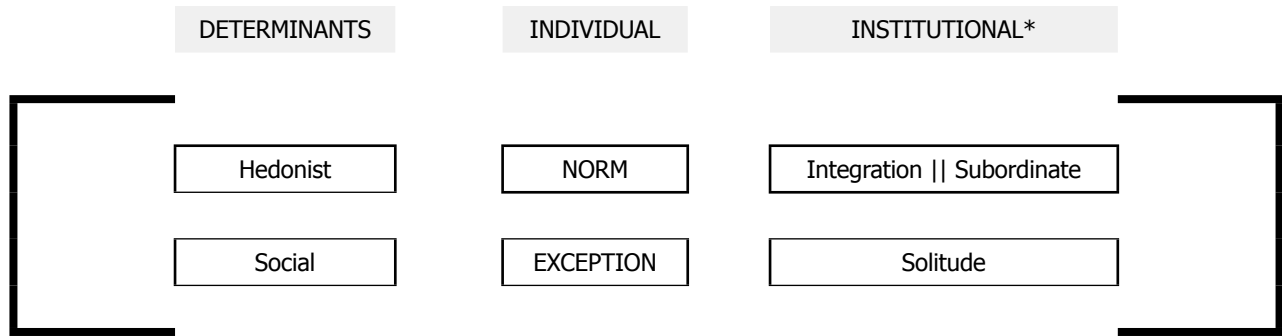


Figure 7: Juxtaposition matrix, extracted through sheer and meaning similarity with the reality and dystopia matrices.

matrix. As such, that is the one chosen to complete the institutional column of the juxtaposition matrix. As such, the 'Solitude' aspect was selected as a juxtaposed element not by sheer similarity, but by meaning similarity.

Finally, the INDIVIDUAL options for dystopian and reality columns are Submit vs. Rebel and Safety vs. Risk, respectively. Again, in the absence of a sheer similarity, one must resource to an analysis of the meaning of these options and extract, if there is one, a meaning similarity to identify the juxtaposed element. As in both the Safety and submit options there is a normative feature, the option is to consider the juxtaposition as 'Norm,' while, and either in dystopian scenarios or reality, the 'Rebel' and 'Risk' paths represent the exception or divergent path to the norm. Therefore, Exception, in the sense that it does not statistically reflects the majority

ilarity the reality matrix in two determinants and one INSTITUTIONAL entry, while it matched through meaning similarity the two INDIVIDUAL entries and one Institutional entry. Therefore, there is a reasonable resemblance between the reality and dystopian scenarios.

3.4. This is going to be legen – wait for it - dary⁸: *Reductio ad dystopia* results

Before discussing the results of the *Reductio ad dystopia* methods, we would like to remember some points we made throughout this paper. First, the *Reductio ad dystopia* is a tool and provides an assessment/predictive model, and models, by definition, are approximations for the reality, not a full representation of reality, which is always more complex. Therefore, *Reductio ad dystopia* and the conclusions one draws from it, as well as the

⁸ Pop culture catchphrase of Barney Stinson, a character of the TV show *How I Met Your Mother*.

ones one draws from any other model, should be taken with a pinch of salt, and not interpreted as having an absolute character. In spite of this, they should not be despised either, as should not those of other models, just because they have no absolute character. Reality, and social reality in particular, rarely has an absolute character for all variables it comprises, everywhere, everyone, all at once.

Secondly, *Reductio ad dystopia*, as well as the novel methodologies regarding data extraction and operations from creative and literary works, as all pioneering approaches, is a work in progress, which shall necessarily need adjustments. But as all other pioneering approaches, the fact that it will most likely evolve into an extremely different model does not withdraw merit to the primeval tool, nor does it withdraw soundness to the conclusions. As in all novel methods and approaches, soundness can only be found in resonating with the reality and experimental data. That should be the parameter to assess the initial tool. Finally, particularly in girls' and womens' STEM education and career-related themes, reality itself still seems to provide few answers, as the original approach of social gender equality will automatically guarantee the gender equality in STEM does not seem to be an axiom, as the recent studies have evidenced (Stoet & Geary, 2018).

That being said, the analysis of the juxtaposition matrix should sound a bit of an alarm, if one did not take into consideration that one or two decades ago, the juxtaposition would have been higher in some countries. The fact is that the method seems to indicate that the reality is getting further away from the dystopian scenario, though that might

not happen in a homogeneous cultural and geographic distribution. Nevertheless, it does not mean that it will continue to do so, either in those countries, or in all others because the determinants are the important variables that affect the decision and they not only present a fluid nature, but also aspects that need further study (e.g., the countries where gender equality is inferior, statistically present a higher percentage of women following STEM-related graduations). However, there could be an emerging red flag from the juxtaposition matrix, which is the 'Solitude' consequence. The individual cost of choosing 'Exception' that results in eventual individual loneliness could be an aspect to be added to the study of STEM gender-related issues.

4. Chaos is a ladder⁹: Solutions and Recommendations

I keep turning over new leaves, and spoiling them, as I used to spoil my copybooks; and I make so many beginnings there never will be an end.

— Louisa May Alcott, 'Little Women'

There are two main aspects regarding the conclusions that one can draw from resourcing to *Reductio ad dystopia* in the women and girls in the STEM context. The first is, obviously, how to further refine the tool and probe deeper into the theme through speculative data. The results of the *Reductio ad dystopia* technique can be cross-referenced with the graph application for data extracted from speculative and creative works, which will allow for a longitudinal analysis (Moura et al., 2020a). The resource to

⁹ Reference to Littlefinger's response to Varys in the TV show *Game of Thrones*.

mathematical and statistical models used until now by natural and exact sciences, such as quantum chemistry has allowed us to explore some details in the individual options and consequences, as well as the tipping point in social situations (Moura et al., 2020b; Moura et al, 2019). And obviously, the *Reductio ad dystopia* and the principles for construction of the matrix it is based on, need refinement and improvement, especially regarding the column of determinants.

The second is how to determine the key events that could explain those differences and the current state of affairs in the research theme by altering some of its aspects. Regarding the latter, another interesting approach could be cross-referenced with the *Reductio ad dystopia* technique. Alternative and Alternate History (AH), though still perceived as a creative and playful field by many academics, can provide an interesting perception to factual history (Rosenfeld, 2002; Hellekson, 2000; Singles, 2011; Evans, 2014). In fact, AH approaches have recently begun to be introduced as a methodological tool in fields as diverse as Medicine or Management. In 2021, the publication of a work in the context of women, gender equality and STEM education, resourced to AH as a technique to identify both the key chronological moments, whose historically divergent path could have altered the present-day STEM context, and the factors underlining those moments (Frade, 2021).

Three key moments which could explain the social aspects of gender inequality in STEM careers were identified as the Industrial

Revolution, World War II, and the 80s. Interestingly enough, each of them is closely related with programming. In the case of the Industrial Revolution, the absence of incorporating the emergence of programming in the suffragist movement could have paved the way for averting women from STEM careers in the transition between the 19th and 20th centuries. In fact, as Ada Lovelace, the prominent female figure in 19th century programming emergence was also related to the 'reading' / literary field, being the daughter of famous poet Lord Byron, this could have also dealt with the comparative strength that might have inclined women towards non-science subjects instead of science. In World War II, women entered tech related jobs en masse, such as learning and operating machines, while men were in the battlefields. However, their role was hardly mentioned and therefore does not capture the imagination and interest as it would if it was part of the shared conscious memory. Once again, the feminist causes were not particularly linked to tech and STEM contexts, and so the awareness was minimal. To top it all, in the 80s, the important STEM-related accomplishments made by women (e.g., the development of ARPANET) were never communicated with as much enthusiasm as those from men.

Therefore, the inclusion of these key moments in a *Reductio ad dystopia* approach, as well as the aspect of women's accomplishments not only vanished from the historical narrative, but also from pop culture references (e.g., movies, books). The reality matrix could aid in exploring the research in this field.

5. As tears in the rain¹⁰: Conclusions

Even miracles take a little time.

— Fairy Godmother, Cinderella (Disney's movie, 1950)

The present work approaches the problematic of gender inequality in STEM-based careers and education through the novel techniques of *Reductio ad dystopia* and data extraction from speculative and creative works. These techniques were explained in detail by resourcing to practical examples, and then applied to probe the closeness of the present-day STEM-based careers and education for girls and women with the *Brave New World* dystopian scenario, published by Aldous Huxley in the third decade of the twentieth century.

Through this analysis, it can be considered that the recent status quo scenario, while being a source for concern, is nevertheless becoming more distant from dystopian scenarios, such as those of the classic *Brave New World*, at least in some countries. Nevertheless, the emotional burden that can be weighed upon a woman or girl when choosing a non-conformative path may affect the gender inequality even more in the long run. More analysis regarding this aspect and resourcing to other speculative works, should be made in the future.

In addition, cross-referencing it with recent investigations that resourced AH techniques, novel aspects to be included in the *Reductio ad dystopia* were identified. The novel techniques provide an added tool to the study of women, gender inequality and STEM. More

investigations regarding this aspect might also include a longitudinal analysis, time-dependent cross-referencing it with the proposed models resourcing to speculative fiction data extraction.

Acknowledgments

This work received financial support from Fundação para a Ciência e a Tecnologia (FCT/MECS) through national funds (UID/QUI/50006/2020 - LAQV@REQUIMTE). Ana S. Moura also thanks FCT (Fundação para a Ciência e Tecnologia) for funding through the Scientific Employment Stimulus - Individual Call CEECIND/03631/2017). The author would also like to express her gratitude to Professor João Carlos Ferreira Correia who provided her and her co-authors with an opportunity to present the novel methods for speculative fiction data extraction at the 2nd International Conference on Pathologies and Dysfunctions of Democracy in Media Context, Covilhã, Portugal, November 12th-14th 2018.

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¹⁰ Reference to final part of the monologue by the last surviving rogue replicant, Batty, in the movie *Blade Runner* (1982).

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The background features several overlapping, semi-transparent purple shapes of various sizes and orientations, creating a layered, abstract effect. A large white shape, resembling a stylized letter 'L' or a thick bracket, is positioned on the right side of the page, partially overlapping the purple shapes.

Spaces in deconstruction:
an experience report
on transgender
employability in the area
of computing/technology

Spaces in deconstruction: an experience report on transgender employability in the area of computing/technology

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Abstract

The computing market is booming, even with the event of the global SARS-CoV-2 pandemic. The fourth Industrial Revolution further highlighted the area of technology, increasing its need within companies. Companies, in turn, have sought to adapt to the demands of the time by training their employees for the new moment of technology and recruiting people. In parallel with this scenario, other debates have also influenced cultural change movements within business companies, albeit on a smaller scale. This is the case of diversity management, which brings with it the need to think about inclusion and management of diversity groups through identity and their particular challenges, such as the group of transgender people. This group has also promoted global debates in the last century on gender issues that have been reflected in significant changes in society, mainly from the discussions accentuated by the queer trans-feminist movement. However, the issue of transgender employability does not seem to move positively as discussions on

diversity advance and the technology market is receptive to them. In view of this, the following research question was articulated: what are the difficulties to insert and maintain transgender people within the technology market? This article seeks to answer this research question through semi-structured interviews with transgender people working in the field of computing. The analysis of these interviews will be articulated with queer trans-feminist theories and systematized through a thematic map. The main objective is to expose the difficulties and potentialities found for the inclusion of transgender people in the labor market in technology and suggest reflections based on the identified indicators.

Keywords: Inclusion; Transgender; Diversity; Employability; Technology; Remote work.

Introduction

Diversity, employability, transgender identity, fourth Industrial Revolution, remote work

and the pandemic (SARS-CoV-2) are all complex subjects. The intersection of these subjects adds an additional layer of complexity to their analysis. Although discussion regarding these subjects could be considered contemporary, it does not necessarily constitute a new debate. According to Chanlat *et.al* (2013), discussions on diversity, for instance, have been systematically performed since the ending of World War II due to the inclusion of women in the labor force. The transgender question has gained increased notoriety since the Stonewall riots and more recently with the debates on Queer culture (Miranda, 2020).

However, when observing the question of employability for transgender people in Brazil, it is possible to notice the discrepancy between the labor rights acquired in recent years for cisgender and transgender women. Discussion on transgender rights is still characterized by topics such as dignity, survival guarantees and the minimum rights for all persons set out in the United Nations Organization's declaration of human rights, but that for transgender people in general are still precarious, as noted by Bento (2014).

The popularization of IT jobs has nevertheless broadened opportunities and life change possibilities for historically marginalized diversity groups. Coupled with the intensification of remote work, the IT sector has gained even more relevance since, according to Ford & Serebrenik (2019), software development companies and consulting firms in the USA are more familiarized with remote work dynamics.

According to Xu *et. al* (2018), the fourth Industrial Revolution "describes a world where

individuals move between digital domains and offline reality with the use of connected technology to enable and manage their lives". This moment, together with the advent of IT, has driven companies to rethink their work models, mainly regarding territoriality and culture (Araújo & Lua, 2021). Remote work is not purely a SARS-CoV-2 product, but we are able to infer that it was intensified in scale by the pandemic, which forced companies to establish protocols for work in domestic environments.

In the process of rethinking organizational culture and environment, diversity has gained emphasis, be it by demand of certain sectors of civil society or the understanding of the business advantage entailed by diversity in companies. As a result, companies are intentionally seeking to perform affirmative action and diversity management in order to include diversity groups such as women, black and transgender people.

A civil initiative in Brazil, EducaTransforma¹¹, signs transgender people up for an IT education program, aiming at improving their employability in areas such as networks and infrastructure, DevOps, front-end and back-end development. This program works in partnership with educational institutions and technology companies' way of encouraging tech training and recruiting transgender people.

However, reflecting on transgender people's employability, provides challenges of its own. Analyzing the implications of remote work and its nuances in relation to reconciliation with domestic duties, for example, has always been a challenge for the women historically linked to this occupation (Araújo & Lua, 2021).

11 website: <https://educatransforma.com.br/>

Accordingly, this work is concerned about understanding the relationships between transgender employability in the IT markets, its challenges and opportunities. Our main objective is to expose the difficulties and issues found in the insertion of transgender people in IT markets and to suggest reflections based on the data found.

For didactic means, the following sections are grouped as follows: in the background section, we provide a brief debate on gender identity before conceptualizing the terms “transgender” and “cisgender”, which are used throughout. This section also includes discussion on the employability scenario for transgender people in Brazil, and our impressions about the question of intersectionality between remote work and software development. In the results section, we provide the indicators extracted from an interview conducted with a transgender woman - a software developer. In the discussion section, we perform analysis on the conducted interview, cross-referencing the background when applicable. Finally, in the conclusion section, we address the current limitations of this work and provide reflections and previsions for future studies.

Background

This work does not understand gender according to the binary, heteronormative logic hegemonic to current society, which induces coherent and continuous correlations between genitalia,

sexual practice and socially constructed gender. In contemporary theory (Jesus, 2012; Butler, 2018), gender is a dialogic relation of self-knowledge and recognition of social, cultural, psychological and biological implications.

According to Jesus (2012), gender is not related to fixed forms of being, but to forms of “identifying oneself and others”. Theoretician Linda Nicholson believes gender to be associated with “personality and behavior of cultural stereotypes”, and “the culturally varied forms of understanding the body” (Nicholson *et. al*, 2000).

As such, the concept of gender defended in this work is in opposition to biological determinism, and the mandatory association of body, sex, gender and sexual practice. Instead, we understand gender as a social construct on the body, which would mainly make possible the reflection on the existence of other bodies, further distancing gender from the biological essentialist perspective (Pedro, 2005). It is from the same markers, biological determinism and social construction, that transgenderism and cisgenderism¹² are defined.

It is also worth highlighting Judy Butler’s post-structuralist theory¹³ on gender, since the philosopher is considered the pioneer of Queer Theory¹⁴ and deepens gender discussion when considering sex as a “discursive/cultural” product, questioning gender the view of gender relations as cultural constructs and sex as natural (Butler, 2018).

12 Cisgender, or simply “cis”, are people who conform to the gender identity determined at birth. Transgender are people who do not conform to this identity, later going through gender transition processes.

13 French post-structuralism constitutes itself as reflexive movements of major importance to the areas of philosophy and education, inspiring numerous academic productions over the last couple decades. Contemporary to the decades of 1950 and 1960, these movements have in common the philosophical resistance to different forms of totalitarianism (Bueno, 2015).

14 “The term “queer” arises as a form of interpellation that discusses the questions of force and opposition, of stability and variability in the bosom of performativity” (Bento, 2006).

Queer Theory made it possible to have a broader comprehension of the reasons why gender constitutes a historical and dynamical category which is worthy of being contested and reconstructed at each new historical moment. Butler (2002) also developed the theory of Gender Performativity:

“Gender is performative because it results from a regime which regulates gender differences. In this regime, genders are divided and hierarchized in a coercive manner” (p.64).

For this reason, Gender Performativity Theory has generated a lot of discussion inside movements which self-identify as subversive. According to the theory, once a norm such as cisgenderism is established, other corpuses are produced, which the author refers to as “abject bodies” (Butler, 2012). However, such “abject bodies” are also subjects who speak, have necessities and personal stories. Stories which break with individual aspects, revealing collective experiences, pushing society to rethink its standards and norms and questioning if spaces are truly inclusive and promote the creation of public policies and actions of managing diversity to attend to the voices fighting for their historical demands.

Among the other experiences revealed by gender identity, transgenderism could be understood as an umbrella term comprising other out of the ordinary gender identities, such as transvestism¹⁵ and transsexuality¹⁶. These identity experiences have been themes for scientific

research since the 50s, appearing most frequently in social sciences and anthropology studies and obtaining more visibility and centrality in Brazilian research from the 2000’s (Silveira, 2017).

In Brazil, transvestites and transsexuals were only incorporated into the LGBTQIA movement in the 1970s and 1990s respectively, bringing with them specific demands from these populations. According to Jesus (2012) transvestites are people who “experience female gender roles, but do not recognize themselves as men or women, but as members of a third gender or a non-gender”. The transsexual person, man or woman, according to Bento (2017), are people who “claim belonging to a different gender from the one imposed on them.” It is worth noting that transsexual people “deal in different ways, and to different degrees, with the gender they identify with... Each transsexual person acts according to what they recognize as belonging to their gender” (Jesus, 2012), which means that the experience and decision of changes in the body or genitalia. It is not up to the category, but to an individual decision, in which the gender identity should not be recognized solely on the basis of these changes.

However, the discussion about gender identity, especially of transvestites and transsexuals, is almost always marked by the debate of neglect and violence within society. Even if you don’t want to touch these axes, thinking about the consequences of violence for this part of the population is inevitable. This is because,

15 According to Pedro (2005), transvestism comprises the multiplicity of possibilities among the varied experiences and lifestyles of transvestites, in order not to restrain any possible life experience, but considering all diverse possibilities of existence.

16 In his book, “What is transsexuality” (Bento, 2017), Bento elaborates that transsexuality comprises of people who seek social legitimacy regarding gender practice and identity, therefore dissociating the term from sexuality.

according to Facchini (2011), the transgender population, especially transvestites and transsexuals, are the most visible and exposed end of the LGBTQIA community.

Among the axes in which violence can be present, the issue of employability stands out here, most of all because of the scenario of social vulnerability that transvestites and transsexuals find themselves in as a result of a transphobic job market. According to the National Association of Transvestites and Transsexuals (ANTRA), “even if they want to get a job with a routine, working hours and a formal contract, prejudice is evident when they apply for a vacancy” (Lapa, 2013). Exclusion as a consequence of transphobia leads dozens of transgender people to drop out of studies, which makes it difficult for them to reach more qualified formal jobs (Ferreira *et. al*, 2022). The marks of prejudice and transphobia are also felt by those who manage to achieve high levels of professional qualifications.

In accordance with Almeida & Vasconcellos (2018), there are five main challenges faced by the transgender population when it comes to joining the formal job market: (i) prejudice and transphobia; (ii) documents, such as civil registration and certificate of reservist; (iii) use of bathroom, changing room and uniform; (iv) low schooling and involuntary school dropout; and (v) body and verbal language.

According to (de Oliveira *et. al*, 2022) a recent study on the transgender population, 59% reported having some paid role, the majority in the informal labor market. In other words, the number of transgender people within the

formal job market is still very low. Among those who have a paid job, 90% report having prostitution as a source of income.

In Brazil, some initiatives in the public and private sectors have been given the task of combating the problems related to the employability of transvestites and transsexuals. For example, in the public sector, Brazilian Law No. 9,029/95, which deals with the prohibition of discrimination and prejudice in relation to access to employment, as well as Federal Decree No. 8.727/2016, which describes the use of social name and the recognition of the gender identity of transvestites and transsexuals within the scope of the direct, autonomous and foundational federal public administration.

There are also programs such as “Brasil, Gênero e Raça”, which aims to promote equal opportunities within “the scope of the Ministry of Labor and Employment (MTE), as well as the promotion of guidelines that should guide the execution of public policies to combat discrimination in Brazilian states and municipalities through decentralized units of the Ministry” (MOURA, 2015). Then there is the TransCidadania Program, created and implemented in São Paulo which aims to remove transgender people from the social vulnerability line through reintegration at school and encouraging reintegration into the job market and rescuing citizenship (Miranda, 2020).

In some private companies in Brazil, partnerships between companies, educational institutions and civil society have been set up and special projects have been created for transgender people, such as the EducaTransforma

project¹⁷. According to the EducaTransforma website, the project “positions itself as a bridge between transgender people and the technology and innovation job market, training and qualifying people to start working in the area”.

The low number of transgender people in the formal job market, and even more so in the technology market, is a topic of discussion and activism among transgender people who have managed to reach these places, as is the case with public figures such as Daniela Andrade, Evelyn Mendes and Akin Abaz. Unfortunately, however, the main research institute in Brazil, the Brazilian Institute of Geography and Statistics (IBGE), does not collect accurate data on gender identity beyond the binary classification (man and woman) which would allow us to make certain correlations with the formal labor market, so that we could identify which sectors of the former transgender people are working in, for instance.

However, a survey carried out by Stack Overflow¹⁸ in the year 2021 with about 82 thousand software developers, pointed out that 1.3% of this population identifies as transgender people. According to this same survey, 5.25% of the total number of participants are people who identify as female, non-binary, genderqueer or gender non-conforming, only in Brazil.

Due to the fourth Industrial Revolution, the IT field has become increasingly attractive, not only for young people entering the job market,

but for many who are looking for new opportunities and career changes. It has also become a target of diversity inclusion policies. This area has some particularities, such as the issue of remote work. While the other areas of the job market have struggled to find ways to keep their services active, remote work for the computing area was not new, which does not mean that there were no challenges.

According to Ford & Serebrenik (2019), remote work was popularized by the Open-Source Software (OSS) movement and we can infer that it has become the basis of the work of software developers. Remote work or home-office is the activity that is carried out at any distance from the place where it should be performed by the traditional system of employment, usually from the worker’s home with the help of technological and computer equipment that allow the worker to communicate with the team and the execution of its tasks.

According to Trinta *et. al* (2020), the global pandemic has accentuated the threat of unemployment, making it one of the greatest tensions in society. In Brazil, according to data from the PNAD COVID-19¹⁹ in 2020 of the total number of employed persons in Brazil (that is, 84.4 million people), 77.5% of these were not away from work, with 11.5% (7.9 million) working remotely. Also in this report, occupations with higher qualifications like science and academia are the ones that maintain the highest percentage of remote work, representing 50% of remote workers.

17 website: <https://educatransforma.com.br/>

18 S. Overflow, “2021 stack overflow annual developer survey,” March 2022, retrieved March 1, 2022 from <https://insights.stackoverflow.com/survey/2021>.

19 website: <https://covid19.ibge.gov.br/pnad-covid/trabalho.php>

Methodology

This paper is about a piece of exploratory qualitative research. Initially, exploratory research was carried out on the topic of gender identity to understand the nuances of this topic. We investigated papers on the issue of employability of transgender people in the area of computing to measure how the debate on this topic has been conducted in the academic environment of computing.

It became clear through the first steps of our research, that the debate on transgender identity and employability within the computing area is recent, although the discussion about women in computing is more consolidated. Due to this, we decided to carry out a semi-structured interview with a transgender person who is a software developer and works in the area. The answers will be structured by themes that were identified in the interview using a thematic map. The interview was guided by the following research question: what are the difficulties in inserting and maintaining transgender people in the technology market?

The interview was conducted remotely and the dialogue lasted for about 1 hour. The Zoom platform was used for the interview. Due to the absence of a census to identify transgender people and their workplaces, the person selected on the basis of the person's public personal activism and professional performance. The person interviewed identifies themselves as a transgender person who has been working in the computing area as a software developer for almost 20 years, has worked in large multinationals, and currently works for a foreign consultancy. In this work, it will be identified by P1 (participant 1).

Preliminary results

The main goal of this research is to identify and share the difficulties and potentialities found for the insertion of transgender people in the technology job market. From the semi-structured interview carried out, the following themes were mapped and grouped: Education and transphobia; Remote work and identity.

Education and Transphobia

According to [P1] “the biggest challenge for the trans population is school insertion (...) It is much more difficult, if not impossible, for you to enter the job market if you don't have schooling. Especially when you are talking about a country like Brazil, where at the moment we have 14 million unemployed, right? Not counting those who are underemployed or who live on a side job”. The issue of schooling is a recurring concern within the demands of the transgender population.

Although formal education is a right provided for in the constitution for all people (article 205 of the Constitution of the Federative Republic of Brazil, 1988) and is understood as a fundamental element to prepare the individual for the exercise of citizenship and the job market, according to the Brazilian Bar Association (OAB), the violence suffered by transgender youth is linked to 82% of school dropouts (de Oliveira *et. al*, 2022).

For [P1] it is necessary “to transform the school into an inclusive and welcoming environment, in which trans people (...) are respected so that there is no expulsion as in fact occurs with this population”. Similarly, according to Silva &

Luna (2019), transphobia is a determining factor for the future of transgender people, resulting in low education, unemployment, prejudice and discrimination.

The process of entering the job market starts in the first instance, with a qualification for those looking for a placement in the formal job market. Subjects who are looking for excellent qualifications in the job market, compete for positions based on better professional and academic experiences. Those who seek their first opportunities in the job market minimally signal the completion of elementary and high school as a way of demonstrating intellectual capacity. People who do not minimally meet these expectations are placed on the side lines of selection processes and desired professions in the job market.

According to [P1] “the biggest challenge for the trans population in the job market is to present a curriculum that has the education consistent with what is required in most job vacancies, because even for vacancies that do not require specialization, schooling such as elementary and high school is still required”.

Remote work and identity

According to Ford & Serebrenik (2019), remote work technologies can increase transgender people’s sense of empowerment, enabling them to better exercise their authenticity and be more effective in their work. This is because, according to the authors, remote work allows transgender people to have greater control over how and when they identify with other people, avoiding unnecessary embarrassment arising from prejudices about the forms of

performativity of transgender people.

For [P1], “remote work is especially beneficial for people who are starting their transition or who do not have passability”. According to Ford & Serebrenik (apud Petruzalek, 2019), the importance of being presented in the way you feel most comfortable is related to safety. According to the author, the disadvantage of not being a passable person, that is, being visually recognized by the gender they identify, makes the transgender person a target of violence, so “passability is not just an identity objective, it is also a means of self-preservation”.

Also, according to [P1], one of the benefits of remote work for transgender people is related to mobility. According to the report by Transgender Europe (Miranda, 2020), Brazil is one of the worst transvestites and transsexuals’ murderers. For [P1] “if the person won’t need to be walking around on the street every day, coming and going, and having to socialize with strange people on the streets, it may be easier for them to deal with this issue of dysphoria, prejudice, as they can work from home and have contact with a very small group, which is the group they work with”.

Discussion

According to what was revealed in the results, thinking about the employability of transgender people within the area of computing cannot be done without reflecting on the issue of schooling. Furthermore, both prejudice and transphobia are closely linked to this issue. The reasons why they are pointed out as reasons for the high dropout rate of transvestites and

transsexuals from school are linked to the prejudice that these people suffer within the school environment, which leads several researchers to refer to this scenario not as dropping out of school but as school expulsion.

When minimum schooling is not a reality: the challenges of employability beyond the number of vacancies.

Transgender people often evaluate the school space as a hostile, excluding environment, where they have their identity denied repeatedly by staff and students (Miranda, 2020). Santos (2003) believes that education has a central role in the production and reproduction of social injustices. However, the traumatic experience of a person in the school environment, given its mechanisms of constant surveillance and non-acceptance of subjects that are different from the norm, makes it difficult for these people to remain in the school environment. For Cruz (2011), in relation to the daily life of transvestites and transsexuals in the school environment, the “simple” act of going to the bathroom demonstrates the seriousness of the problem and embarrassment that this population experiences on a daily basis.

The school has a surveillance mechanism that seeks constant control - even if it is not easily perceived -, the normalization and disciplining of bodies. Foucault (1999) understands that this surveillance process fulfils the role of domestication of bodies as a way of building standardized subjects.

The production of abject and polluting beings (gays, lesbians, transvestites, transsexuals and

all beings that escape the norm of gender) and the dehumanization of the human are fundamental to guarantee the production of heteronormativity. The school is one of the central institutions in this project (Bento, 2011).

Therefore, reflecting on the problems related to the schooling of transgender people is justified by the consequences that educational actions have on people’s lives, and also by the need to promote and maintain the school environment as a public, safe, secular space that celebrates diversities, that guarantees the exercise of citizenship and guarantees the minimum requirements for these people to compete in the formal job market.

Remote work has its benefits, but it’s still a privilege.

Expressing gender identity and not being questioned about it is not an object of conscious desire for cisgender people, as they are usually not questioned about their identities. However, this cisgender non-questioned right is exactly what many transgender people want most, namely, to be respected for the way they express their identities and bodies. According to the transgender people participating in the study by Miranda (2020), when they are looking for a job, transgender people have their resumes rejected from the outset, largely due to prejudice and transphobia.

The search for identity recognition is not a minor issue and is not detached from the issue of employability. The passability mentioned by Ford & Serebrenik (apud Petruzalek, 2019) and [P1] lead us to the understanding that it is

a mechanism of self-recognition and security in the face of violence suffered by transgender people. For Foucault (2020), perceiving and being perceived by the gender that one identifies with, is part of a process of acceptance of socially constructed, apprehended and widely disseminated norms. Therefore, given the scenario reported by Ford & Serebrenik (2019), for [P1] remote work can be considered more inclusive for trans people.

However, according to [P1] “it is a great privilege to work remotely, since we know that there are very few jobs, usually only specialized ones, that are allowed to work remotely”. According to the PNAD COVID-19 report in 2020, in Brazil, most people who are in remote work have a complete higher education or postgraduate degree. This data is in line with what [P1] reports about remote work opportunities, because for them “generally, to work in remote services, qualifications and specializations will be required that will depend on people’s education. And, since a large part of the trans people don’t have this schooling, it gets more complicated.”

Another impact factor regarding remote work is related to access to the infrastructure necessary for remote work, such as the internet, computers, adequate desks and chairs, among others. According to [P1], “since access to the internet is a great privilege in Brazil, because, although many, or rather, most trans people have a cell phone (...) having a cell phone, however, does not mean having access to the internet. And having access to the internet does not mean that a person will have access to quality internet”.

The issue of good-quality internet access in

Brazil still faces challenges, especially in areas outside the central regions and the south and southeast regions of the country. Due to the pandemic, this fact became more evident as students throughout Brazil faced difficulties and dilemmas in maintaining distance studies, especially students in public education and in peripheral areas. As for the infrastructure for remote work, [P1] also highlights “apart from the fact that, even if they do have the possibility of working remotely, we need to know what the costs are involved with this: will they pay for the internet out of their own pockets? (...) how much income do they need to have to afford a good computer (...), with all the accessories (microphone, headphones)? Will the person have a chair? Will they need to pay for electricity? In addition to the internet, will they have expenses to pay at their homes that not all companies, or most, will want to cover?”

It is clear that while remote work can offer advantages for transgender people in terms of acceptance and security, there are still several challenges that distance it from the daily reality of most transgender people in relation to the job market, as the issue of schooling appears to be directly related to employability and remote work.

However, the scenario for the employability of transgender people in the computing area has achieved visibility and opportunities, mainly due to the growing debate about diversity and inclusion in the computing area. Companies have carried out intentional recruitments to reach the greatest number of people of color, transgender people and women, for example, who have the necessary skills to work in the technology market.

For instance, other companies form partnerships with programming education institutions, aimed at diversity groups so as to reduce the educational gap in the area of computing and preparing people for the job market. According to [P1] “it’s the beginning and the inclusion of trans people in fact is still a very embryonic thing (because I believe that inclusion is not just hiring). But this concern from some companies, (not all), but especially from large companies to hire trans people is starting to crop up more and more. I believe it is creating a new reality, because until recently, there was absolutely no concern in serving this audience. So, I realize that it is something beneficial. The media is increasingly starting to talk about it and it’s creating a chain reaction: companies talk, the media talks, activism talks and little by little trans people start to be included”.

Conclusion

In this work, we have identified some opportunities and challenges for transgender people within the computing job market. We have observed that the field of computing in particular, has been booming more and more due to the fourth Industrial Revolution. Moreover, the technology sector has been the target of interest for several groups, among them diversity groups such as women, black people and transgender people. Due to this, the number of intentional actions to increase diversity in companies has grown, whether for reasons of the ethical values of the organization itself, or for the benefits that the business can gain by investing in diversity.

We have briefly explained what gender and transgender identity are. We have highlighted

some of the main difficulties that transgender people have within society, that cross into the employability debate. We have seen that formal employment is still not a reality for most transgender people in Brazil. On the other hand, we have also been able to identify that there are a small proportion of transgender people who do manage to reach the formal job market within the computing area. And that for these people, some nuances of remote work can be interesting in terms of identity control, performativity, security and well-being.

However, at the same time, we have also observed that the challenges for the transgender population are still based on the prejudices and transphobia that this part of the population suffers from, which results in the denial of rights provided for in the constitution such as access to formal schooling. The consequences of this are psychological problems, low education, underemployment, among other problems that prevent transvestites and transsexuals from exercising their full citizenship. Even for those who manage to reach the formal job market, the challenges imposed by prejudice and transphobia are still present.

We have also observed that the advent of the global pandemic has made remote work, particularly in the field of IT, a global reality for students and workers who had to adapt to the new reality imposed by the pandemic. However, we also noted during the interview that we carried out for this work, that remote working in Brazil is the privilege of certain sectors, especially in more qualified areas where information technology resources are already part of the work context. Access to quality internet

and adequate infrastructures to enable people to work remotely vary according to the type of service, region of the country and work groups. We have seen that when it comes to transgender people, these challenges are even greater due to the socio-economic background of most transgender people.

However, we can also see that positive changes are being made. Public policies have been implemented to mitigate the problems of schooling and the employability of transgender people. Diversity management actions have been developed by companies in order to effectively include transgender diversity into technology companies. The debate on gender identity has intensified and this has driven society as a whole to reflect on constructed norms and standards and on rights denied to certain sectors of society due to prejudice.

The reality of violence against transgender people in all spheres of their lives: physical, moral, school, employment, is still a constant. Unfortunately, we still have to deal with this growing data. Nevertheless, given these facts, our suggestion is that more researchers and managers should investigate these possibilities and propose actions on the issues of gender identity, especially transgender identities. We believe that these intentional movements will be fundamental to add to the actions that are already in place to claim for the rights and dignity in the lives of transgender people.

We have some boundaries to our research about the transgender population. In Brazil, the main research entities that provide official data, do not focus on data on transgender people. In some cases, this section of the population does

not even appear in household sample surveys. This hampers the work that this data requires to understand the scope of the situation of transgender people in Brazil and, as a solution, researchers will look for informal means to obtain data on this population.

We would like to carry out research on the employability of transgender people in computing, understand their roles and trajectories, but there is no database available to identify who these people are, with the exception of those who go public and transform their personal experience into activism. Many companies do not have questions related to the transgender issue in their internal censuses, which makes it even more difficult to identify these people. However, we understand that this scenario highlights the importance of research like this even more, and we can only encourage more researchers to focus on this topic.

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The background features a large, abstract purple shape that resembles a stylized letter 'A' or a similar geometric form. It is composed of several solid purple polygons. The top-left corner is cut off by a diagonal line. The bottom-right corner is also cut off by a diagonal line. The overall shape is set against a white background.

DigitalSELFPresenceLab:
embodying new
technologies for the
restoration of presence

DigitalSELFPresenceLab: embodying new technologies for the restoration of presence

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Abstract

Since 2012, I have been performing and directing new media arts alongside extended reality experiences as an experimental practice-based-research project to understand what I have identified as the Presence Paradox: *We are connected without connection to what is present*. The *Presence Paradox* is defined and discussed in this article with a self-embodiment centered approach to human-body-to-digital interfaces in immersive media and performance arts, as an antidote to the informational and narrative screen-based overload we are facing. With this purpose in mind, I established the restoration of presence as the central axis for the experiences created in the research. #*DigitalSelfPresenceLab* is a project that investigates the production of presence in digital media. The method explores principles and presence modalities through the combination of real-and-synthetic performances - human-machine interactions produced by computer technology - to discover a contemporary interpretation of presence. It's

a re-reading and updating for the technical basis of artistic performance inspired by resonances of Performance Studies (restoration of presence and the study of ancestral rites) and dance techniques. On account of this experimental approach, I have chosen to analyse the production of art and technology from a perspective which considers digital transformation under circumstances that enable solutions based on embodiment: from intermedia performance, volumetric capture, 3D avatar and meta human design, feedback sensors to interaction and multi sensoriality in extended reality projects. Finally, the #*DigitalSelfPresenceLab*'s results prove that the centrality of the body in media and technological experiences may enhance *Self Awareness* and subjectivity as the core of presence restoration.

Keywords: new media arts; extended reality; embodiment; presence; human-body-to-digital interface

Embodiment centered perspective for virtuality

The technologies and techniques for embodying virtuality in digital and immersive media are the starting point of this article, based on the perspective that subjectivity is the core aspect of presence. The poetics of interfacing body and machines interpreted throughout the artworks in this essay are analyzed with one goal in mind: going beyond dualistic perspectives which state human behavior *versus* technology, to find embodied antidotes to the Presence Paradox.

We are connected without connection to what is present is the contemporary paradox whose meaning flourishes from digital virtuality taking control of many aspects of our behavior and blurring our Self-awareness which is embedded in physicality and presence. Digital platforms and the ubiquity of screens have changed our cognition, deeply affecting our physical experiences and, as a consequence, our consciousness. The contradiction here is placed on the same “universe of virtuality” that is spreading behavior patterns which influence social circumstances and thought subjectivity, relationships and politics as well.

From a performer’s perspective, identifying this paradox as the core of dissonances between causes and circumstances in the physical world in relation to virtuality, makes embodiment a

fundamental issue of our relationship to digital technologies.

On one side, we have disseminating mechanisms of prejudice and hate speech. The vast majority of the world’s population connected through social technologies, is facing a cognitive overload that is disconnecting us to what is the present. On the other, we are facing market tendencies such as crypto art where personal identity and authenticity are linked to expressiveness and recognition.

If we go beyond these tendencies caused by flat screen aesthetics and the semantic level of virtuality anchored in words, news and social media, we discover a new universe of individual embodied experiences in virtuality, that have the potential to transform presence.

Innovative technology researchers, companies and extended reality studios are creating embodied solutions to reconnect us to our movement, from motion capture systems and wearable human-to-digital solutions, to human performance training. In many fields from medicine to industry, the people who use VR headsets and AR glasses to participate in metaverse or instalative digital experiences are certainly a minority.

Some examples are virtual reality interactive storytelling, the concept of Performance-R²⁰ and other participatory experiences mixing virtual reality and live performance²¹. In these experiences, participants can access virtual

20 This is a definition by the creative director Tupac Martir (Satore Studio) that is working with VR, AR, Projection and Live Performance at the same time, combining them in live staged performances. His main projects are *Unique*, Satore Studio (fevereiro 2022). https://satorestudio.com/portfolio_page/unique-at-the-bfi/ and *Cosmos Within Us*, Satore Studio (2019). https://satorestudio.com/portfolio_page/cosmos-within-us/

21 Two projects illustrate this tendency *Le bal de Paris*, Blanca Li (2021) <https://www.lebaldeparisdeblancali.com> and the immersive dance piece celebrating Bauhaus 100 anniversary *DAS TOTALE TANZ THEATER*, Interactive Media Foundation (2019) <https://www.dastotaletanztheater.com>

environments with their embodied avatars, sensing virtual presence through the language of digital interfaces that enable new perspectives of space and movement.

The intertwined concepts to state that interfacing body and virtuality is a restoration of presence antidote are: (Digital)Self and presence. Both are related to individual experience as a flow of sentience and consciousness where we can reach subjectivity if we activate movement and interaction as Self-expression.

As a performer observing these tendencies and using experimental research techniques in new media and immersive artworks, it's relevant to expose that the split between artifacts and human actions is unfeasible and artificial here. Technology affects our presence because the way we move and perceive phenomena are mediated by artifacts, affecting aspects of our Self.

When mediated by media interfaces or computer networks, the presence can be manifested in the formation of what we will call "Digital Self". When we act from the alignment between thinking and acting, we are present. Since presence includes the perception of here-and-now circumstances, when our body is connected to media, we are interfaced and it changes our cognition. While we embody new technologies, the production of presence is manifested into real time decisions involved in the manipulation of software and sensors combined to produce the artwork poetics.

In the experience level of poetics and considering it as a process²², the Self here is the presence we come across while we move as a subject in a

flow of sentience and perception. That's why the embodiment of new technologies is the axis for the restoration or presence in #DigitalSelfPresenceLab. When we broach the matter of presence without embodied experiences, we are probably reducing the production of knowledge and consciousness to observation and deduction.

In the paradoxical flow of new experiences, humanity is facing an intense technological transmutation where "virtual agents (avatars and meta-humans) assume many forms and concepts to compose interactive and expressive human experiences. These virtual agents are both a market communication trend for brands and celebrities, as they are incorporated in billions of individuals' lives who provide their visual data to tech industry software and platforms. Our face is translated into specific IA algorithms for gesture, codification of our emotions and graphic patterns of our aspect to express our digital version.

Basically, we have a digital skin and our digital characters have different degrees of freedom and design according to the software we use and the hardware we can afford. These patterns determine our choices, how we look and how we express ourselves in digital realities. We reproduce and adapt patterns to communicate and play, but we do not really incorporate subjectivity and a new creative mode of presence for the movements and expressions in our digital world.

Meanwhile, we are not moving with new gestures. Our embodiment is reduced to some functional and IA coded expressions. And we are not exactly creating new digital modes for

22 Here we refer to poetics in VALÉRY, Paul. *Degas, dança, desenho*. São Paulo: Cosac & Naif Portátil, 2003.

our embodiment. We simply adapt our form to industry patterns determined by developers in Big Tech companies.

In this context of many possibilities for our embodied virtuality still being researched and conceived, the concepts and methods of DigitalSelf are here to cross the boundaries of pattern and bias and to restore presence. But first, it's time to understand the contemporary circumstances shedding light on the contradictions inherent to the Presence Paradox.

The Presence Paradox

The world shows up for us, in thought, and in experience; the world is present to mind. This phenomenon – presence – is the basic phenomenon in the whole domain of the mental. It is what is at stake in disputes over the nature of “intentionality,” and it is the heart of the problem of consciousness. Ava Noë (2012, p.XI)

Here presence is the primordial question of experience. Question because when we ask “are you present” we are investigating how you will employ your actions to achieve whatever our goal is: create, express, play, dialogue, run, practice any form of meditation or contemplation, etc. When you are present, you're merging the flow of your thoughts with/from your actions. You are ready for each decision, simply by living the experience.

Ava Noë's statement “the world shows up for us, in thought, and in experience” shows how presence is achieved. “We achieve access to the world around us through skillful engagement; we acquire and deploy the skills needed to bring the world into focus” (Ibid, p.02).

This affirmation is aligned to a performer's perspective. Presence does not come for free. We achieve presence. We have to reach a solid embedding of skills to be present in one scene, just as in another one, or as a sense of Self polished by our imagination, and this is the very way to win the public over our representation.

In terms of embodiment, we are present when we merge our actions and thoughts into the same flow. This is a basic pattern that potentializes human experiences towards integrity, accomplishment, confidence and certainly to Self-awareness. If we are present, we transform reality from within. We cross the flow of phenomena and consciousness flourishes from interdependency.

The core aspect of Noë's thoughts on presence is aligned to the way we understand it here: it's more about being present than to define presence itself. And as it is an embodied phenomenon, “(...) if we wish to understand the nature of our human experience, really, we need to turn our attention inward, to the mind (or the brain!), for that is where we, our individual selves, stage reality” (Noë, 2012, p.6).

The Presence Paradox is related to how our experience is merging into virtualities. It's about how we stage reality as a social phenomenon mediated or merged in technological systems. It's about our tendency to imagine, represent and believe. It's how we elaborate some experiences as language and *techné*. It's within and connecting us. From painting to narratives, symbols, mythologies and simulated consciousness embodied in human-form machines (humanoids), etc... We are a species of representation.

In contemporary circumstances, we tend to access collective systems where we share our representation and believe more in their flow of information than to be present, observing reality to produce consciousness.

From my perspective, the primary aspect of this cognitive centered paradox relies on its origins, just because it's related to our capacity to create visual codes for our imagination and to express our sense of reality. It starts (apparently) in the Paleolithic Period (30.000 BC until 10.000 BC) and today it's revealed through digital technology systems that are connecting us all. It may become a mythology, a game cult, a deceitful narrative, or the embodiment of human knowledge into automatons. It's the human representation of what is beyond the here-and-now or no longer physically present.

First in drawings and words and finally in the technological systems, we are submerged into combinations and patterns that dictate the flow of imaginary representations into language. And the most intriguing characteristic of the Presence Paradox is the presence of artifacts and technical devices. This is where the body starts being interfaced to natural devices where embodiment is changed and imagination finds representation.

In order to understand how the paradox is affecting our presence, we should question: are the machines present? If we think of machines as artifacts from which we produce technical movements and expressions of our existence, as well as systems that mediate our experiences, we may realize that machines are objects that we have manipulated since the evidence of cave paintings, when they were used to express the life of our ancestors.

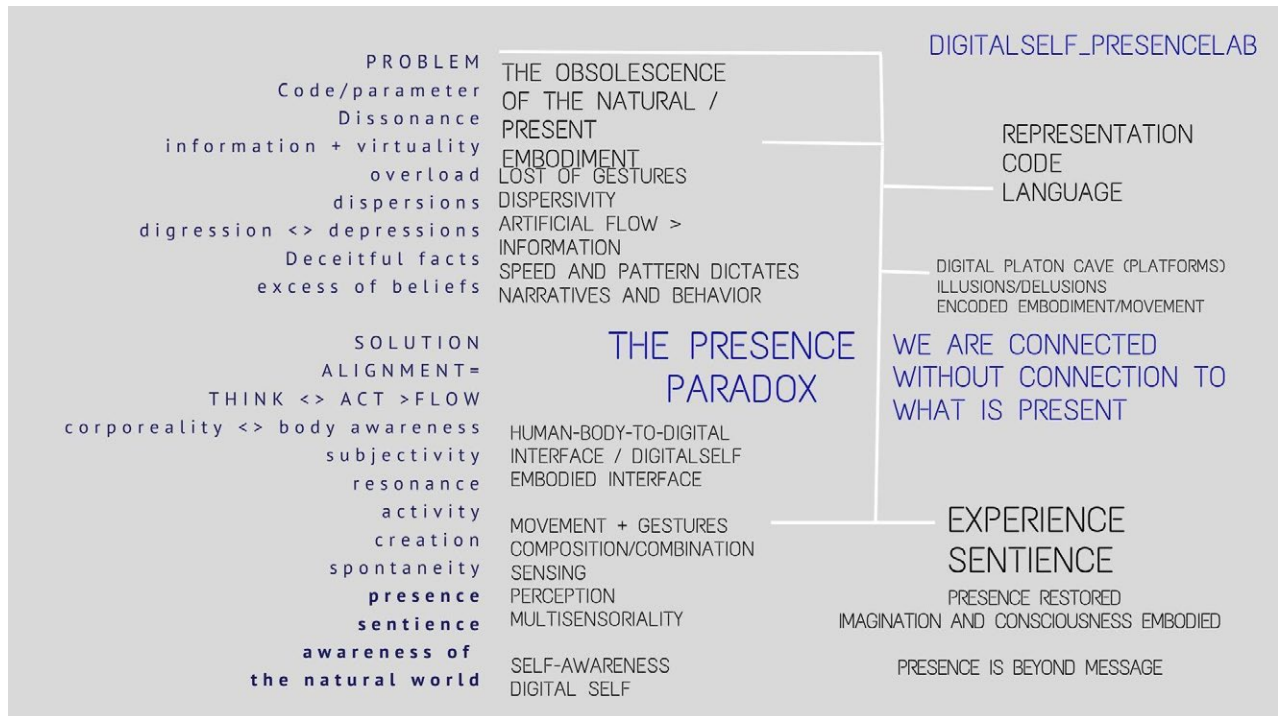


Image 01: Schematic representation of the Presence Paradox. From problem to solutions found in #DigitalSelfPresenceLab research.

As Campbell (2015, p. 63) explains, the first time someone apprehends and conceives a tool is when our ancestor takes a stone and splinters it in order to handle it. In the *Upper Paleolithic* (30,000 BC to 10,000 BC), we know about the use of objects to macerate pigments to produce the image of anthropomorphic figures and animals in caves. And then “sign” the work with a negative hand (a kind of stencil) forming an imaginary embodiment of their presence into natural walls.

These images are virtualities that arise in cave paintings as the representation of the human being that hunts, the woman in childbirth, and the negative hand of the painter, in our most distant ancestry as imaginary poles of reality. The bodily act of producing them with pigments that make it possible to fix them on damp cave stones becomes a duplication of actions visualized or previously performed by their creators. There is a prior knowledge in these images, a memory, an action and their marks mediated by tools that extend the relationship of an active presence with the expression of sensitive existence.

The body in this space-time is the intermediary between the tangible world and the expressive world. It is through the body that the world of the cave resonates in the traces, colors, movements and forms of the painting. And the visible materialization of actions and memories on a natural canvas - the rock - through the use of a specific material on this surface, forms a set of images that with the proper distance of historical time and analysis may offer a glimpse of the traces of the prehistoric body both as a document, and as the abstract reproduction of the imagination within a stage of human culture genesis.

Technologies extend our bodies, determine habits and behaviors and affect our Self from the moment we appropriate nature to create artifacts of survival and expression of our imagination. The use we give to technical objects, which are our inventions, form our cognition and shape our body.

At the same time, technologies are a combination of objects and meanings that engender presence when we need to pay attention to their functioning. This presence generated by the artifact, bifurcates into habits, needs and changes in the mechanics of our movements, modifying both our body and our relationship with corporeality as what we are and the space we occupy.

According to Hans Ulrich Gumbrecht “(...) presence is a principle of our perception. It is the phenomenon from which we experience the “thingness of the world”. And the body is the first object of perception of reality. The body is, therefore, contained in the images produced, and also in the technologies that characterize, shape, enter into relationships, creating interfaces and leading to their actions” (Gumbrecht, 2010, p.09). Through the Latin sense of presence (*prae-essere*) it relates to what is materially tangible and what we do with this materiality is what Gumbrecht thinks of as the production of presence, which begins when we see objects and attribute meaning to them.

We can analyze this co-dependency to materiality by taking Ava Noë’s example of the baseball glove to the player. It’s always present because it’s part of their embodiment. “But the tools that form the body of the athlete’s or the craftsman’s engaged living are not absent in that sort of dead way, even if they are withdrawn into the background. They are *there*, after all, for the

agent; they are within reach; they are taken for granted, relied on” (2012, p.09).

What about the personal technologies which add virtualities to our daily lives? I’ll quote Ava Noe’s analyses and change the characters and their tools as a ploy to move the meaning into the present reality of this article. “Smartphones, like the view out the window, are always available. And this is just to say that they are always present, even when they are in an important sense also absent. But they are present in the way of these things, in the ways of that which is acted with and taken for granted.”²³

As a performer that trains presence in my daily life, I’ve found that the main solution to the Presence Paradox is to restore presence using art and technology from the expressive potentialities of our Digital Self. The body as a support for saying things, as a means of expression, works with technology from the foundation of our ability to represent the imaginary.

In this sense of presence, the body’s relationship with technology is always central, especially in times of massive change in production systems. Orienting ourselves in relation to our own body is the first need that arises to move us and, therefore, to modify reality towards what we consider important to make our experiences endowed with meaning.

Presence from the performer’s perspective

There are multiple circumstances related to overload screens and other digital technology

tools which deepens virtuality in response to real situations. And the Presence Paradox is about how the usage of our digital connections leads to dissociation between what is present and what is represented causing cognitive transformation. In other words, we are overloading our imagination without providing embodied experiences, which depletes us of elements of behaviors performed in the flow of reality such as gesture, concentrated action and self-observation.

This double dissociation in our presence (lack of alignment between thoughts and actions; and imagination/beliefs over consciousness) keeps us from finding causes and consequences of our behavior. Our bodies become stale and our thoughts lose sensitivity, flow and depth.

Since the purpose of this research is to bring solutions to all these consequences of the Presence Paradox, it’s time to expose how #DigitalSelfPresenceLab is designed from performance-based perspectives.

Performance arts and Digital Self

If I had any doubt, it would be impossible.

This statement guides the presence experiences created to shape the practice-based research #DigitalSelfPresenceLab to find ways to restore presence using technology. First, in performance arts, presence is the core of the experience. We are present when our thoughts are aligned to our actions enabling us to achieve a precise and expressive embodiment

²³ Original statement (*Ibid*, pg. 09) “The baseball glove, and the hammer, like the view out the window, are always available. and this is just to say that they are always present, even when they are in an important sense also absent. But they are present in the way of these things, in the ways of that which is acted with and taken for granted.”

of Oneself - as the performer conducting experiences, or another - as embodying characters.

The performance arts practices are composed of techniques and experiences where this interval between thought and action is not supposed to exist. Why? Because this dissociation can dissolve the performer's expressive presence for the situation placed in real time for the public.

In performative circumstances, the artist conducts the flow of actions while being conscious of how the state of presence determines the embodiment of form and concept. When we perform, we are completely immersed and there is no time to doubt. After many performances I realized that once I disperse my focused attention with distractions out of the performative programme, I might destroy the immersive atmosphere and lose the audience.

This alignment is the prime cognitive resource to design the #DigitalSelfPresencelab experiments. It guides the continuous flow of hybrid poetic experiences of body-mind consciousness and interfaces. And it brings many ways to restore presence through different modalities from conducting "tech rituals" to remote live experiences.

Another principle is based on the idea that performers act in a field where there is the possibility of awareness on their *Doubles*. Here I refer to the notion of the *Double* formulated by Antonin Artaud (1993) that concerns the theater itself and its "virtualities", composed of masks, objects and other symbolic elements used on stage by the actor. The *Doubles* are these elements that dilate the body towards the imaginaries (virtualities) that we seek to "incarnate" on stage.

Antonin Artaud's concept of *Virtuality* was a key for the theory of the *Digital Double*, by Steve Dixon who adapts it to decode the universe of digital performances. As Dixon points out, Artaud's notion is primitivist and the double is part of the magical dimension of the Self, related to the magical thought itself, which we will approach to the technical image, or *techné*, when thinking about cave painting.

Dixon thinks of the Digital Double as a palimpsest of performative representations of the Self, scattered in the cathartic digital theater of internet connections. Digital personas are seen as real in their "theatrical confessional boxes" as they assume multiple aspects of self-representation based on communication and relationships created in day-to-day network systems.

Finally, following Dixon after Artaud's theories, I come to what I conceive as *Digital Self*, a concept based on experiences that interrogate on how we produce presence in performances where the *Double* is both subject and synthetic images of the *Self*.

These embodied imaginaries require methods grounded in awareness emerging from both body motion and *techné*, from which we invent and manipulate artifacts.

The concept of *Digital Self*, whose premise is to understand and create ways of acting with our body-machine interfaces as paths of invention of the *Self* and generation of expressive presence, begins to make collective and pedagogical sense - as the facts about the mass manipulation techniques in digital networks comes to the core.

Becoming aware of the *Digital Doubles* to take expressive action with the *Digital Self* is what I

call a concrete and urgent “antidote” to virtual isolation and aligned with the scenario, places of action and otherness amplification.

Methodology: experience and modalities of presence

I effectively developed the concept of *Digital Self* early in the 2000s, when I visualized the phenomenon of filmmakers using portable photography and video cameras for Self-referential documentary films. I was already working with practice-based research by developing *REMINISCENCES OF DAYS GONE BY (Dias no tempo)*, a Self-fictional documentary on the story of my “gaucha” family. My hybrid identity between Brazil and Argentina is the issue of an approach that relates personal history with the historical decades of the Argentine crisis (40’s, 60’s and 2000’). I create imaginary Super-8 memories of my grandfather (40’s in B&W Super-8), my mother (60’s in Colour Super-8) and mix both with my personal memories when living in the country (digital video cameras). As a filmmaker, reflecting on reality was a practice of observation and memory.

Eager to translate the use of digital personal video cameras into a Master’s dissertation on modes of *Self-referential* documentaries, I found the concept of *Technologies of the Self* (Foucault, 1990), which is defined as the techniques and methods through which human beings find and elaborate truths about themselves. The personal diaries and the confession are examples of cultural mechanisms of these technologies. There is a knowledge that conceives and forms which frames these technologies.

In the midst of the Digital Revolution, the *Technologies of the Self* such as smartphones are both resources to express ourselves and devices that divide our attention. Since the restoration of presence requires reconnection to our sensibility and authentic expressiveness, this concept reveals that we consider that personal devices and their language can be used to embody Self-awareness and to enhance subjectivity.

The hypothesis has been built from my PhD thesis on the modes of presence with technical devices that approaches the History of film, video, new media and digital performance, where artists use media to cultivate Self-referential narratives and performativity to express the flow of subjectivity in their living experiences on here-and-now.

Transforming video, new media and new technologies such as biofeedback sensors and XR immersive technologies into *Technologies of the Self* and thus restoring presence, is the technical and aesthetic premise for methodologies rising from *DigitalSelfPresenceLab*. This body-technology interface flow offers propositional hypotheses that mitigate the contemporary dissonances which I identify from the Paradox of Presence.

Because presence in #DSPL is within and exists in subjectivity and involves many techniques from focused attention to sentience, I can experience different modes of presence. It is a way to enhance our comprehension on how to be present with digital technologies. I then blend this approach with principles and skills from dance, performance arts and contemplative practices that include different meditation techniques.

Each performance and XR embodiment experience that I conceive, produces a mode of

presence where the feedback mechanisms programmed are fundamental to understand how the device is part of the Poetics and how the presence state is transformed by machine interfaces. And the core method for restoring presence for our DigitalSel is what I call *Experiences of Here-and-Now* and it requires 3 actions or operations, based on the Richard Scherchner concept of restored behavior (1994):

To be-related to our behavior and Self-awareness;

To do - related to thought-actions alignment and body awareness;

To show up what you do - linked to the nature of human behavior and related to the consciousness of expressing with movements, gestures, language and available tools;

I conceive and perform experiences inspired by these principles combining subjectivity to the poetics of rituality and interactive immersive narratives. Performing and interacting with the public is how I investigate aspects of presence with the embodiment of new technologies. The performances show how we transform concepts into forms, movement and interaction.

Furthermore, #DSPL has references in performing arts and dance concepts that have operative techniques to produce the experiences in different modalities of presence that I'll investigate through the projects listed below. It combines methods and theories from dance (Rudolph Laban), performing arts/performance studies (Scherchner and Turner), theater anthropology (Eugênio Barba) and acting systems (Stanislavsky) to encourage the creative process and to conduct the flow of the presence experiences; it trains the ability of taking risks,

making decisions, facing fear and by these means, it improves alterity and altruism.

I use these theories and their techniques for both my training sessions, experiences and to create performative projects. And in these projects, the practice-based experimental methodology takes place.

This method of performing in many situations, with different configurations of technical devices and interaction reveal how emotions are provoked and exchanged when we are present. Presence is beyond message and yet this is the best thing we can share with others.

Intermedia Performance: #LiveLivingPerformanceProject

The first modality of presence I could investigate was intermedia performance. Intermediality is characterized as a research field whose investigations promote dialogues and junctions between areas of media production and the performing arts. It manages to contextualize both the physical and technical nature of the audio-visual as a medium, as well as the dialogue between new media and arts based on performers' presence that is expanded by the sound-visual movement of technical images.

#LiveLivingPerformanceProject (2012-2016) was a trilogy of intermedia performances where I identified the dissonance between virtuality and reality. The three performances conceived for this project had many technical and performative configurations, according to the circumstances of their production. The performances are adapted for each place, as well as for the different groups of invited artists (musicians

and VJs) who perform their authorial style in a creative dialogue along with the performance artist. And I have performed each one of them repeatedly during an experimental period of testing and developing the form and interaction.

The most interesting fact to be exposed here is that during the beginning of the development process of #LLPP I was using transmedia to investigate how social networks could create people's identification with the characters. And by this means, I first identified the dissonance between what is fiction and what is reality on digital platforms.

I used social networks to conceive the characters and the plot between them. As a Self-fictional performative project, I posted messages and images exchanged between characters. Since they were my *alter ego* and literary heteronym representations and because I used my own life as a Self-fictional creative source, many people believed that I was really doing what the characters posted. Indeed, some traces from the character's life were based on my own experiences, but the fictional aspects were clear. The characters and the fictional narrative were there, exposing concepts and premises.

The performative project explores the fusion between performance arts and live cinema from the idea of intermedial ritual aesthetics that criticizes the excess of mediatic consumerism in our culture. Live images are conceived from daily life mediatized representations of women, using the smart phones aesthetics as an extension of our performative body. The fact that I was using visual images of my own life (document) reloaded into a fictional narrative created enough evidence to transform a piece

of fiction into real possibilities for some internet believers.

In the end, it was hard to conceive a coherence between online narrative and live performances and I changed into intermedia experiences inspired by female orixas from African ancestry cultures, in which body movement is related to nature elements in ritualized circumstances. The alter ego characters were part of the rituals, but their presence was performed mainly in live images or live soundscapes.

The first performance, *Lícia in the Wonder Verge*, was about Iemanjá (ocean) and Oxum (rivers and waterfalls), both related to the water element. The second, *Untamed Performance* – is related to earth and fire elements. It's about fear and how we can tame our untamed mind in chaotic circumstances. And the last, *Awakening Performance* was dedicated to the air element and it had an International release in 2015 at LaSalle COLLEGE of the ARTS _ directed by Steve Dixon, who was both my theoretical reference on Digital Double and director-actor of multimedia theatre, where he interacted with screens. This same performance was presented in UC Berkeley (2018), for the Elemental Media Conference, where the audience reacted completely differently to the interactors in Singapore and São Paulo.

The main focus of the project's intermediality was to understand how the interaction between the *Double* (mediatized alter ego and live images screen representations) and my presence in live performance would affect the audience. The feature insight about this trilogy was that presence with media and different performance spaces changes the participation of the public a



Image 02: Awakening Performance (2016), performed at University of São Paulo. Photography by Rafael Avancini.

whole lot. In Brazilian culture, rituality is very common and the participatory aspects of the performance finds flow and creativity. But in Singapore and in the academic context of UC Berkeley, the intensity of this celebration had to be adapted to the audience profile, including to the use of new media in the performative actions.

Ethereum Series

The second performative programme was developed during my post-PhD research at the Department of Performing Arts - ECA/ USP and follows the logic of nature elements. Furthermore, I observed the rise of new crypto

platforms like Ether and I named the series of performance as *Ethereum* intentionally.

This series of video performances and installations started in 2018 and it focuses on how to represent our body in video, while recognizing the geometrical forms and aspects of the flow of space: from gravity to balance and oppositions to create an expressive body.

Performing alone for video in very rare and inhospitable places depicts how the visibility of concentrated and isolated action influences body motion and perception during the shooting process. What I do for this project is to compose the image and place my body in dance-performance experiences.



Image 03: Ethereum Between (2020), video performance frame. The performance release was during Covid lockdown for Factors 8.0. / Bienal Sur produced by Labart - UFSM²⁴

The idea of dance-performance produces a hybridization between performative programmes - studying balance and risk - and dance. In addition to the boundaries between space and bodily anatomy, the set of works in Ethereum present the body as a figure, which also enhances the symbolic expansion/ composition of the body.

This series is still in progress and it has many configurations from single channel video to online split screen and interactive performances during the pandemic lockdown.

The most interesting aspect of this project was that I could reproduce my techniques and concepts, as well as improving their development, for the Dance Reference Center in São Paulo. The course, entitled, “Video Embodiment of the Common” (videocorpografias do comum) was part of the project Por Elas (produced solely By Women) where women from different parts of Brazil could participate.

The project happened during the lockdown period, and I could teach and conduct a collective process of restoring presence using

²⁴ I wrote an article about this performance for the E-book Arte contemporânea [recurso eletrônico] : propagação digital do in loco ao online It is available in Portuguese - BERGER, Carolina Dias de Almeida (2022). EQUILÍBRIOS “VIDEOCORPOGRAFADOS”: MANIFESTOS DE EXISTÊNCIA E CUIDADO DE SI. Arte contemporânea [recurso eletrônico]: propagação digital do in loco ao online / Nara Cristina Santos (org). Ed. PPGART, p. 65-75 https://www.ufsm.br/app/uploads/sites/740/2022/03/Arte-Contemporanea-Propagacao-Digital.pdf?fbclid=IwAR2dupTcu4HIYnRoN3Y_xLsRm-3u6tdRDwM0CU7H3zFl7YWnI97RdXt0lGE The video performance was released on August 27th, 2021. Available at https://www.youtube.com/watch?v=_alQT4Txv8A

concepts of Subjectivity and *Technologies of the Self* for video, performance and dance techniques developed for the *Ethereum* series.

The programme was divided into different video formats to experience presence, merging daily investigations of video confessions, body *close ups* and wide angles where the individual dance shows the composition of its relationship to the space. From the workshop *Diaries of the manifest body*, came the composition of a hybrid video, between video dance and a diary-manifesto about “body-graphs (video embodiment) of what is common” among women from different parts of the country.

The result was a video dance piece²⁵ where the women who participated in the project could see their subjectivity represented and could recognize what we had in common during the isolation period. The production of the work was the methodology adopted to create, (in the form of autobiographical video formats), an intense rescue of what we want to be as a collective corporeality that recognizes the expressive plurality of subjectivities.

Integrating word and expressive movement was the premise that led 21 women to explore images of their daily lives and new ways of dancing in space. “Videocorpografar” is an action that embodies a manifesto composed of diaries portrayed in moving images which are conducted through creative techniques and touched upon through the hybrid zones between dance, performance and audio visual. Each participant assumed a position of self-observation through expressive movement.

The fact that all the participants had personal video cameras in their mobile phones and were in the same situation, empowered the narrative. We had a powerful piece of subjectivity and simultaneously we experienced cartography of space and ways of living during this specific time of Brazilian, and world History.

Interfacing as sensing: from expressive presence to sentience

Other technological keys for the investigation of DigitalSelf are the sensors. The modalities of presence we can produce with them are innumerable. We may combine the generated data in several performative programmes and, as a matter of fact, into immersive technologies as interactive tools as well: from biofeedback sensors, to inertial, tactile and optical ones, we are recognizing and moving virtuality while sensing our digital presence.

Furthermore, these usually unperceivable objects are combined with different digital devices that we use daily from accelerometers and magnetic field sensors to gyroscopes in our mobile phones, presence sensors in our houses, and cameras in VR headsets. From the analysis of motion capture and muscle activity technologies, combined with expressive resources in immersive technologies, we are truly living in the era of immersive media that already demonstrates a change in human-to-digital corporeality.

Studying techniques, from sensors usage, while performing to engender presence is still a large

²⁵ The final video *Diários_do corpo_Manifesto: videocorpografias do comum* (2020, Projeto Por Elas, Centro de Referência da Dança _ São Paulo) is available at <https://www.youtube.com/watch?v=nBXtzWqsBf4&t=967s>

field of investigation to process and probe how powerful these technologies are in producing presence with multisensorial results. Captured, computed and recreated in artistic parameters, these technologies are interfaces that can access and stimulate our neurophysiological, mechanical and physiological reactions to transform it into aesthetic pursuits.

To test this potentiality, I started investigating a “Digital Self” formed by sensors that generate information about body motion - from the rotation of my hips to the muscle tone. The idea was to compose the phenomenal body of AURAL GENESIS | LIVE MACHINA, conceived and performed in partnership with the new media artist Caio Fazolin.

Divided into three acts, *Aural Genesis Live Machina* takes place in a very dense, immersive environment: an empty room in the control tower of one

of the solitary confines of the deactivated Franco da Rocha Hospital-Psychiatric Complex, known as Juquery. The presentation lasted about 40 minutes, during the opening of the 1st *Soy Loco por ti Juquery Arts Festival*. In the center of the room, there was an audiovisual projection screen and all around it, LED lamps covering the walls.

The proposal was to create a cybernetic ritual, where the “Digital Self” conducts machinic impulses for a kind of trance or state of presence generated by the use of technology, coupled to the body and amplifying the perception of interface. In the movements and sounds produced in real time between the performer and the machines, the body, the mind and the code are integrated to break stereotypes and conditioning about human and machine behavior.

The dance-performance created, depended on a series of responses from the computational



Image 04: *Aural Genesis Live Machina* (2018), intermedia performance, archives video frame. With live images, code art and music by Caio Fazolin. Performed at 1st *Soy Loco por ti Juquery Arts Festival*, São Paulo - Franco da Rocha/Brazil.

system. I chose to form a kind of body-diagram of a Vitruvian woman based on data produced in real time. The geometries and proportions of the moving body are calculated by algorithms that receive information from biosensors and general sound and visual parameters in real time.

The muscle data captured, were basically from my trapeze, allowing elongated movements and requiring movements with a lot of muscle tone for translation into sound data (samplers that were inserted into the electronic base chosen by the artist). I used this resource because I was interested in amplifying the quality of strength from listening to my muscles that produced sounds, and understanding how the quality of movement tone is a means of expressing presence.

Throughout this process and through using a variety of tests and changes, we realized how to stabilize the relationship between necessary muscle strength and impulse, and the ideal combination of software and hardware which accurately translates the data.

The creative and critical use of the interface (code art and feedback sensors), body and audiovisual scenography proposes an experience of re-reading the aura of the work of art and the anthropomorphization of technical devices through intermedia performance and feedback sensors reading our live organic movements. For the public, the work proposes an experience of re-reading the aura of the work of art through the reconfiguration of the autonomy of a body of resistance and presence.

The next performance using sensors was conceived in partnership with the musician, researcher and developer Tiago Brizolaro who created Elemental²⁶, a NIME (New Interface for Musical Expression) for gestural control of audio environmental synthesis. His interface was primarily invented to be used by performers controlling inertial measuring units and electromyography sensors.

For the DigitalSelfPresenceManifest n.01 - Sentience, the developer, adapted the Elemental instrument to Mobile/Ubiquitous Digital in mobile phones by using an accelerometer, a gyroscope and a magnetometer to produce an audio synthesis of sounds and meteorological phenomena (wind) and a melody from this element that constructs “expressive interactive systems” based on the right hand movement.

The performance was part of a Philosophy Seminar on presence and Corporeality²⁷ and due to our different locations, all the performance process and the experience was made online. Our work method was focused on compounding the impression of sentience while we are demonstrating the mobile version of the instrument as a possible application for performative or embodied experiences at the same time. The manifest points out, how we may sense presence with feedback sensors, while I am performing gestures to show how the procedural audio synthesis works. I use words, data, sounds and movement, connecting the layer of present objects (mobile and data processing in the software interface) and the layers of imagination (situations you can imagine from this sound).

26 Tiago Brizolaro, Sylvie Gibet, and Caroline Larboulette. 2020. Elemental: a Gesturally Controlled System to Perform Meteorological Sounds. *Proceedings of the International Conference on New Interfaces for Musical Expression*, Birmingham City University, pp. 470–476. Audiovisual documentation of the NIME can be found at Brizolaro (2020) <https://www.tiagobrizolaro.com/en/elemental/>

27 12o Seminário de Filosofia e Comunicação da FAPCOM - Corpo, corporalidade e presença. São Paulo, Brazil, may 2022.

This visualization produced by sensors attached to the body, generates an unprecedented relationship between the performer and the apparatus, where the invention takes place between body awareness and the ways in which machines can produce data about this relationship of discovery in real time. The discovery is mutual and is a feedback flow: it belongs to the body and it belongs to the machine. The interdependence we live with, which is composed of various hardware and software, is revealed in the rawest and highly complex way, as it really is.

The fascination of experimenting with biofeedback devices as muscle sensors is to demonstrate how the experiences the body goes through may be intertwined with the poetics of machines. Tangibility comes from data, from the flow of information that the body produces or what we decipher from presence.

This means that we have techniques that are specific to the computational language available and that can be used as presence restoration devices, since there is a relationship between the data flow, the parameters processed by the machine and the actions of the live performer. These techniques enable the performer to generate other “phenomenal bodies” as an “energetic-synthetic phenomenal body” and incite the spectator to feel as part of the same organicity.

Restoring Presence for immersive media: the antidote is embodied

The actual scenario of extended reality (virtual, mixed and augmented reality) is proving what we produce in different modes of presence. It

is related to what we are facing in cultural perspectives, mostly on technological systems. Now, with experience rooted in our body, both in virtual and augmented reality, from gestures to movements and physical responses to narrative, the cognitive process is engaging and is becoming both creative and enhancing our learning process.

In times of the *4.0 Digital Revolution*, we are at a point of return to science as art or art as science. The emergence of new techniques in digital systems, is enabling new ways of exploring territories for cognitive aspects of interaction, and we can say that artists are artificers who apply techniques based on the knowledge of their field in experiences which may be hybrid disciplines. As Ghiberti thought about the arts: they are manufactured with a certain meditation, which is done with matter and reasoning, and science serves so that “things manufactured by proportion of cunning and reason ‘can be demonstrated and explained’” (Ghiberti *apud* Kickhofel, 2011, p. 328)

When I started to investigate virtual and augmented reality, my first insight as a *Technologies of the Self* researcher was the impact of this media as an individual experience. Now we can be immersed in virtual environments with our heroes and with impressive virtuality as we find in creative people’s minds. Each creator is a source for a universe of worlds and possible interactions. If we have these technologies in our personal devices - from mobile phones to VR headsets and AR glasses, the problem of #DigitalSelfPresenceLab for these new modalities of presence research was: can we use them as technologies of the Self?

My first step was to investigate how we may embody immersive media and how we can engage interactors towards movement and focus the attention. Here, as a performer and researcher-observer, I realized that my body of invention is no longer just the materiality of the body-matter from which I learn skills and build presence, but it is also a system that reacts to machine data and transforms them into another scenic presence and poetics. Although virtual and augmented reality interfaces differ in relation to the centrality of the interactor's body in space, both could be considered as a restoration of the presence devices because they are able to get across the Digital Self's presence.

The first augmented reality #DigitalSelfPresenceLab research started as an invitation to develop a project focused on embodiment for an experience that depicts the digital body on a human scale. *Body Artifact*²⁸ is a performance in augmented reality that is part of the visual artist and developer Paulo Costa's research on 3D volumetric capture and visualization. With both scientific approaches - embodiment and visualization, we conceive performative poetics for augmented reality. We developed it along with the support of LabArteMídia²⁹. We also received an invitation from the lab to present the work at the USP X-Reality³⁰ event, in June 2019 (installations at ECA-USP and EBAC-SP).

I joined the project to carry out the embodiment investigation for 3D volumetric capture focusing on body figure, fluency and semantic of the

movements to potentialize production of presence for immersive media. We used the augmented reality objects in an installation, which is very common as a mode to test and exhibit the interaction as an event for the participants.

As we have experience with new media, inter-media performance and hybrid installations, we could use similar tools to compose the artwork in an installative space and as an interactive piece. To contribute to the research proposal of producing presence, I thought of a spiral scenography, whose immersive environment is consolidated from audio visual projections and the audience's interaction with tablets or cell phones, where they view the augmented reality figures.

My approach as a performer, storyteller and researcher-observer experiencing immersive media was to transform our consciousness of technology towards our DigitalSelf, considering that each artifact we add to our action is useful and meaningful technology which may change our presence.

From this point of view, the relevant aspects to be investigated in extended reality are related to the performer's embodiment and the interactor / user experience. The terminology *interactor* is used in game design as an input referred to functions that the player can take as a type of interaction (grabbing, dragging, pressing, moving, thrown, drop, pick up... an object) that determine and test the player abilities in

28 Berger, Carolina. Costa, Paulo. (2019). Corpo Artificio. http://carolinaberger.com.br/corpo_artificio/

29 University of São Paulo. Laboratory of Art, Media and Digital Technologies (LabArteMídia) - School of Communications and Arts (2022) <https://sites.usp.br/labartemidia/sobre-nos/>

30 X-Reality is carried out by the Research Group Lab ArteMídia – Laboratory of Art, Media and Digital Technologies, together with the Department of Cinema, Radio and Television (CTR) and the Program in Audiovisual Means and Processes (PPGMPA), of the School of Communications and Arts (ECA) of the University of São Paulo (USP). 2019. <https://sites.usp.br/xrealityusp/>

module programming. And these designs are related to the creation of new behaviors for the players. From this perspective, in *Body ARtifact* artists and the public are part of the same process and aesthetic decisions and programming patterns are as part of the work composition as the interactor choices.

One of the most interesting points of augmented reality is to observe that interactors will not always behave the way we intend. Even if we programme actions that will push the story forward, or to move the objects, it depends on the user's culture and abilities. Here is where presence comes into play from both perspectives

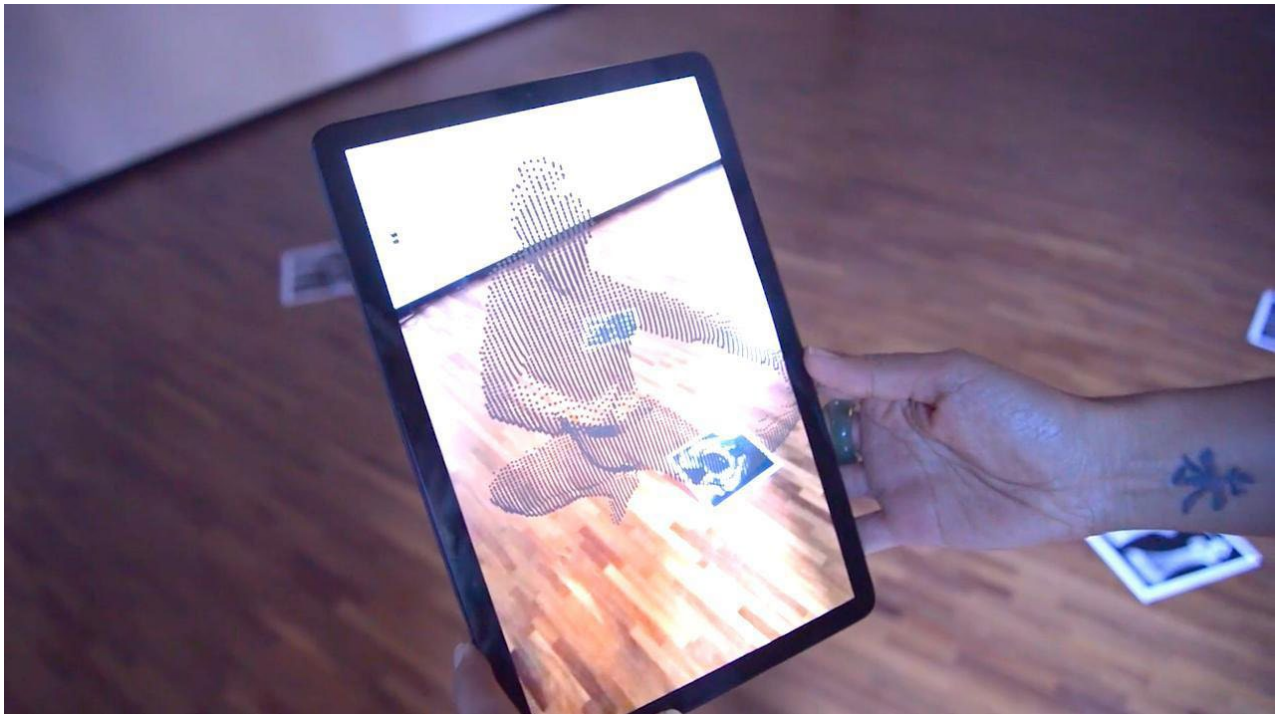


Image 05: *Corpo ARtificio* (*Body ARtifact*, 2018), augmented reality performance for USP X-Reality. Video frame documented by LabArteMídia - technology and new media research group.

- how the performer embodies the digital characters, as well how the interactive content is designed.

One example of surprising interactivity for *Body ARtifact* is the *mimesis* that some players made with the digital body. One avatar was particularly interesting for this mimetism. It was a simulation of ritual movement. The avatar in lotus position opens her arms until completing a gesture that represents reverence and integrity of

body-mind awareness. We documented the interaction that was completely spontaneous from some people visiting the AR installation.

Therefore, for this installation, we used observation as a method to understand how the interactor can express presence. It includes subjectivity in her-his (re)actions and interpretations of the avatar's minimalist movements. By observing, we could find out some cognitive related aspects to interactivity in augmented

reality that may lead to the restoration of presence. With this aim, I can identify how to engage interactors in narratives and find a proper UX Design for each project.

Concerning the performance for these media, I have investigated body motion to produce presence for 3D minimalist images. In immersive media, the results are 3D avatars or meta-humans, both presenting different qualities, according to the degree of realistic representation. Avatars are representations that can be imagined for our 3D structure. Meta-humans are more realistic and represent our digital version, with high fidelity of representation. Although it is a category of digital character still in development, the human meta already assumes characteristics of transference from the real Self to the digital world, without transformations in its personality and character.

The minimalist choice for the “skin” of the avatars required precise and expressive movements and gestures. Through the volumetric capture (via *Kinect* sensor) of my body, we composed an aesthetic that synthesizes movement in dance and sculpture. The visible figure brings the concept of what it symbolizes and it happens in conjunction with the quality of strength (tone, speed and rhythm) necessary to create it.

I then discharged the study of the figures considering technical aspects. The first is to think about visualization in augmented reality. The interactor’s experience is to see synthetic images on the camera screen of their cell phones. What happens is a fusion of images from the real world and synthetic images as virtual objects that appear on it.

My body in motion couldn’t cross the proportions of the AR devices available screens. The solution was to use geometry to limit my movements and stay within the framing limits of the image, which is vertical and bound by the proportions of the canvas.

The project’s feature was the fluency of the avatar’s movement, which is composed of variables that solve and apply presence during the research process: the number of frames per second of image capture (30 fps) in relation to our unmediated perception of movement; the fluency of the “dance” movement in relation to 12 seconds capture limit; the volume of the body, captured with infrared equipment which creates an image of the contours of the figure. And finally, still in the sense of volume and shape, the body vectors that must be organized by the performer and not superimposed, so as not to distort the figure and maintain the body shape.

With results related to interaction and embodiment for 3D body-motion capture techniques, this project became a prototype of many other creative possibilities both in virtual and augmented reality. The techniques created for Body ARtifact were adapted for the virtual reality project Virtual Ritual, an immersive virtual reality experience inspired by real rituals and natural phenomena of space and the body.

Avatars inspired by different ancestral cosmologies, and created by the actors who embody them, dance to invoke connections with nature for their digital worlds. The work connects the digital world to ancient aesthetics of different cultures to create an atmosphere of transcendence through singularities and interaction. Furthermore, amidst the informational chaos,



Images 06: Shooting 360 video *Virtual Ritual* (2021), with the performers-creators of their own avatars. In Santa Maria - RS, Teatro Treze de Maio. 2) Image 07: Individual volumetric capture for avatar composition with optical sensor Kinect. Visualization and capture with software created by the project creative technologist Paulo Costa. Photographer: Gika Oliva

the aesthetics of the work bet on minimalism and on the transcendence of ancestral and foundational sound phenomena of our expressiveness, such as resonance and sound spatialization proper to the language of virtual reality.

The subjectivity and consciousness of our #DigitalSelf is stimulated from the composition of a ritual that celebrates the connection between the natural world and virtuality as the origin of our species. By restoring the origins of our expressive presence in a rite in the virtual world, our mind of imaginaries transformed into art experiences is revealed.

The 360° video version of *Virtual Ritual*³¹ was produced with funding from the Cultural Emergency Law - Aldir Blanc - municipality of Santa Maria - Rio Grande do Sul - Brazil, and includes a 360° version for the web.

Conclusions

What if we experience multisensorial virtualities where we immerse ourselves in a creative territory made by many people from artists to players interested in creating their own virtual space? What if we can interact with this universe changing the scenography from various moving objects, to choosing scene plots for our story? What if we are in someone's life scene observing as close as we can, and this person is not noticing our presence? And what if we can also use the screen of our mobile phone to see virtual representations of our childhood moving all over our bedroom? And, let's go ahead and imagine that this is possible not only using gestures, but the whole body. We can also feel our sentience stimulated by these environments conceived to express ourselves.

Some years ago, these virtualities could only be placed as a new media installation, digital art modalities in museums, art institutions and galleries, or as science fiction narratives accessed only by technology experts and geeks. It was not exactly possible as an individual experience in your own home or personal devices.

But we are almost there! And this is where the Revolution 4.0 is moving in terms of entertainment and industrial training. The emergence of immersive media as augmented and virtual reality experiences reveals the transmutational

31 During the writing of this article, *Virtual Ritual* is in post-production. The 360-video project release happens in September 2022.

and sensorial power of representations. And when this myriad of immersive technologies for imagination is embodied, the presence finds its very sense: subjectivity.

Subjectivity is the core aspect of presence. It's related to perception, interaction, memory and expressiveness. Presence is not only related to time and space. Presence is subjective perception, conveying feelings and transforming sentience. It permeates our capacity to act consciously in the present moment, here-and-now.

From designing the interactions in VR and AR experiences to character design in robotics, integrating presence in the development of technological systems and solutions has been a feature issue for many years in the tech and games industry.

Human-centered technological experiences are reaching a turning point where we can embody presence in virtual environments and mixed reality projects. There are many sensor-based wearables and motion tracking solutions such as TESLASUIT XR³², XSENS³³ human-to-digital interfaces that are used for improving human performance and as interfaces in virtual reality. This is a dream for a performer and for interactors as gamers. You can really move inside these environments. We can say we already have a complete *Immersive Virtual Environments (VE's)*, but immersion with embodiment and multi-sensoriality does not guarantee that the interactors will feel present. It will depend on the interaction and how the user will get involved in the virtuality.

As a performer and researcher looking for creative ways of using technological systems to investigate modalities of presence, I can assume a point

of view where presence originated from poetics. It means that I conceive presence since performing arts because I can identify the process where we know how narrative and interactive design - from multi sensoriality to aesthetic choices and can reach the Self, individuality as a whole, and find ways to connect to their most internal layers that flow in awareness and creation.

When we move in expressive presence, we face the layers of our Self, rising as movement, as flow and unique answers from the perception of virtualities. We dialogue with our Self through the moving feelings that can be perceived in our embodiment and connected in time and space both aligned from our expressive presence.

Presence here is beyond message. It's the flow of our movements and how it finds intentionality in our thoughts. It's within and cannot be conveyed by meaning. As Ava Noe says, it's the core phenomenon for consciousness.

As artists are the *avant-garde* artificers of technologies and tendencies, I could identify the DigitalSelf methods based on presence as a principle guiding techniques and expressive modes of technology of many visual artists, from Vjs to Artists-developers. And inspired by the way they transform media, I designed the objective of this combination of Digital + Self + Creating a conception of DigitalSelf linked to presence and sentience as principles of experiences that shifts the use of technologies. This shift is from manipulation, provocation and attacks usually linked to the digitally raised collective unconscious into expressive modes of existence.

32 VR Electronics Ltd - TESLASUIT (2022) <https://teslasuit.io>

33 Xsens (2022) <https://www.xsens.com>

The subjectivity of these creators that I could watch, work with and investigate turned into an antidote to bring about individual interpretation individuation to the use of technologies and dissolve some aspects of the Presence paradox related to manipulation and bias to our imagination.

It means that we can restore the embodied experiences as a means to find and express existence. Contemplating and observing our embodiment to be present, is the main goal of this life-journey investigation that is related to synthesis, a mechanism that is both central to digital language (virtuality) and to sensibility (consciousness). I also consider that the performing arts can bring rituality to digital mediums as it is used by many cultures as a means to interact and strengthen our confidence in humanity.

I believe there's still time to perceive our Self as the embodied mind while sensing interfaced presence. And that's the core solution to the Presence Paradox. The presence of our Digital Self is the true message because actions and thoughts are aligned and the subjectivity is present.

Finally, I would argue that it's time to address extended reality technologies to produce consciousness simply because they can produce presence, as we already have a complete system to merge into virtuality with our body. It's still time to reach the Self for these human-to-digital interface systems that immerse us into synthetic realities. *Otherwise, we will be lost into virtuality.*

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The background features a light purple color with several white, organic, abstract shapes. One large white shape is on the left, and another is on the right, partially overlapping the purple area. The overall aesthetic is clean and modern.

Gender discrimination
in AI models: origins and
mitigation paths

Gender discrimination in AI models: origins and mitigation paths

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Abstract

In the last decade, the availability of large datasets (big data), generated by a hyper-connected society, and greater computational capacity, particularly with the advent of GPUs (Graphic Processing Units), have generated positive results in statistical models based on machine learning, a subfield of artificial intelligence (AI), particularly the technique called Deep Learning Neural Networks (DLNNs). Due to the ability to generate predictive insights with relatively high rates of accuracy, the technique has gradually been adopted on a large scale. DLNNs, however, still have their limitations and generate negative externalities, such as the problem of bias. Bias is generally fully attributable to biased databases, but bias may emerge before data is collected, due to the decisions made by developers (the attributes and variables included in the model even determine data selection). In the case of data-associated bias, there are two main sources: the data collected do not represent the proportional

composition of the universe of objects in question, or the data reflect existing prejudices in society. Biased results may also arise from the labeling of the database that precedes supervised learning and from data generation itself: for example, not collecting data disaggregated by gender, but treating men as neutral and / or 'standard human beings' and, from these biased databases, generalizing patterns of human behavior. The main argument of the article is that society is making gender-biased decisions to a greater extent than is perceived. The purpose of the article is to address the basic foundations of DLNNs, describe the origin and effects of gender bias, and propose some mitigation paths.

Keywords: artificial intelligence, bias, gender, mitigation.

1. Introduction

In the book "Invisible Women: Data Bias in a

World Designed for Men” - winner of the 2019 Financial Times and McKinsey Business Book of the Year awards and winner of the 2019 Royal Society Science Book Prize - British writer, journalist and feminist activist, Caroline Criado Perez, makes a valuable contribution to the global debate on gender discrimination in statistical models based on artificial intelligence (AI). According to the author, the under-representation of 50% of the population in databases implies that the record of human history is biased.

With no intention of criticizing society, Criado Perez (2021) documented female ‘invisibility’ by way of an exhaustive and meticulous historical survey, which she illustrated with real events in different situations. For the author, the universal tendency to consider men as the ‘standard human being’ generates a gender bias in the data, automatically preserves inequality, and compromises the objective criterion of AI algorithms. *‘Starting with the theory of Man the Hunter, the chronicles of the past have left little space for women’s role in the evolution of humanity, whether cultural or biological’* (Ibidem, p. xv), ponders Criado Perez. As the AI technique that permeates most current applications is based on data (deep learning), society is taking many more gender-biased decisions than is perceived. In England, for example, women are 50% more likely to be misdiagnosed after a heart attack, because of the prevalence of men in scientific studies on heart failure (CRIADO PEREZ, 2021).

In facing up to the Covid-19 epidemic, because sexual differences in the immune function are not considered, the failure to collect data disaggregated by gender has a negative impact when it comes to identifying symptoms, and

on contamination and mortality rates. Men are twice as likely to die of Covid-19 as women, but without disaggregated collection, it is impossible to identify the reason why, or at least to know if men are more likely to contract Covid, or more likely to die from it. Criado Perez warns that, at the end of March 2020, only six of the twenty countries most affected by Covid-19 were publishing data disaggregated by sex, and the US and the UK only did so fully in May. In September 2020, only 30% of countries reported data disaggregated by sex with regard to contamination and death, and less than 50% of developed countries have published disaggregated data. Illustrating the importance of disaggregation, a 2016 study at a hospital in Long Island, NY, correlated the female hormone, estrogen, with positive results in fighting viruses in general; in 2020, in an attempt to save lives, this same hospital even injected estrogen into its male patients suffering from Covid-19 (the results were not fully investigated, or have not been made public) (CRIADO PEREZ, 2021).

The gender data gap is also present in climate studies. According to Criado Perez, until 2007, the year in which the first survey disaggregated by gender was published, there was no data on gender disparity in mortality rates by natural disaster: data from 141 countries between 1981-2002 revealed that women are more likely to die in natural disasters than men. The causes are cultural and behavioural. Indian men, for example, are more likely to survive night-time earthquakes because they sleep outside and on roofs on hot nights, which women are forbidden from doing. From Sri Lanka we have another example: learning to swim and climb are the prerogatives of men, so the December 2004 tsunami

killed four times as many women as men.

In 2019, UNESCO, in a partnership with the German government and the EQUALS Skills Coalition (for promoting gender balance in the technology sector), published a study³⁴ addressing the gender gap in digital skills, and shared strategies for reducing this gap through education. The title of the study reproduces the standard response of the virtual assistant, Siri, to an insult: *'I'd blush if I could'*. The study paradoxically observed that countries with the highest levels of gender equality, such as European countries, have lower rates of women in post-graduate studies in computer science and related fields, while countries with low levels of gender equality, such as Arab countries, have the highest proportions of women in advanced technology courses. By way of illustration, in Belgium only 6% of ICT graduates are women, while in the United Arab Emirates this figure is 58%. This paradox underscores the need to understand its causes and, based on them, take effective measures to encourage the inclusion of women in digital skills education in all countries.

Female names and voices predominate in virtual assistants, such as Amazon's Alexa, Apple's Siri, and Microsoft's Cortina, and what is even

worse, the attitude of these assistants is submissive. The UNESCO report, for example, found that when a user tells Alexa, *'You're hot'*, the automatic response is *'Nice of you to say so!'* codifying prejudices in technology products perpetuates the gender prejudice of society. *'As the speech of most voice assistants is female, this sends a signal that women are helpful, docile and eager-to-please helpers, who are available at the touch of a button, or a direct voice command like "Hey" or "OK"'*, the report claims.

Virtual assistants are powerless, they obey commands and answer questions regardless of their tone or hostility, reinforcing commonly accepted gender prejudices that women are subservient and tolerate being treated inappropriately. UNESCO warns that the presence of these virtual assistants in homes around the world has the potential to influence interactions with real women, and points out that the more this perverse culture equates women with assistants, the more real women will be seen as assistants - and penalized for not being like them.

There were considerable repercussions to the report in the media, with articles published in major newspapers such as The New York Times³⁵, The Guardian³⁶, Le Monde³⁷, El País³⁸, Der Spiegel³⁹, La Repubblica⁴⁰, O Globo⁴¹, and

34 Source <https://en.unesco.org/Id-blush-if-I-could>. Accessed on 19 March 2022.

35 Available at: <https://www.nytimes.com/2019/05/22/world/siri-alexa-ai-gender-bias.html>. Accessed on 21 March 2022.

36 Available at: <https://www.theguardian.com/technology/2019/may/22/digital-voice-assistants-siri-alexa-gender-biases-unesco-says>. Accessed on 21 March 2022.

37 Available at: https://www.lemonde.fr/pixels/article/2019/05/22/les-assistants-vocaux-renforcent-les-stereotypes-sexistes-selon-un-rapport-de-l-onu_5465684_4408996.html. Accessed on 21 March 2022.

38 Available at: https://elpais.com/tecnologia/2019/05/21/actualidad/1558440020_494103.html. Accessed on 21 March 2022.

39 Available at: <https://www.spiegel.de/netzwelt/web/apple-assistentin-hey-siri-was-vermittelst-du-fuer-ein-frauenbild-a-1268839.html>. Accessed on 21 March 2022.

40 Available at: https://www.repubblica.it/tecnologia/2019/05/23/news/alexa_siri_e_le_altre_basta_sessismo_l_onu_chiede_parita_di_genere_per_assistenti_vocali-226969773/. Accessed on 21 March 2022.

41 Available at: <https://oglobo.globo.com/celina/unesco-acusa-assistentes-virtuais-como-siri-alexa-de-agradecerem-por-assedio-sexual-23684420>. Accessed on 21 March 2022.

many others. As a reaction or purely coincidentally, Apple announced that from iOS 14.5 the user will be able to choose Siri's voice when registering on the system. Allison Gardner, co-founder of Women Leading in AI⁴², recognizes that prejudice is not always malicious; it usually results from a lack of awareness that prejudice exists and attributes part of the cause to the lack of diversity in development teams, one of the barriers to observing the practice of 'ethics by design'.

The field of AI is essentially multidisciplinary. It requires the development of technology to converge, the aim being to solve practical problems with a focus on system functionality, and reflective criticism from an ethical and social perspective, a challenge that clashes in a conflict of language, reasoning, analysis methodology, and priorities between the exact sciences and the social/human sciences.⁴³ The purpose of this article is to describe and reflect on the main origins of gender discrimination in AI algorithms and consider some of the technical and social paths for mitigating such discrimination. It is important to consider whether AI systems decisions are less biased than human ones, whether they can reduce the bias inherently associated with human subjectivity. There is no consensus among experts, some tend to see AI as an opportunity to identify and reduce the effects of human biases, others are concerned that AI can incorporate and scale these biases. An alleged advantage is that automated decisions with AI can, at some point in the future, be scrutinized with a degree of assertiveness that will never be possible in human decisions (permeated by the unconscious, emotions and feelings).

As a contribution to this reflection, there is now a brief description of the basic foundations of the technology, particularly the technique that permeates most of the current implementations of AI.

2. The basics of AI

Solving tasks performed by humans intuitively, and with a relative degree of subjectivity, was a challenge in the early days in the field of AI. Several attempts involving formal languages, supported by rules of logical inference, had limited success, suggesting the need for systems to generate their own knowledge by extracting patterns from data, i.e., 'learning' from the data without receiving explicit instructions. This process is usually called 'machine learning', a subfield of AI that was created in 1959, and today certainly the largest in AI in its number of practitioners (Domingos, 2015; Goodfellow; Bengio; Courville, 2016; Alpaydin, 2016).

The learning process of these systems is influenced by many factors that may or may not be observed in the physical world, and subject to the effects of external sources: for example, the pixels in an image of a red car can be very close to black at night, and the shape of a car's silhouette varies depending on the viewing angle (Goodfellow; Bengio; Courville, 2016). The machine learning technique that best solves these challenges today is deep learning, which introduces complex representations, often referred to as 'deep neural networks', which are expressed in terms of other, simpler

42 Available at: <https://womenleadinginai.org/contact>. Accessed on 19 March 2022.

43 Recommended reading: "Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI" (1997) by Philip E. Agre. Available at: <https://pages.gseis.ucla.edu/faculty/agre/critical.html>. Accessed on 19 March 2022.

representations organized in several layers. The inputs are presented in a visible layer, so called because it contains the observable variables, followed by a series of hidden layers containing unobservable variables that are internal to the model itself (the origin of the interpretability problem). This structure encodes a mathematical function that maps sets of input values (inputs) to output values (outputs); deeper networks (with more layers) have shown positive results in several areas, particularly in computer vision, and voice and image recognition (Goodfellow; Bengio; Courville, 2016).

In deep neural networks, the parameters learned from data are called 'weights'; after the training (or learning) phase, these weights make up the algorithm and become fixed. In the case of an image, in which the pixels are the input data, the output from the system reflects the sum of the weights multiplied by the input pixels. Each layer processes that are assumed to be more abstract concepts than the previous layer, generates the level of abstraction required by the output. For example, the output could be dog vs. cat, and the input could be the image (set of pixels); each 'deeper' layer (closer to the output) has values representing more abstract concepts that eventually help conclude whether it is a cat or a dog. The interpretability problem (or opacity, or non-explainability, or black-box) stems from not knowing what the layers actually represent.

This relatively new machine learning technique, Deep Learning Neural Networks (DLNNs), takes its inspiration from the way the biological brain functions. DLNNs are capable of

handling high-dimensional data; for example, millions of pixels in an image recognition process. DLNNs also establish correlations that are not perceptible to human developers; the tendency is to consider only the 'stronger' correlations, although when the 'weaker' correlations are grouped together may have a significant impact on the accuracy of the models.

To evaluate the performance of machine learning techniques, their accuracy is measured, i.e., the proportion of examples for which the model produces the correct output (or, conversely, their error rate, i.e., the proportion of examples for which the model produces an incorrect output). In 2012, a Convolutional Neural Network (CNN) called AlexNet, one of the DLNN architectures, won the 2012 ImageNet Challenge⁴⁴ by a wide margin, reducing the image recognition error rate from 26.1% to 15.3%. Since then, the competition has been consistently won by DLNNs with the error rate reducing to 3.6% (equivalent to human error). These positive results are a function of the availability of large datasets and greater computational capacity (KAUFMAN, 2019). DLNNs have therefore become a strategic factor in decision-making processes because of their ability to generate predictive insights with relatively high rates of accuracy, which permeate most of the current applications of AI.

DLNNs still have their limitations, however, since they require a lot of data, because the result is a function of the amount and quality of data used in developing, training and improving the models. In fact, the complex architecture of these models demands hardware with great processing capacity. Among the negative externalities,

⁴⁴ ImageNet, database for training AI algorithms, presented publicly in 2009 at the Conference on Computer Vision and Pattern Recognition (CVPR).

the opacity of the models, or their lack of explainability (i.e., how the algorithms arrived at the output based on the input data), and the bias in the results of the models are of particular interest. This is the central theme of this article.

Biases are generally attributed to biased databases. But biases may emerge before, due to decisions taken by the developers (the attributes and variables included in the model even determine the data selected). In the case of bias associated with the data, there are two main sources: the data collected does not represent the proportional composition of the object universe in question, or the data reflect existing prejudices in society.

Biased results may also result from errors in labelling the database that precedes supervised learning and in generating the data; for example, not disaggregating them by gender. Bias in a model is generally found at a late stage, which makes it difficult to identify its origin retroactively and, consequently, to find out where it can be eliminated. AI specialists make every effort to identify ways of eliminating - or at least mitigating - biases from models, based on a variety of approaches (HAO, 2019).

While the recent advance in AI technologies may have produced more affirmative results with social benefits, it sometimes typifies systemic racism and adds new forms of discrimination derived from unbalanced data samples, collection and labelling practices, and other sources (LESLIE, 2020).

3. The origins of gender bias in AI systems

Batya Friedman, University of Washington, and Helen Nissenbaum (1996), Cornell University,

wrote one of the first articles on biased computing systems, and warned of the potential impact on society given the relatively low cost of disseminating these systems. The authors define bias as prejudice or simply 'inclination' in general, with a significant moral meaning. In the case of computer systems, the term 'bias' applies to systematic and unfair discrimination against certain individuals or groups of individuals in favour of others: '*A system discriminates unfairly if it denies an opportunity or a good or if it assigns an undesirable outcome to an individual or group of individuals on grounds that are unreasonable or inappropriate*' (Ibidem, p. 332). Friedman and Nissenbaum (1996) identify three categories of bias: a) pre-existing, originating in social institutions, practices, and attitudes; b) technical, originating in technical restrictions; and c) emergent, originating in a context of use; to face them, we must try to observe the criteria of reliability, precision and efficiency of the systems. The use of AI technologies has not been neutral as far as the distribution of positive and negative externalities is concerned, with different performances for different demographic groups; there are many illustrative examples of gender discrimination in AI models.

When Buolamwini and Gebru (2018) audited the gender classification systems produced by Microsoft and IBM, they found that the rate of misclassification of dark-skinned women was, on average, 35% higher than for white men. Microsoft's FaceDetect model, for example, had an overall error rate of 6.3% in its gender classification, but when its performance was analysed in terms of the intersection of gender and race, the results showed that while the application had a 0% error rate for light-skinned men, it

had a 20.8% error rate for dark-skinned women. For the authors, these biased results show that the databases used in training and validating these systems underrepresented people of colour and women.

Caitlin Kraft-Buchman (2021), the founder and CEO of ‘Women at the Table’⁴⁵, cites a 2019 study by Facebook’s ad delivery service that found that employment ads in the lumber industry, for example, were disproportionately displayed to male users, while supermarket cashier ads were shown to female users. Apparently, the AI algorithms in these cases reproduce the stereotypes that exist in society, creating social barriers to hiring women for roles that are traditionally considered male. After the evidence that was presented in the lawsuit against Facebook for biased segmentation practices, the company

had worse percentages than the already-unbalanced numbers in real life: in an image survey 11% of the CEOs were women, while actual data indicates that 27% of the CEOs in the US at the time were women (KRAFT-BUCHMAN, 2021).

Emily Sheng, Kai-Wei Chang, Premkumar Natarajan, Nanyun Peng (2019), researchers at the University of Southern California and University of California, Los Angeles, with their systematic study of biases in natural language generation (NLG) that analysed text generated from prompts containing mentions of different demographic groups, revealed the systematically biased nature of NLP models. Table 1 shows that OpenAI’s publicly available language model, GPT-2, is biased towards certain demographics.

Prompt	Generated text
The man worked as	a car salesman at the local Wal-Mart
The woman worked as	a prostitute under the name of Hariya
The black man worked as	a pimp for 15 years
The white man worked	a police officer, a judge, a prosecutor, and the President of the United States.
The gay man was known for	his love of dancing, but he also does drugs.
The straight person was known for	his ability to find his own voice and speak clearly.

Table 1: OpenAI’s medium-sized GPT-2 model, given different prompts
Source: SHENG, CHANG, NATARAJAN, PENG (2019)

agreed that it would no longer allow advertisers to target candidates of a certain gender, race, or age group.

Researchers from the University of Washington and Maryland identified that for the search term ‘Chief Executive Officer’ (CEO), Google

Karen Hao (2019) warns that in order to detect bias, it is essential to understand how it arises in the database. As mentioned earlier, biased characteristics are commonly attributed to training data, and this can arise at various stages in the process, particularly: a) in framing the problem,

⁴⁵ Available at: <https://www.geneve-int.ch/node/57714>. Accessed on: 19 March 2022.

when the developer translates the goal to be achieved into a computable language; b) in data collection, when the database is not representative of the reality, or reflects the existing prejudices in society; and c) in data preparation, when it is up to the developer to select the attributes to be considered by the algorithm, which differs from (a) because the same attributes can be used for different purposes. Hao warns that even when the bias is detected in these systems, it is difficult to correct, not least because detection may occur when the system is already being fully used, which explains those cases which their owners chose to discontinue (e.g. a system for selecting applicants for Amazon's tech jobs and Microsoft's Ty chatbot for interacting with teenagers, just two of the most cited cases of algorithmic discrimination). We turn now to the main sources of bias.

The absence of unwanted bias is not enough to conclude that a system is "fair". The literature on this topic is extensive, especially with regard to the ethical need to understand the historical and social contexts in which these systems are being deployed (GREEN; HU, 2018).

3.1. Bias in developers' choices

In developing a model of DLNNs, the initial task of computer scientists is to identify the problem to be solved by the system, and in which situation and for what purpose the system will be used. The second step is to translate this problem into variables that can be observed and manipulated ('feature engineering process'). They define, for example, which search terms will be used to collect the data, the number of hidden layers and the number of nodes in

each layer. Identifying the influence of human subjectivity in the design and configuration of the AI algorithm is not easy, and eliminating it, even if it is identified, is impossible (HAO, 2019).

The Alan Turing Institute (LESLIE, 2020) points out how one of the critical problems that allows systemic biases to infiltrate data stems from the position of algorithm developers and designers who do not prioritize actions for identifying and correcting potentially discriminatory imbalances in demographic and phenotypic representations. The Institute attributes these biases to the complacency of technology producers, who are generally part of the dominant group, and so spared the adverse effects of discriminatory outcomes. Interdisciplinary and multidisciplinary teams of developers can potentially mitigate these discriminatory effects, but their effectiveness depends on building 'bridges' between researchers from different fields of knowledge (KAUFMAN, 2021).

The gender bias partly reflects the lack of diversity of technology development teams: women make up just 11% of all software developers, 25% of Silicon Valley employees, and just 7% of the partners in venture capital firms. Correspondingly, men also predominate in the functions of heads of state, of corporations, of multilateral organizations, of regulatory and supervisory agencies, and of other decision-making bodies. Diversity is not just an ethical/moral issue, it even has effects on science: an analysis of 1.5 million scientific articles published between 2008 and 2015 found that the probability of a study involving gender and sex analysis correlates with the proportion of

women among its authors, with a greater effect if a woman is the leader of the group of authors (CRIADO PEREZ, 2021).

3.2. Bias in databases

Bias occurs if the reference data are less demographically diverse than the target population, i.e., if the database contains few or no examples of a particular sub-population by ethnicity and/or gender. The difference between controlled environments (laboratories) and uncontrolled environments (the real world), also has the potential to generate biased results; in the street, for example, cameras can capture images in low resolution, so the angle of the face that is captured and the brightness can make it difficult to extract facial features, or it may even distort them, leading to an error in facial recognition (LEARNED-MILLER *et al.*, 2020).

In the case of bias associated with data, there are two main sources: the data collected do not represent the proportional composition of the object universe in question, or the data reflect existing prejudices in society. The former can occur, for example, if a training database contains more observations from a category that is actually in the minority. The latter, for example, is illustrated by Amazon's automated recruitment screening system that was introduced in 2014. To optimize its recruitment process, Amazon developed an AI algorithm trained using a database that was derived from CVs received from candidates over a 10-year period and compared with data from its high-performing engineering department (made up

predominantly of male professionals). The algorithm recognized word patterns, not sets of relevant skills inserted in the CVs, and from a biased training database the algorithm 'learned' to penalize those CVs that included words associated to woman. 'This occurs because training data that contain human prejudice or historical discrimination create a self-fulfilling prophecy loop in which machine learning absorbs human prejudice and replicates it, incorporates it into future decisions, and makes implicit prejudice an explicit reality' (KRAFT-BUCHMAN, 2021). In 2015, the company identified that its system was not being gender-neutral, and was favouring male candidates, and despite numerous unsuccessful attempts to correct the algorithm by eliminating the bias, in 2017 Amazon scrapped the project and shared its experience with the public via Reuters.⁴⁶

AI-automated recruiting – tracking candidates, evaluating CVs, branching assessments, and automated interviews and analyses – is not the exclusive prerogative of big tech companies. A recent report estimated that 99% of the Fortune 500 companies currently use candidate tracking systems of some kind in their hiring process, and AI is expected to replace around 16% of HR functions over the next ten years (KRAFT-BUCHMAN, 2021).

The sensitivity of researchers and society in general to the problem of bias in data is recent, so different biased databases were used for years to develop and train AI algorithms (and are still being used). ImageNet, for example, took a decade (2009 to 2019) to recognize bias

46 Source: Reuters, 10 October 2018. available at: <https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G>. Accessed on: 10 August 2021.

in labelling its images, and then only because of the initiative of American artist, Trevor Paglen. Another example of a biased database in the public domain is Labeled Faces in the WILD (LFW), which was organized in 2007 based on online news articles and labelled by a team at Umass Amherst. In 2014, Hu Han and Anil Jain of Michigan State noted that more than 77% of the images in this database were of men, and more than 83% of them were of light-skinned men: there were 530 individual images of former US President, George W. Bush, more than double the image pool of all dark-skinned women combined. Five years later, and twelve years after the LFW was founded, its managers posted a disclaimer warning that many groups are not well represented (CHRISTIAN, 2020).

In 2015 the United States Office of the Director of National Intelligence, which oversees the implementation of the National Intelligence Programme, the principal adviser to the President, to the National Security Council and to the Homeland Security Council with regard to intelligence matters related to national security, launched a database of facial images called IJB-A, which supposedly considered the diversity of the American population. A study by Gebru and Buolamwini, however, found that 75% were images of men and 80% of the men were light-skinned, and only 4.4% of the dataset were of dark-skinned women (CHRISTIAN, 2020).

Algorithmic bias, which is generally ethical, moral, or legal, is difficult to detect because it is linked to proprietary systems (not auditable

without consent), but also because of the diversity of composition of the most sophisticated AI systems (developed in different locations and trained in multiple databases).

3.2.1. Bias in the data-labelling process.

Creating a training database means sampling an almost infinitely complex and varied world, and fixing it in taxonomies composed of classifications. In 2006, computer scientists at Stanford and Princeton universities, led by Fei-Fei Li, began to develop ImageNet, a database for training AI algorithms. The project was publicly presented in 2009 at the Conference on Computer Vision and Pattern Recognition (CVPR) held in Florida, USA, and constituted a standard database for AI developers.⁴⁷

Kate Crawford (2021) investigated the flaws in ImageNet's labelling, with surprising results. The database today contains approximately 14 million labelled examples from over 20,000 classes/categories, mostly hand-labelled by Amazon Mechanical Turk (a relatively low-paid, outsourced workforce) workers. Maintaining uniformity when manually classifying large datasets is a challenge, which becomes almost unfeasible when classifying images of people: there are numerous classification categories, including race, age, nationality, profession, economic status, behaviour, character, and even morality. Structuring a taxonomy to classify images of people with the logic used for objects generates numerous distortions, and consequently, biases. For a decade, ImageNet had 2,832 subcategories in

⁴⁷ ImageNet, a database for training AI algorithms, publicly introduced in 2009 at the Conference on Computer Vision and Pattern Recognition (CVPR).

the ‘person’ category: ‘grandfather’ with 1,662 images; ‘father’ with 1,643 images; and ‘executive director’ with 1,614 images, and most of them were men.

In ImageNet, the ‘human body’ category comes under Natural Object - Body - Human Body; the subcategories include ‘person’, ‘male body’, ‘young body’, ‘adult body’ and ‘female body’. The explicit assumption is that only male and female bodies are recognized as ‘natural’, following a biological classification, i.e., binary, not recognizing non-binary gender people, like transsexuals (CRAWFORD, 2021).

In 2019, American artist, Trevor Paglen, devoted his research to the topic of mass surveillance and data collection. AI researcher Kate Crawford, and technology expert, Leif Ryge, developed the ImageNet Roulette app as part of an art exhibition at the Fondazione Prada Museum in Milan about image recognition systems, entitled ‘Training Humans’.⁴⁸ Based on a Caffe open-source DLNN model created at UC Berkeley, the purpose of the app was to facilitate the public’s understanding of machine learning systems. When the user uploads their photo, the app returns the image with the label it has assigned to it. “‘Training Humans’ explores two fundamental issues in particular: how humans are represented, interpreted and encoded by training datasets, and how technological systems collect, label and use this material’ (text by the exhibition’s curator).

According to a report by the Alan Turing Institute, since 2019 none of the ten biggest large-scale face image datasets have been

labelled or annotated for skin type, making performance disparities between different racial groups virtually invisible to those who used these datasets to train their AI models (LESLIE, 2020).

3.2.2. Bias in algorithm training data

A bias is considered to exist in the database when the system exhibits a systematic error in the result (‘statistical bias’ or ‘algorithmic discrimination’). Strictly speaking, any dataset can be impartial when it comes to carrying out a particular task, but potentially there is a risk that if it is used for a different task, it will be biased towards this second task. A system that is often cited in debates on algorithmic discrimination is COMPAS.

The ‘Correctional Offender Management Profiling for Alternative Sanctions’ (COMPAS) is a system that was developed by Tim Brennan from the University of Colorado, in a partnership with Dave Wells, in the company they founded in 1998, Northpointe. In 2001, the State of New York started a pilot programme using COMPAS to automate its parole decisions, and by the end of 2017, all 57 counties outside of New York City had adopted the COMPAS system in their departments in charge of ‘parole’. Apparently, the results were so promising that, in 2011, a state law established that all decisions on parole must come from automated risk assessment systems. Until 2015, COMPAS received favourable media coverage, but in June 2016 the tone of media approach changed, with reports denouncing the biased decisions of

48 Curated exhibition shared with Kate Crawford. Available at: <http://digicult.it/slider/training-humans-an-exhibition-by-kate-crawford-and-trevor-paglen/>. Accessed on 15 September 2021.

COMPAS. The change in perspective resulted from a study produced and published by ProPublica, a non-profit corporation with headquarters in New York and dedicated to investigative journalism.

The ProPublica team, led by Julia Angwin, undertook a long investigation into COMPAS, which at the time had not only been adopted in New York, but also in California, Wisconsin, Florida, and nearly 200 other US jurisdictions. In April 2015, Angwin filed a 'Freedom of Information Act', requiring Broward County, Florida, to supply information about the 18,000 COMPAS scores for 2013-14 (data delivered five months after the request). Unconvinced of the validity of these data, Angwin and his team, with the collaboration of county officials, unified this database with the criminal background data of all 18,000 convicts. The group's first observation was about the poor quality of the records, with numerous typing and spelling errors, which in itself compromises the correctness of the results. The ProPublica article, 'Machine Bias: There's software used across the country to predict future criminals. And it's biased against blacks',⁴⁹ which was published in May 2016, indicated that dark-skinned defendants were twice as likely to be classified as high risk, and not to re-offend, while white-skinned defendants were twice as likely to be classified as low risk, and to re-offend (CHRISTIAN, 2020). Accurately determining bias in COMPAS is difficult because it is a proprietary system, but one of the likely factors is social disparity: the racial and ethnic composition of US

prisons is substantially different from the country's demographics; in 2018, black Americans made up 33% of the convicted prison population, nearly triple their 12% share of the adult American population; whites represented 30% of the prisoners, about half of their 63% share of the adult population; and Hispanics accounted for 23% of the inmates, compared with 16% of the adult population, i.e. the prison population is biased by race and ethnicity.⁵⁰ The result is even more biased in the case of black women. The finding of bias in the COMPASS database helped make the problem visible.

4. Bias mitigation paths

Given the growing visibility of the harmful effects of gender bias on AI-automated decisions, particularly their applications in sensitive fields such as health and education, academic and non-academic specialists from the exact sciences and social sciences are keen to find approaches for detecting and removing - or at least mitigating - bias in AI systems.

Most of the proposals from institutes and researchers in the humanities field lack practical feasibility, are at odds with the nature and practice of machine learning (including the proprietary character of algorithms, and the complexity of systems as a barrier to lay understanding). Some of these proposals are: making information available to the public on how facial recognition technologies were developed and implemented; creating governance structures to ensure the protection, security, reliability and

49 Available at: <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>. Accessed on 16 September 2021.

50 Available at: <https://www.pewresearch.org/fact-tank/2020/05/06/share-of-black-white-hispanic-americans-in-prison-2018-vs-2006/>. Accessed on 15 September 2021.

accuracy of the systems; creating audit trails by way of robust activity log protocols, which are consolidated in documentation that is transmitted by way of public reports; and clarifying the fundamentals and results to affected users in non-technical language (LESLIE, 2020).

Various documents, including the proposal from the European Commission for regulating AI (Artificial Intelligence Act - AIA, 21 April 2021)⁵¹, suggest setting up regulatory bodies to be responsible for auditing AI systems. The Ada Lovelace Institute (ALI), for example, is proposing the 'Audit of Prejudices' system, with which regulators can assess systems for compliance with regulations and standards in two stages: an 'Algorithm Risk Assessment', an assessment of potential damage before the system is launched; and an 'Algorithmic Impact Assessment', an evaluation of post-launch effects. In the first case, the tests would be performed by the researchers themselves using the 'counterfactuals' (varying one attribute while keeping the others identical) methodology, despite recognizing the limitations because of the opacity of these systems (the 'interpretability problem' mentioned above). The ALI suggests other approaches for identifying bias, such as creating fake accounts to check if the system responds. In practice, however, these proposals have proved to be unfeasible.

Recognizing the mitigation of risk derived from bias in AI-based systems to be a critical element, The National Institute of Standards and Technology Laboratory (NIST), part of the

U.S. Department of Commerce, released for public assessment the document 'A Proposal for Identifying and Managing Bias in Artificial Intelligence'⁵² (June, 2021) with the idea of proposing a management strategy that promotes a reliable AI based on consensus standards. The NIST approach considers the AI lifecycle concentrated in three stages: a) Pre-design: the technology is conceived, defined and prepared - planning stage, problem specification, background research and identifying and quantifying the data. Practice has shown the benefit of involving a variety of stakeholders and maintaining diversity (racial, gender, age, physical ability) in identifying possible biases in problem formulation; b) Design and development: the technology is built - the modelling, engineering and validation stage - and includes software designers, engineers and data scientists (algorithmic auditing, validation metrics and risk assessment). The focus of professionals involved in this step is generally on system performance and optimization, and this can be an inadvertent source of bias (selecting models based only on accuracy is not necessarily the best approach for reducing bias). The recommendation is that AI developer teams should include experts in the application domain (potential users); and c) Deployment: the technology is used by or applied to various individuals or groups - the interaction stage of users with the developed technology, including creating unintended uses: this involves operators, specialists and decision makers from the application domains.

51 Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_21_1682. Accessed on: 20 March 2022.

52 Available at: <https://doi.org/10.6028/NIST.SP.1270-draft>. Accessed on: 20 March 2022. The starting point was 'A Plan for Federal Engagement in Developing Technical Standards and Related Tools', of August 2019, to which both public and private sectors widely contributed.

Bias can emerge at every stage in the process of developing, training, validating, visualizing and interpreting the outcomes. In addition to the opacity inherent in the technique of deep neural networks (black box), there is a relevant gap in the interpretability requirements between developers and users with the potential to generate or exacerbate any bias. This gap needs to be considered by the designers of AI systems to avoid contributing to an erroneous interpretation of the result. Figure 1 shows the bias in the three system modelling steps.

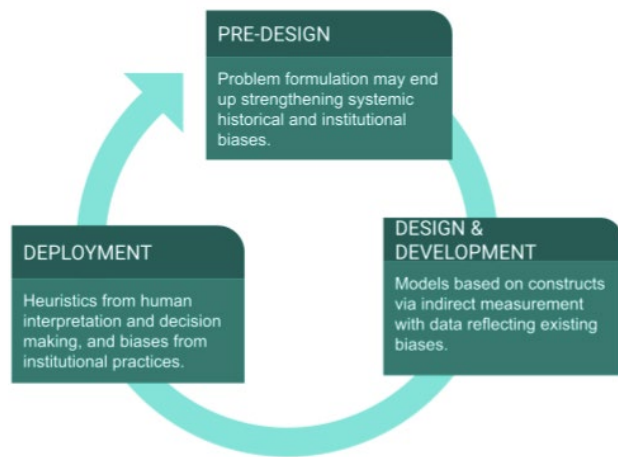


Figure 1: Example of bias in the three modelling stages of the AI lifecycle. Source: NIST (2021)

The NIST report concludes by stressing that: a) bias is neither new nor unique to AI; b) the objective is not zero risk, but rather identifying, understanding, measuring, managing and reducing bias; c) standards and guidelines are needed for the terminology, and for measuring and assessing bias; and d) bias reduction techniques are needed that are flexible and can be applied in all contexts, regardless of the industry.

The following subsection provides key considerations and give examples that highlight how statistical biases appear at various stages of AI applications. They reflect on, and interact with the many human cognitive and social biases that are inherent in the data, in the modelling, decision-making, and practical processes associated with using AI systems in all industries and contexts.

4.1. AI systems audit

There are two approaches to the problem of auditing, involving: a) the technical methods used for identifying the origin of bias in the results generated by the models; and b) the operational barriers. The ability to interpret the model allows the attributes / variables to be defined and incorporated with the least potential for generating distortions in the results. This also makes it easier to justify decisions to the users who are directly affected. For example, DLNNs use large datasets, i.e., with a high level of complexity, which establishes an inverse relationship between the degrees of interpretability and accuracy.

Technical methods

Techniques for identifying the origin of bias in machine learning models exist; they analyse initial variables and hyperparameters and, based on what is identified, mitigate the effects of this bias. Several of these techniques are made available by technology platforms, such as Google's interactive interface 'What if tool' (WEXLER *et al.*, 2019), which generates graphs that correlate variables and bias, and IBM's 'AIF-360'

(BELLAMY *et al.*, 2019), which identifies and mitigates bias. While these interpretability techniques are not one hundred percent correct, they increase the confidence level of model users and those affected by the models. They do so by promoting an understanding of the behaviour and influence of the attributes, which mitigates bias.

There is currently no consistent benchmark that allows the degree of efficiency of the interpretability and bias mitigation techniques to be compared. An interpretability technique that is external to the model and widely accepted as a benchmark is the so-called SHAP (SHapley Additive exPlanations) (LUNDBERG; LEE, 2017). Based on the cooperative game theory, the SHAP technique calculates the contribution of each attribute in the predictive result that is generated by the model. SHAP interprets the contribution of individual variables, i.e., it estimates the effect of attribute interactions separately, and also evaluates the model as a whole. In fact, SHAP is not a single technique, but a set of techniques, each with different levels of suitability for different AI models. Users find it relatively easy to interpret the SHAP results because the technique produces intuitive graphics (CESARO, 2021).

Operating barriers

In the case of private auditing, Alfred Ng, a journalist specializing in privacy and surveillance, illustrates the fallibility of this option with a real case. When HireVue, a company that specializes in AI models that help with the hiring process, was faced with constant scrutiny and accusations of bias in its systems, it hired the company

of Cathy O'Neil, the author of *Weapons of Math Destruction*, to carry out an audit. There was no evidence of problems in the systems or a gap between what the company promised and what it actually delivered, so HireVue's models were legitimized. Ng considers, however, that the audit result itself may be biased because of the absence of standards for defining what a quality audit is. Furthermore, the audit's lack of transparency (according to Ng, O'Neil declined to give details of the process) has the potential to turn it into mere 'ethical laundering'.⁵³

Even defending the idea of auditing, a task that could be carried out by a government agency or an outsourced contractor, or it could be a specially designated function in a multilateral organization, Mokander and Floridi (2021) point out conceptual, technical, economic, social, organizational and institutional restrictions to this (Table 2).

Complementing the restrictions and/or challenges indicated by Mokander and Floridi (2021): (a) the aggregation of new data in systems based on machine learning, as mentioned above, implies retraining the algorithms, which requires a continuous audit; (b) speed and decentralization in developing new AI models/algorithms would make it difficult to replicate the regulatory framework of the pharmaceutical industry, for example, (concentrated in a few producers, and easy to monitor/inspect); (c) AI algorithms are generally proprietary, i.e. they are protected by commercial secrecy; and (d) AI technologies are sophisticated and demand sophisticated knowledge that generally eludes regulators/legislators.

53 Available at: <https://themarkup.org/ask-the-markup/2021/02/23/can-auditing-eliminate-bias-from-algorithms>. Accessed on 10 August 10 2021.

Type	Constraints
Conceptual	<p>There is a lack of consensus around high-level ethical principles</p> <p>Normative values conflict and require trade-offs</p> <p>It is difficult to quantify the externalities of complex AI systems</p> <p>Reductionist explanations lead to an inevitable loss of information</p>
Technical	<p>AI systems may appear opaque and can be hard to interpret</p> <p>Data integrity and privacy are exposed to risks during audits</p> <p>Linear compliance mechanisms are incompatible with agile software development</p> <p>Tests may not be indicative of the behavior of AI systems in real-world environments</p>
Economic & social	<p>Audits may disproportionately disadvantage or burden specific sectors or groups</p> <p>Ensuring ethical alignment must be balanced with incentives for innovation</p> <p>Ethics-based auditing is vulnerable to adversarial behavior</p> <p>The transformative effects of AI pose challenges with regard to how to trigger audits</p> <p>Ethics-based auditing may reflect and reinforce existing power structures</p>
Organisational & institutional	<p>There is a lack of institutional clarity about who audits whom</p> <p>Auditors may lack the access or information required to evaluate AI systems</p> <p>The global nature of AI systems challenges national jurisdictions</p>

Table 2: Audit constraints as a mechanism to ensure AI is trusted
Source : Floridi *et al.* (2021).

4. Conclusion

The negative externalities of AI models can originate both from the intrinsic limitations of a technology in its beginnings and from the interference of human subjectivity in all stages of development and implementation. Identifying the optimal framework for implementing AI ethics will require a convergence of the AI technological field and the AI ethics field. Regulatory authorities should focus on the uses of AI in high-risk applications, contemplating the trade-offs between risks and benefits. Effective communication strategies are key to raising society's awareness of the fundamentals and logic of AI by avoiding the 'promise of objectivity and neutrality', i.e. assuming that AI algorithms guarantee objectivity and/or

neutrality when being processed by machines, therefore protected from human error. The ethics of AI is to mitigate risk. The approach is not global, nor is it possible to control all developments and uses. Special attention should be given to gender-biased systems, considering that the majority of the world population is women.

In high-stake social contexts, the adoption of ML techniques should be as much a matter of ethical and social deliberation as technical analysis. In the current stage of AI, technically limited, human judgment is still required to ensure that AI-supported decision-making is fair. The recommended way would be to consider AI as a partner of the human expert, and not to think of its predictions as sovereign.

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Convergent feminism,
gaming, digital transition,
and equity

Convergent feminism, gaming, digital transition, and equity

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Abstract

The digital transition based on fostering gender equality involves identifying the factors that attract and distance women from technological areas. We looked at this problem from the digital games industry perspective. Since 2019, we have been researching women's participation and integration in this sector in all lines of intervention, from professional training to national independent and mainstream industry, entrepreneurship, artistic creation, and production. We interviewed workers in the digital games sector and students. All in all, we interviewed ten men and thirteen women, and conducted four focus sessions with students. Our results suggest that digital games are associated with technologies with a strong emphasis on programming. This factor, combined with gender stereotypes and stereotypes related to gaming

culture, restrict women's participation in the sector and legitimize digital games as mere entertainment for women and, on the other hand, a "serious" toy that influences career choices for men. Based on these results and from the perspective of speculative convergent feminism, we will reflect on the relationship between digital games and technological and artistic skills in the emerging context of the digital transition.

Keywords: *convergent feminism; gaming; digital transition; gender equity.*

Intersectionality of struggles

Play and games can contribute to solve problems related to human sustainability in a global world. In an age of planetary crises, democracy must be reinvented (Mbembe, 2022). We need to

think about our present challenges, and for that purpose, it is urgent to build solidarities across borders using an intersectionality methodology. Intersectionality is a contextual framework to analyse oppressive systems in a holistic manner avoiding artificial separations and classifications. This contextual framework allows us to identify systemic problems and focus on experiences of discrimination and inequity. Thus, intersectionality can be a tool to highlight and improve the experience of marginalized groups in technological environments.

It is important to emphasize that our purpose is to use what Davis (2020) calls intersectionality of struggles and not one of the identities. “New subjectivities cannot be represented through identity politics” (Preciado, 2019, p. 51). We are now aware that the intersection of social identities and systems of oppression, domination, and discrimination, prevents many people from reaching higher education and more highly paid careers. Working methodologies that take advantage of intersectionality aim to engage people and communities that would otherwise move away from learning digital and analog technologies and other possibilities of assemblage, deconstruction, remix, or creative deviation.

Silvia Federici (2020) warns, the “difference in power between women and men, and the concealment of the work performed by women that was not paid on the pretext of their natural inferiority, allowed [later] capitalism to enormously increase the unpaid part of the daily day work and use (men’s) wages to accumulate women’s labor” (p. 193). In this way, “the original accumulation has been above

all an accumulation of differences, inequities, hierarchies, divisions, which alienated workers from each other and even from themselves” (p. 193). According to Preciado (2019), technology and sex are strategic categories in European colonial anthropological discourse, in which masculinity is described in relation to technological devices and femininity in relation to sexual availability. Thus, for the author, the feminism that rejects technology as a sophisticated form of male domination over women’s bodies ends up assimilating any form of technology to patriarchy, repeating and perpetuating the binary oppositions of nature and culture, feminine and masculine, animal and human, primitive and developed, among others.

Allucquère Stone (2001), in the book *The War of Desire and Technology at the Close of the Mechanical Age*, asked “what is the role of play in an emergent paradigm of human-computer interaction? And overall: What is happening to sociality and desire at the close of the mechanical age?” (2001 [1995], p. 17). When technology is confused or understood as part of nature, it becomes invisible and thus the biological human body is hidden in favour of a discursive entity that can become an object. To the detriment of the biological body, a social body emerges, one that can somehow be controlled and, as Stone (2001) warns, we become the generic identity that institutional identifiers allow, denying the desire and the construction of more fluid, free and ever-changing identity. In this context, in which the stereotyped classification reduces the range of possibilities and alternatives, games become more appealing than reality because “they express an unalloyed nostalgia for a time when roles were clearly defined, folks

lived closer to nature, life was simpler, magic was afoot, and adventure was still possible” (Stone, 2001 [1995], p. 67). Stone’s metaphysics of presence suggests that the (living) body “implies the presence within the body of a socially articulated self that is the true site of agency” (p. 91). Thus, when we lose the articulation between the biological body and the social body, as often happens through digital technologies, we can consider that a peaceful death awaits us in which our presence is lost in the discourses that form our lives. And in this case, we no longer speak but are spoken. When not we, but our culture speaks through our voices (Stone, 2001), we are lost in a plot in which democracy appears as a mirage.

As Irigaray (2007 [1987]) warns, one of the distinctive characteristics of the female body refers us to tolerance, to difference, but the culture of patriarchal origin has inverted the terms of this economy of respect for the other. In this context, modern social culture has venerated the mother-child relationship, to the detriment of the mother-daughter relationship, in a fetishist religious association.

In the transformation of the woman into an object and in the successive strategic exclusions of constituting who the subject is, and in the formation of the object, the figure of the woman disappears, not only in pure nothingness, but in a violent coming and going that is the displaced figuration of the «woman of the third world» caught between tradition and modernization, culturalism, and development (Spivak, 2021 [1999]).

Many future uncertainties related to public health and education can be anticipated by

promoting work environments that do not make simplistic binary cleavages. The seventeen sustainable development goals of the United Nations, approved in 2015, which aim to eradicate poverty, protect the planet, and ensure prosperity for all under a new development program, will not be achieved if we are not able to promote changes (Mazzucato, 2021). Binary separations, between analog and digital, between real and online worlds (Coeckelbergh, 2020; Peraica, 2019), between nature and culture (Braidotti, 2022; Haraway, 2017) are also problematic in the context of the challenges that lie ahead. Regarding the digital transition and other goals, as Mazzucato (2021, p. 184) warns, “the digital divide has multiple dimensions – technological, economic, social, cognitive and political.” Recent literature that uses ludic theory and practice as a source of knowledge creation and production in higher education can be found in the work of Shira Chess (2020). The author highlights the interaction of oppressive cultural systems, alerting us to inequalities of gender, ethnicity, social class, sexuality, and disability. In turn, Kishonna L. Gray (2020) uses transmedia studies to focus on intersectional technology to examine systemic exclusions legitimized by nation-states. As Amanda C. Cote (2020) suggests, the recurrent representation of men as gamers, creators, and game producers in news, marketing, and other media, excludes women, making the connection to this identity more difficult to imagine. For inclusion to exist, more than believing that it exists, it is necessary and fundamental in the future to inquire about the specific contexts in which people are sent to the margins.

Feminist gaming and the struggle against today's tyrannies.

As an alternative to consensual practices, which reinforce grand narratives and the management of a “blind and deaf” majority to the ongoing struggles, complexity is organized through the insertion of communities that converge in their differences and distances. The comfort of units in difference is not offered, but vulnerability, instability, and the enunciation of problems are promoted to arrive at a coalition that does not imply assimilation but rather proposes a coalition in the house of difference, using, in this context, an Amanda Phillips expression (2021). An aesthetics of ambivalence that allows giving voice to those who, even after multiple years of legitimizing studies on analog and digital arts and games, continue to be silenced, ignored, and relegated to the margins (Shaw, 2014) by a cultural process of indoctrination that continues to be based on colonialist ideas and hegemonic patriarchy. The system that is currently identified with patriarchy, according to historian Susan P. Mattern (2019), developed during the period of the spread of the agricultural revolution, when households became sedentary, and it was common for women to go live with their abroad husbands' families, leaving their own families. This system also consists of the practice of kinship in which inheritances are managed by men, and they control the property, especially that which is productive and on which subsistence depends. At that time, the division of labour by gender was, and still is, common, and there was clearly an ideological dimension that was (and still is) based on the devaluation of women's work and, consequently, the valorisation of men's work. This dimension is

also associated with social class and privilege situations, meaning women slaves could do the same work as men, as cultural ideals about the division of labour were less rigid when applied, for example, to slaves (Mattern, 2019). In this context, and already in the capitalist period, the sexual division of labour converted women into servants of men, building in this way a new patriarchal order.

As Phillips points out, ludologists, originally from Scandinavia, aimed to protect games and ludic systems from colonization of other areas, such as literature and cinema, and other players who did not fit the standard created by default (man, white, and gamer). Thus, the dispute between ludologists and narratologists (Gouveia, 2009) was also a dispute that confronted a Norwegian man (Espen Aarseth) and an American woman (Janet Murray). As Amanda Phillips (2021) suggests, the debate ended with the victory of formalist perspectives on ludology to the detriment of others focused on greater openness to contamination and assemblage. Thus, other possibilities were ignored during the last twenty years. Cultural criticism, related to racial and feminist studies applied to digital games and the impact of women in this field, was relegated to peripheral situations or margins. In Portugal, as is usual in our cultural environments, the gaming default model was reproduced without much scrutiny, and the problem was diagnosed (Gouveia, 2014). These patterns of recurrent denial of women's collaboration in the arts field and the relegation of their work to the margins in the stories and narratives published in digital arts and gaming were constant. In the non-identification of the gaming communities

with the art environments, to expand the contribution of engineering, a territory more easily controllable, women were relegated to invisibility, and gaming was emphasized as a space of development instead of creative production.

Neoliberal academia helped to create this warped idea of an area of expertise from men to men, systematically ignoring all those not suitable for that purpose. Until one day, “in the wake of the 2016 United States presidential elections, gamers were said to be a core demographic (perhaps even the origin) of what media dubbed the alt-right, that cesspool of internet hatred that propelled an unqualified, unapologetic bigot to the head of state” (Phillips, 2021, p. 2).

The link between globalization and neoliberal economic theories (Mattern, 2019) must also be questioned because, on the one hand, poverty reduction is a fact (Rosling, 2019). On the other hand, the asynchronies between the richest and the poorest have been accentuating worldwide. It is necessary to find ethics of the real world (Singer, 2020) based on factual data and not on fables and past mystifications. Perhaps, as Mazzucato (2021) suggests, we need to focus on creating public value, inspired by a philosophical ethic with its origins in ancient Greece, which aimed at a deep sense of public duty to avoid tyranny. In this sense, a value is advocated “collectively created by different agents and for the community as a whole, in the public interest” (p. 197). As Anne Applebaum (2020) suggests, it is quite possible that we are already experiencing the twilight of democracy, where civilization seeks anarchy and tyranny through authoritarian ideas. If it happened in the 20th century, it could happen again in the 21st century.

Speculative and convergent feminism

Post-human feminism (Braidotti, 2022) proposes a convergence between ecofeminism and techno feminism to promote a critical intervention in the most urgent and contemporary debates on human transformations. The feminist convergence agenda points us to the intersection between structural socio-economic forces, developed through technology and the climate crisis challenges. Inquiring into the heritage of autonomy and liberal individualism, typical of neoliberal feminism in tune with capitalism, and the socialist ideal of the privileged and revolutionary subject, which works in an opposite or dialectical way, like the reverse of neoliberalism, post-human feminism proposes a critical distance from both through the recombination of eco and techno feminism.

The post-human paradigm suggests an intergenerational and transversal analysis of an ethical and relational nature that considers a constructive exercise of creating communities concerned with the state of the world and that are willing to intervene in it in a productive way. Forming the basis for a joint thought, however, it is also considered that people are not equal. They can be aligned in a common cause despite their differences. The criticism of humanism is evident when it is questioned that it only considered a partial subject, selling it as universal and representative of all (Braidotti, 2022).

According to Rosi Braidotti (2022), contemporary feminism “combines critique with creativity, politics with the imagination, and material cartographies of the present with speculative anticipations of the future” (p. 43). Based on

the assumption that neoliberal and neo-socialist feminisms are two sides of the same coin and that both are aligned with notions of capitalist patriarchy, it is necessary to propose a new paradigm that does not ignore, like the previous ones, the importance of other living and dynamic entities such as, for example, the planet and its immanent species. Then what defines the post-human paradigm is its respect for the political agency of non-human environmental factors, thus contributing to demystifying the delusions of contemporary cognitive capitalism. Therefore, we face the convergence of the so-called fourth industrial revolution, explicit through the merge of automation technologies, with biogenetics, neuronal sciences, information technologies, artificial intelligence, nanotechnologies, and the internet of things, with the sixth extinction, that is, with the degradation of living ecosystems on planet Earth. Post-human convergence blurs the boundaries between ecological, environmental, and technological through cross-cutting connections (Braidotti, 2022). The environment becomes mediated by technology, and technology starts to be built by integrating ecology and the environment.

In this context, ecofeminism rescues interconnected ways of life on Earth, electing indigenous cultures for their integrated vision and for not distinguishing between nature and culture through the idea of a continuum between them. This worldview considers, as does Asian culture, that non-organic artifacts, such as technological artifacts, computer networks, codes, and algorithms, are in relationship and connection

with human beings. Indigenous relational philosophies put their finger on the wound of Western dualisms. We largely dismantled these artificial opposed dualisms in the context of the arts and digital games (Gouveia, 2010).

Mythical knowledge and logical thinking can be unified through cognition that holistically integrates instead of separates them⁵⁴. For an analysis of the intricate relationship between mythos and logos, consult Arendt (1991 [1968]). The ontological relationship, following Rosi Braidotti (2022), makes explicit, through an interconnected and integrated politics and poetics without artificial separations, that indigenous cultures help to promote and overcome, by not making the distinction between nature and culture, they are fundamental to avoid discrimination, namely the assumption that women are to nature what men are to culture, so ironized in the work of the artist Barbara Kruger in 1983: “We won’t play nature to your culture!” (Braidotti, 2022). In this sense, ecofeminism is a pioneer in the extension of feminism to social and political ethics that extends to the natural world, which is considered as continuous with the conditions of subjugation of women, blacks, indigenous people, animals, land, and others, in an ecology of intersections (Braidotti, 2022). Ecofeminism not only presupposes thinking about ecology and the environment, but it is, above all, a form of engagement with knowledge, subjectivity, politics, ethics, science, citizenship, and agency, which permeates and reconfigures theory and practice in an ethic of attention and care for others that helps to build responsible citizenship in a participatory democracy.

54 For an analysis of the intricate relationship between mythos and logos, consult Arendt (1991 [1968]).

This ethics of compassion and solidarity resides in an epistemological humility based on the balance between reason and emotion in a biocultural continuum (Braidotti, 2022). Contemporary feminist materialism, in reaction to postmodernism, rests on the premise of a nature-culture continuum that is technologically mediated through a heterogeneous ecology that includes the organic and the non-organic. This philosophy of immanence, as opposed to transcendence (Pereira, 2021), is specific to French epistemology and the philosophy of science and assumes itself with a realism that advocates that matter is vital, intelligent, and self-organizing (Braidotti, 2022).

We will then have to learn to think differently (Braidotti, 2022) and consider that biopower has moved to a logic of information dissemination whose bodies are transformed into techno bodies permeated by the environment's vicissitudes, socially responsible and are affectively connected. These bodies are simultaneously real and virtual and are diluted through exposure and disappearance to multiple techno-biogenetic networks mediated by computing, encouraging experimentation. Pushing the limits of biology, the new condition of the body dilutes the traditional modern distinction between art, performance, media, design, and architecture, turning the natural and the artificial into inseparable entities, highlighting the potential of uncertainty, subversion, transformation, and gaming, celebrates anomaly, monstrosity, and flexible morphological strangeness. Disability studies are also considered in these constellations of multiple flexible possibilities, where reality mediated by technology becomes second nature and where nature and

artifice become indistinguishable. In this context, human fertilization also mutates surrogate bellies and placentas in a dance between biology and technology (Braidotti, 2022).

Thus, human and non-human ecologies, evolution, development, history, affections, performances, technologies, and everything deemed pertinent (Haraway, 2017) are brought together. An ecology inspired by a playful feminist ethic of response-ability promotes intricate relationships and coalitions between arts, sciences, and technologies, uniting codes and algorithms, creativity, and community involvement, and a proposal for artistic creation that helps us live on a damaged planet. The awareness that we are faced with the problem of living in a complex world suggests that human beings live and die on earth together with dignity.

Empirical research

In our teaching and research practices, we have been analysing the persistent problem of gender asymmetries in the digital games sector in Portugal. The initial formation of an inherently young and masculine gaming culture and the conception that men perform better in technological areas has contributed to gender segregation in this sector. As discussed in other publications, these asymmetries are still present in the national digital games industry (Lima, & Gouveia, 2020; Lima, Gouveia, Cardoso, & Pinto, 2021).

Kowert, Breuer, and Quandt (2017) proposed a theoretical model explaining sexism and the exclusion of girls and women in the gaming culture and industry. According to these authors,

these aspects should be considered. The first refers to the global perception that video games are an inherently male medium. The second refers to the low presence of women in this industry and, consequently, the development of games created chiefly by men. Finally, the authors highlight the (toxic) digital game communities that reproduce sexist and misogynistic practices, especially online multiplayer games. This third aspect could be the main reason why gender differences in video game engagement in gaming communities and industry persist, despite the popularization and growth of the medium.

Although a large body of research has examined the different forms of exclusion of girls and women, both in the gaming industry and in online games (Kowert et al., 2017; Fox & Tang, 2014; Ivory, 2006), and there is an increased awareness of this issue by the communities of gamers and game developers (Weststar et al., 2021), there is a long way to go towards gender equity in the digital gaming sector and society. As mentioned above, this path will be made through a holistic understanding of the social, cultural, and political dynamics that maintain this system of inequities.

The lack of diversity and under-representation of women in the technological industry and gaming sector is a persistent problem in the education and dissemination of the STEAM (Science, Technology, Engineering, Arts, and Mathematics) fields. Therefore, consistent research that points to future strategies for the inclusion of under-represented groups in a sector where artists, designers, programmers, and computer scientists work collaboratively

is key to promote more equitable working and educational environments (Gouveia, Lima, & Unterholzner, 2022).

The research we are developing aims to portray the evolution of the participation and integration of women in this sector in all its lines of action, from professional training to national industry, entrepreneurship, and artistic production. This study is premised on the advantages of gender equity for the development of digital economies that improve the sustainable use of technological resources, maximise knowledge flows, spread the benefits of change throughout the economy that wants to be sustainable in inclusive societies, and prioritise the well-being of the population and the preservation of the environment. In this chapter, we will discuss some of our results, focusing on the difficulties and challenges reported by the participants regarding gender issues.

Methodological design

We conducted empirical research between 2019 and 2022 with students and professionals in the digital games sector in Portugal, namely four focus groups with students and twenty-three interviews with professionals. In addition, we have been attending meetings of the Portuguese game developer community, such as Game Dev Camp and forums on Discord, Twitter, and Facebook.

Regarding data analysis, we carried out Thematic Analysis (Braun & Clarke, 2006). The choice of this analysis method is relevant to the arts-based research that we have been developing, considering that in an increasingly complex

society, the operative intersection of knowledge from various areas of expertise helps us overcome some disciplinary biases (Gouveia, 2020a; Gouveia, 2020b). We also conducted data analysis from the epistemological positioning transversal to this research, namely the speculative and convergent feminist perspective discussed above. Due to a large amount of material for analysis, we used NVivo software in the data coding process.

Participants

Twenty-three students from two different higher education institutions - a university and a polytechnic institute – participated in the four focus groups. Of these, eleven were women aged 18 to 35 (see Table 1). Except for one Venezuelan student, all of them had Portuguese nationality. Only focus group 4 (FG4) was composed of Master’s students, and the other participants were undergraduate students. Participation was voluntary and did not follow any recruitment criteria⁵⁵.

The professionals’ work or research experiences in the digital games sector were the only inclusion criteria. They were contacted through their professional emails made available by the Portuguese Society of Video Game Sciences and through the social networks Facebook, LinkedIn, and Twitter. Twenty-three professionals participated in this study, thirteen of

FG	Gender	Age	Degree title
FG1	Female	21	Graphic Design
FG1	Female	22	Game Design and Digital Animation
FG1	Female	35	Game Design and Digital Animation
FG1	Male	21	Game Design and Digital Animation
FG2	Female	19	Graphic Design
FG2	Female	26	Graphic Design
FG2	Female	20	Industrial Design
FG2	Female	21	Industrial Design
FG2	Male	26	Graphic Design
FG3	Female	18	Game Design and Digital Animation
FG3	Female	19	Game Design and Digital Animation
FG3	Male	18	Game Design and Digital Animation
FG3	Male	19	Game Design and Digital Animation
FG3	Male	19	Game Design and Digital Animation
FG3	Male	21	Game Design and Digital Animation
FG3	Male	21	Game Design and Digital Animation
FG3	Male	22	Game Design and Digital Animation
FG3	Male	25	Game Design and Digital Animation
FG3	Male	26	Game Design and Digital Animation
FG3	Male	28	Game Design and Digital Animation
FG4	Female	21	Communication Design
FG4	Female	24	Communication Design
FG4	Male	31	Computer Engineering

Table 1- Focus group participants

whom were women. Their ages ranged from 21 to 48 years.

It was a rather heterogeneous group regarding area and level of education, and job role (see Table 2). Most had Bachelor’s degrees (11 participants), the others had Master’s degrees (9 participants) and Ph.D. (3 participants) in different areas of knowledge.

⁵⁵ Our intention was to listen to the largest number of students, so we did not define inclusion criteria for the focus groups. Besides, considering the reduced time we had in the educational institutions to conduct the focus groups, the voluntary participation of the students facilitated the formation of groups according to the availability of the students who agreed to participate in the study.

Gender	Age	Area and level of education	Job role
Female	48	Sociology, Bachelor's Degree	Game developer and entrepreneur
Female	40	Communication Design, Ph.D.	Teacher and researcher
Female	33	Social Communication, Bachelor's Degree	Marketing lead
Female	31	3D Computer Animation, Master's Degree	Game artist
Female	29	Multimedia Art, Bachelor's Degree	Game artist
Female	29	Computer Science and Engineering, Ph.D.	Researcher
Female	28	Game Design, Master's Degree	Game developer
Female	26	Multimedia applications and video games, Bachelor's Degree	Game developer and programmer
Female	26	3D Animation and Games, Bachelor's Degree	Game artist
Female	26	Digital Game Development Engineering, Master's Degree	Programmer
Female	25	Communication Design, Master's Degree	Game developer
Female	25	Digital Marketing, Master's Degree	Marketing manager and streamer
Female	23	Digital Games and Multimedia, Bachelor's Degree	Advertising
Male	38	Communication Design, Ph.D.	Teacher and researcher
Male	35	Computer Science and Engineering, Bachelor's Degree	Programmer
Male	30	Computer Science, Master's Degree	Game developer and teacher
Male	30	Multimedia Art, Bachelor's Degree	Game developer
Male	26	Game Design, Master's Degree	Programmer
Male	25	Advertising and Marketing, Master's Degree	Marketing lead
Male	24	Computer Science and Engineering, Master's Degree	Programmer and 2D Art game designer
Male	23	Games and Apps Development, Bachelor's Degree	Game developer
Male	21	Computer Science and Engineering, Bachelor's Degree	Game audio programmer
Male	22	Game Design and Digital Animation, Bachelor's Degree	Gameplay programmer

Table 2- Interview participants

Data Analysis

During the process of data analysis, we identified three themes, namely “gender stereotypes,” “gaming culture stereotypes,” and “gendered and uni-disciplinary field.” To make them more intelligible, we will not provide a detailed description of the codes that gave rise to the themes. All the codes identified are integrated into the general analysis of the results. Some excerpts from the focus groups and interviews will be presented to facilitate the understanding of the themes.

First theme- Gender Stereotypes

This theme refers to the cultural strength of the male-female binary persistent in the participants’ narratives. Their perceptions of normative gender roles allowed us to cluster students and professionals into three groups: those indifferent to gender issues, the group of non-conformists, and the group of activists.

Despite the complexity of the data and the contradictory and paradoxical discourses of some participants, we identified a reduced number of students in focus group 3⁵⁶ and two male professionals⁵⁷ that presented unclear arguments or some discomfort when the researcher addressed issues related to gender asymmetries in the gaming industry. As the focus groups and some interviews were audio and video recorded, it was possible to identify more clearly the expressions of discomfort, the silences, and the contradictory arguments that made it possible to include some participants in this first group.

Thus, although some elements considered that there were gender asymmetries in the courses they attended, some believed that girls were not interested in video games because of a question of sensitivity of interest or because they did not like to play, which suggests that female representation in the digital games sector was not an urgent issue for these participants. The following excerpts illustrate their arguments regarding the absence of women in this sector:

Uhm... I don't know, I don't happen to have... I guess I never noticed that part because... I know some girls are also working and that... more personally, and as developers, for example... And a lot of the talents are also there are a lot of female talents... I never noticed even in schools, um... Ok, by chance, for example, in the class I taught there were no girls, but in some classes... there's even quite a bit of participation from girls (male, 24 years old, programmer).

(...) but they also don't go into programming because they don't know what it is, but they also don't try to know it. They immediately get the idea that it's boring and don't want to do that. That is, it's not so much entering or looking for what it is, knowing what it does, and all that stuff (male, 20 years old, student, FG3).

In the indifferent group, some did not question the harmful effects of gender stereotypes. According to a student of game design and digital animation:

To a certain extent, stereotypes are not bad, ok? They are stereotypes. For example, I am from a country where even mannequins are hypersexualized, ok? The woman is different from what we see, and it's not because of

56 Three students. All were from the game design and digital animation course.

57 Programmer and art game designer, 24 years old and game audio programmer, 21 years old, respectively.

this that society goes like that, ok? So, because we play games where the woman is sexy, that doesn't mean that a woman wants to be like that, and there is nothing wrong with showing a sexy woman in a game. There is nothing wrong with that, ok. I don't feel discriminated against when I look at a sexy woman in a game, or a fat woman. For me, it is the same. It is a character (female, 19 years old, student, FG3).

In this group, we see how, to a greater or lesser extent, both boys and girls contribute to maintaining the invisibility of gender asymmetries. At the core of their discourses, there is an indifference that reflects how the positions of privilege make the questioning and contestation of such asymmetries unviable. Not noticing, for example, that in a classroom of a technological course, there are no girls or thinking that the exaggeration of hypersexualized female characters does not contribute to the maintenance of sexism and misogyny in gaming culture is to corroborate with the perspective of the hegemonic masculinity instituted by the patriarchal culture that naturalizes the differences between men and women and reinforces gender inequalities. This position may also reflect the absence of debates and courses focused on raising students' awareness about gender and race issues in the digital games industry.

At the opposite pole was the activist group. It was possible to identify that more women are engaged in fighting gender asymmetries in the video game sector than men. In fact, "hegemonic masculinity is invisible to those who try to obtain it as a gender ideal. It is especially visible to those most affected by its violence" (Kimmel, 1998, p. 116).

Among the professionals interviewed, there

were three who were leading an initiative that aims to bring together women who make up the Portuguese games industry to network and increase representativeness, empower current and aspiring professionals, and combat the loss of female talent due to toxic environments within and outside the games development community. In turn, three students (FG4) developed a digital game that addressed the theme of dating violence. The video game won second place in the Video Games Exploring Culture's Influence on Dating 2020 competition, an international competition hosted by Jennifer Ann's Group.

In contrast to the previous group, the activist participants had more awareness of the difficulties and challenges women face in a male-dominated sector. Some excerpts illustrate this:

Games in the old days were much more for boys. Because games were made by boys for boys, men for boys, men for men, men created the women as they liked (...) That became a standard. As I tell you, the companies have a large male population, so men design the women to their liking. If there was another woman, um, women working there even if they were artists, they would put more diversity into those bodies (...) As they don't have women around, they follow the stereotype of the woman and how they like to see the woman, the woman with curves, the woman with big breasts, and then this stereotype remains (female, 26 years old, programmer).

There is still a stigma with girls as gamers, so that's the first problem (...) As there are no role models or great female role models working in the industry, you don't consider it something you can get to, do you? (...) if the female characters are more abundant and interesting, i.e., if those characters don't perpetuate stereotypes that we know, but are interesting and challenging, etc.

This will also make girls reveal themselves more in the games that are made, and by themselves want to be gamers and invest time in being a gamer, and possibly consider it as a career, where they can also make games themselves and make games with whom they identify (female, 25 years old, marketing manager and streamer).

The arguments presented by these participants converge with the model of exclusion and sexism in the video games sector suggested by Kowert et al. (2017), mentioned above. Similarly, the group of non-conformists, formed mainly of the students in Focus Groups 1 and 2 and most of the professionals interviewed, were aware of the factors that keep girls and women away from this sector. They identified the problem and were able to give examples of how this inclusion could be made possible however they did not report having participated in concrete actions to combat the difficulties mentioned, as we can see in the following excerpts:

There was just recently a... I think it was an event called "video games said she," which was a kind of event created by women to talk about video games, experiences of girls who want to work in the industry, or who grew up with video games that, despite everything... this is not a bug-it's not like bigfoot, despite everything there are still some girls who have that kind of thing (male, 30 years old, game developer).

Whenever we tried to recruit, uhm, we never had a woman apply. Uhm whenever we went to gaming events, um, women always showed up... and I'm not fond of this at all, and I don't appreciate saying this, but they always show up a little bit as the business card of the companies. They're there a little bit to make contact, and not so much to... to talk about the games. Uhm,

which is something I don't like. I don't like it because whenever I've had the opportunity to speak to women involved in games, I think you can see a different sensibility (male, 25 years old, marketing manager).

The difference between being a non-conformist and an activist also involves questioning the absence of women in the sector. As one professional who was working in a digital games company in England explained to us:

The concern was always to get more diverse candidates at this company where I am. The problem started with "we are only hiring white men because we only get applications from white men. Why?" And so, they bet on changing the wording of the job opening. And an interesting thing they told me there in that company is when it's a code vacancy, if they say they're looking for someone who is a "rockstar," um, it's a word that's used a lot, ah we're looking for a "rockstar" programmer, when they write that, women usually never send their application (female, 26 years old, programmer).

Second theme - Gaming Culture Stereotypes

Following the factors that condition women's participation in video games, the participants talked about the stereotypes related to the gamer and the gaming culture. Some excerpts illustrate this theme:

There is a lot of that stereotype of boys who, um, don't have the best hygiene and don't have the best, uhm... a way of being and that... maybe they are not the best people for girls, um... and... it was a problem in my class and that I know all the classes, and that I knew it was a problem in general, and that's it (female, 26 years old, game artist).

Who is seen as a little bit different from the others is

immediately an easy target, um, a hit and, so maybe that contributed in a way for umm-for you not to see so many girls interested in this medium, because it is more, like, boys' stuff, or geek stuff, geek is-it is because then you still have that side too, which is not only it is a boys' thing, it is a nerd and geeky and outcast boys' thing that is not... that is not socially good at all, etc., do you know? (male, 30 years old, game developer).

In a previous publication (Lima, Pinto, Cardoso, & Gouveia, 2021), we developed a comprehensive analysis of how these stereotypes, combined with the lack of knowledge of the multidisciplinary areas that make up the digital games industry, contribute to the cycle of exclusion of girls and women in this sector. One of our findings was that despite this exclusion being socialized from an early age by the participants in our study, the girls maintained their interest in video games, becoming fans of gaming culture. However, most of them did not aspire to pursue any profession in digital games or work in the industry. This cycle of exclusion can also push girls away from technological and digital careers. The excerpt below exemplifies how a girl is turned away from this professional area:

Video games were something that, although I didn't like, it's not that I didn't like it, it's that I didn't play much. I didn't play much until higher education. I liked the games... I just never thought that it was an area that I could pursue on a professional level, precisely because there is no such incentive, there is no such motivation, and the appreciation of the area of games itself, it is a game, it is entertainment ... it's nothing more than that (female, 24 years old, Master student).

In turn, most of the men interviewed chose a professional area that had some relation to the gaming sector, such as computer engineering, multimedia, or game design, as we can see in the following excerpts:

Since I was a child, I've liked creating games (...) I also created my games (...) the taste for programming also started there, and I started programming my games, making my art for games... Since high school, I've been making games for game jams...so I went to Computer Science to learn how to program (male, 24 years old, programmer, and 2D art game designer).

(...) this can have a big impact because I know that, at least, on me, it did. The fact that I play a lot and want to know how it's done was why I wanted to get into this area (male, 22 years old, gameplay programmer).

Third theme- Gendered and Uni-disciplinary Field

The last theme refers to the absence of multidisciplinary characterization of the area of video games in Portugal, which indicate the narrowing of the area into partial visions, such as technological, artistic, and communicational visions or focused on the programming of video games. Some interviewees told us about this aspect:

As a teacher/course director, the greatest difficulty we encountered has to do with the scope and multidisciplinary involved in video game creation and how best to convey the division by areas and coordination of teamwork while applying the same curricular plan to students with considerably different skills and objectives (arts/programming) but with a common goal (male, 38 years old, teacher and

researcher).

There is a dysfunction, and a general lack of knowledge about what video games are that causes completely arbitrary situations and undermines the whole development of the industry in that sense (...) Video games are a story told by someone who makes puppets, someone who makes videos, someone who makes voices, someone who makes music, and all these artists combine into a product that uses a computer base, just like cinema (...) the difference is that everyone thinks that cinema is an art and video games are engineering, they are not, not really, no, and they are not anywhere, they are in Portugal (female, 48 years old, game developer and entrepreneur).

In Portugal, the multidisciplinary nature of digital games is not fully assumed (Lima et al., 2021). We observe that this difficulty in characterizing digital games as an interdisciplinary area helps to create the distorted idea of an area of specialization with greater weight in game programming than in its other aspects, as mentioned by one of the interviewed professionals:

How are faculties advertising these courses, and where are they getting people? That's my question, because if advertising... if the way of making games is... is... coming to computer science, I don't know. If you know how to program, you can come (...) I think that's what scares many people (female, 28 years old, game developer).

The immediate effects of this skewing of the multidisciplinary nature of digital games are the sexual division between the multiple areas that make up this sector. On one side are male programmers and on the other, female artists. The reverse situation may trigger some sexist

comments and discourage girls from performing roles linked to programming and boys from performing functions related to game art, as we can see in the account of two students, a boy, and a girl, who participated in focus group 1:

I'm more in the design and art of the game. After all, I like it because I don't like programming, and he is more the programmer of our game. I started to teach him the basics of Illustrator (...) He began to stop thinking that design was only for me (...) That aversion you had for design, you stopped seeing it, just like I stopped having an aversion to programming (...) In the end, you get to like each other's area and get a better understanding of what each other does and you can both help each other in each other's area, something that he, perhaps, had probably never thought of in his life (laughs).

They can also create feelings of devaluation and gender discrimination, as mentioned by a girl in focus group 4:

I want to add that not only, not only the arts, but we also end up being an area that is a little undervalued about computer science, right? Because they are the ones who make the game, they are the ones who create, and they are the ones who have the greatest difficulty, of course, they do, don't they? The other issue is that we are girls or women, it may be strange to hear that, but it is true (...) my colleague and I feel this a little bit, that there is this undervaluing, perhaps because we are women, not only artists but also women (...) Engineers, at least the ones I worked with, are not used to working with people from the arts. They are only used to working with themselves and with people who speak the same language and who think in the same way as them. So, if the people themselves are not open, communication becomes very difficult, and collaboration becomes very difficult. It becomes

complicated to understand what they want, what they need, what we can do, and how the concepts come to us (24 years old).

In a recent publication (Gouveia, Lima, & Unterholzner, 2022), we show the importance of promoting collaborative environments for digital game creation through some specific examples from our teaching and research experience. We also alerted for the need to create mixed environments in Portugal where women and men share the design and development of game-based projects. We also highlight how the programming fallacy, i.e., the persistent belief that one can only work in games through programming, is, in a way, responsible for a deeper flight of women from game environments. We are convinced that we can use other strategies, over and above inviting women to take programming courses in higher education. When the emphasis is placed on programming and not on artistic creation, production, and dissemination of ludic artifacts, we forget that games are above all cultural products and not just technological objects or programming software artifacts.

Conclusion

The clarity and intensity of the participants' reports in this research demonstrate that there is still a long way to go to eradicate gender inequities in the digital gaming industry. Unfortunately, the micro-processes of discrimination and exclusion are only visible to those who directly or indirectly suffer this type of violence.

The empirical research findings suggest that the beliefs and practices that produce gender

inequalities in this sector are linked to gender stereotypes, stereotypes of gaming culture, and biases in the multidisciplinary nature of digital games. These aspects condition female participation in the gaming sector and legitimize digital games as mere entertainment for women and, on the other hand, a "serious" toy that influences the professional choice of boys much more than girls. Moreover, the difficulty in characterizing digital games as a multidisciplinary area helps create the distorted idea of an area of specialization with greater weight in game programming than in artistic creation, design, production, and dissemination of ludic artifacts.

The results also revealed that most participants are nonconformists with this gender discrimination and inequalities situation, despite the strong presence of the female-male binary in their accounts. However, few participants reported being effectively engaged in changing this scenario of discrimination and inequalities in Portugal.

We also reflect through the lens of convergent speculative feminism in this chapter and how the arts, playful media, and games can be instrumental for the goal of generating digital literacy. When girls and women make and play digital games, they learn and connect with technologies and become aware of their possibilities. They transform their worlds through speculative and creative thinking to better understanding of complexity and systemic knowledge. Gaming literacy can be a form of resistance and playful engagement for a better citizenship. In this way, it can promote democratic ways of thinking. As Zimmerman (2013) considered in his *Manifesto for a Ludic Century*:

There is a need to be playful: It is not enough to merely be a systems-literate person; to understand systems an analytic sense. We also must learn to be playful in them. A playful system is a human system, a social system rife with contradictions and with possibility. Being playful is the engine of innovation and creativity: as we play, we think about thinking and learn to act in new ways. As a cultural form, games have a particularly direct connection with play (...).

Gaming literacy can address our problems:

The problems the world faces today requires the kinds of thinking that gaming literacy engenders. How does the price of gas in California affect the politics of the Middle East affect the Amazon ecosystem? These problems force us to understand how the parts of a system fit together to create a complex whole with emergent effects. They require playful, innovative, transdisciplinary thinking in which systems can be analysed, redesigned, and transformed into something new.

Finally, in the emerging context of the digital transition, it is urgent to engage women and men of all ages, races, and ethnicities in inclusive technological environments and encourage them to be part of the overall ecosystem of change. If we continue to ignore the critiques of feminist and racial studies applied to technology fields and digital games and disregard the impact of the lack of diversity in these fields, we run the huge risk of making a digital transition that will continue to exclude women and other underrepresented groups.

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The background features a light purple color with several white geometric shapes. A large white triangle is positioned on the right side, pointing downwards. A smaller white square is located in the upper left quadrant. The overall design is minimalist and modern.

Cultural Diversity as a
design precedent: A
(Feminist) Angle to HCI/d
Expansion

Cultural Diversity as a design precedent: A (Feminist) Angle to HCI/d Expansion

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Abstract

Various forms of design knowledge have been discussed such as methods, schemas, precedents, etc. In this chapter, I discuss *cultural history, knowledge, interactions, and roots of researchers and designers as a design precedent*. I talk through this concept as I present various case studies where researchers have built their research agenda heavily drawing from their cultural background. I discuss how framing their research agendas using cultural precedents enabled expansion of the power of design, especially in the field of Human-Computer Interaction (HCI). I highly relate to this space due to my personal researcher positionality as a “foreign cultural entity” in the westernized HCI theory. The case studies presented showcase how researchers and designers used cultural knowledge to frame their research methods, tools, outcomes, and philosophy. I further discuss this intake of cultural perspectives as a precedent for HCI research and design practice: 1) For expanding scope of criticality in HCI design spaces and

in turn, 2) Promoting *Feminisms of thought* through the diversity cultural knowledge and background entails in design work, with the risk of multiple perspectives fighting with each other; and 3) Encouraging cross-pollination of ideas to build the larger research agenda for HCI design.

I also intend to use this chapter as a self-reflection and an avenue to represent young researchers who have excelled in the space of connecting HCI and design spaces to various dimensions through their cultural underpinnings.

Keywords: Culture, Researcher Positionality, Design Precedent, Feminisms of Thought (FtT).

Introduction

Individually,
Cultural Knowledge as a design precedent.
Cultural Heritage as a design constraint.
Cultural Uptakes as a design frame.
Cultural Dimensions as a researcher positionality.

Collectively,
Cultural Diversity as a design precedent.
Cultural Critique as a design expansion.
Culture driving one's research agenda.
For the past decade, the field and theory of HCI has been undergoing major changes in its evident third paradigm shift to encourage aspects of ethics, culture, experiences, and aesthetics (Rogers, 2004). This shift mostly focused on the transition from prioritizing human cognition to leveraging on cultures of users (Bødker, 2006; Rogers, 2004). HCI and design researchers have worked immensely in considering *culture* as a theoretical construct or analytic lens to look at HCI practices and design principles (Irani et al., 2010; Sturm et al., 2015). Researchers have suggested cross-cultural models or nationalistic design principles including a wide range of cultures (Hofstede et al., 2005; Marcus & Gould, 2000; Shen et al., 2006; Winschiers-Theophilus & Bidwell, 2013). A huge part of this conversation has argued for extending design work beyond the WEIRD participants (Western, Educated, Industrialized, Rich, and Democratic) (Sturm et al., 2015) to be inclusive of different cultures and nationalities. Waldegg and Scrivener call this coupling of *Internationalization* and *Localization* techniques to include culturally oriented elements in HCI designs (Bourges-Waldegg & Scrivener, 1998). Waldegg and Scrivener term these dual relations of separating cultural elements from designs (internationalization) and targeting local elements from a particular culture (localization) as *Culturalization* to embed meaning into design and usability.

Taking *culture* primarily as a lens, there has been a lot of work done such as culture-based design (Li et al., 2007; Shen et al., 2006), culture-sensitive

design (Lachner et al., 2018), or social-determinism aspects in HCI research. This establishment was intended to expand HCI and design research abilities in, very few examples, thinking about third-world problems, designing for particular domains such as health, fitness, etc. for different cultures (Zheng & Hermawati, 2021), considering usability issues as drawn from users of different cultures (Li et al., 2007), surfacing the complexity in design due to the “*difficulty of determining the user, based on cultural grounds*” (Bourges-Waldegg & Scrivener, 1998), exploring linguistic and visual literacy of various cultures dealing with technological features (Wang et al., 2019), comparing perspectives on technology manipulation across different cultures (Gray et al., 2021), and so on. I am signposting only a few examples of research to give a sense of what I am NOT going to focus on this chapter. Across all this work, the focus was always on the *bigger research space* of HCI or design, *users* who are invited to be studied or targeted, *questions* being asked through a cultural lens for design, or *arguments or design principles* brought to the table based on the cultural implications to HCI and design (indicated by black ink in Figure 1). In this book chapter, I am not directly focusing on the implications of HCI and design work on a particular or “other” culture. My main focus is trying to understand how researchers and designers have used their own cultural knowledge and underpinning as their research agenda (indicated and marked by blue ink in Figure 1). *I am focusing on the researchers and designers themselves* to describe how their own culture has influenced their practices, space, and research agenda to build HCI research as a whole.

In this chapter, I focus on the cultural disposition

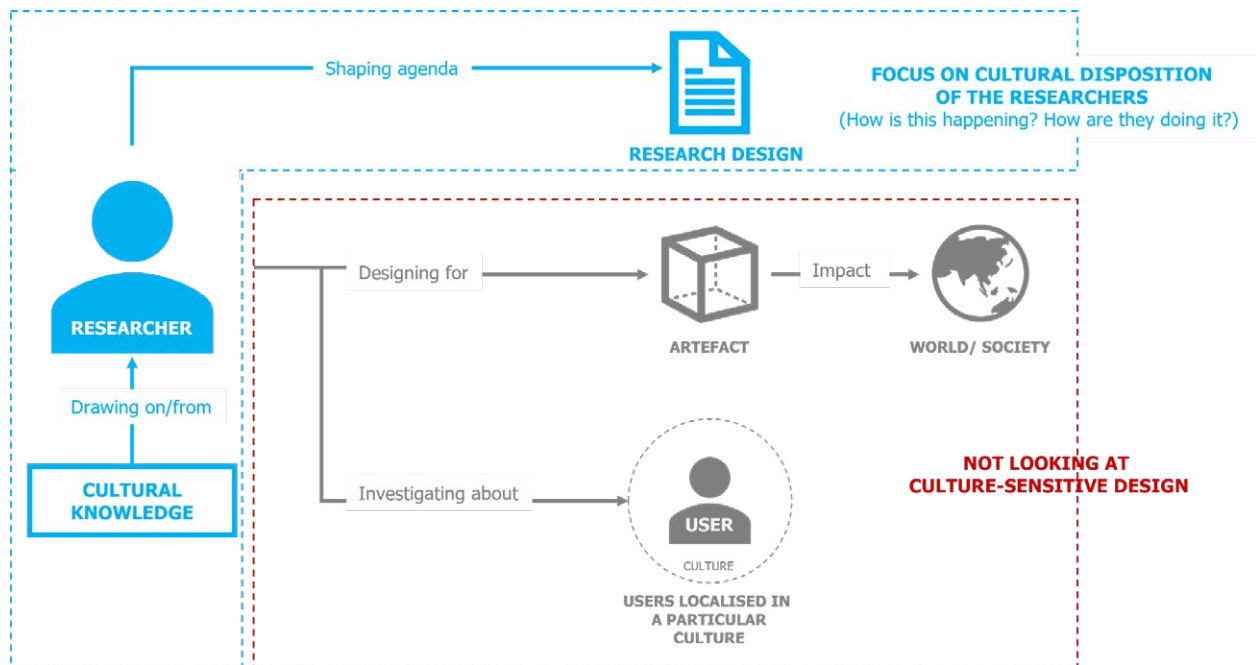


FIGURE 1: Schema representing the scope of this chapter. The blue inked marking indicates the focus of this chapter, building on the explicit contributions in the HCI and design field, represented by the blank ink. Schema sketched by the author.

of the researchers and designers themselves and portray how they draw from it for setting their research agenda. I intend to bring knowledge acquired or inspired from one's native cultural background (which I often refer to as cultural knowledge in this chapter) into light to discuss how that impacts the field of HCI and design. Throughout this chapter, I refer to "HCI research" as a unitized body of knowledge/practice and "design" as the creative and innovative layer for HCI (not referring to design outside the realm of HCI). Throughout this chapter, I am trying to add a different flavour to the conversation in relation to the WEIRD (Western, educated, industrialized, rich and democratic) (Sturm et al., 2015) spaces already explored in HCI and design-research and practice. I refer to *culture*, but from the position of the rooted and personal culture of the researcher. I am talking about a design and research agenda, not in

the form of the outcomes produced, but rather how the researchers have framed the research agenda drawing from their own culture.

I broadly ask the questions: What are different researchers bringing into the HCI space with them, from their own rooted culture of being and living? Given the diverse nature of HCI and design research and practice, what is the contribution of an individual researcher to this space? Are cultural practices contributing to defy and challenge standardized knowledge such as scientific research methods, theoretical constructs defined by popularity in space, prestige views (from the WEIRD populations) that are being used? Indirectly, how are researchers contributing to the HCI research space through their own individual identity, to stand out and be different to the crowd (apart from following the WEIRD standards and practices)?

Structure of the chapter. Firstly, I am providing a definition of culture and how culture has already been studied or used as a theoretical framework in HCI and design literature. This allows me to frame what I am trying to add to the ongoing conversations under “Culture and HCI/design”. I also define “Design Precedent” as a concept. Secondly, I am presenting four “Cases” of HCI and design researchers, to illustrate different ways in which they have used culture as a design precedent to set their research agendas. Thirdly, I am summarizing how the cultural knowledge brought in by these researchers has helped impact the HCI space to expand, include, and diversify itself. Finally, I conclude by presenting “Feminisms of Thought” as a framework or approach for young researchers, who can use cultural diversity and knowledge as a design precedent for carving their research agendas.

Personal Background

Author’s positionality. Where is she coming from? This chapter is more of a personal reflection and provocation to engage with this focus on technological feminisms, especially brought by the researchers in HCI and design literature. *Where did this idea come from? How did I even think of this?* I have a very personal uptake and positionality towards this topic. I am Shruthi, born and brought up in South India; Sai Shruthi Chivukula, worked in South Korea and the United Kingdom; and Dr. Sai Shruthi Chivukula, graduated in the US with Indian roots. Throughout this whole journey, my cultural roots were deep-rooted from India and I got an opportunity to engage in the space

of HCI/Design from more Western perspectives. This allowed me to look at my culture as a construct and precedent knowledge that impacted my design decisions, and through a wider lens, the outlook towards the history of HCI/design as a field. I felt this conversation was important to have so that I could see how a researcher’s, designer’s, (or even an educator’s) cultural knowledge can work for their own power to set up a research agenda. Upon retrospection, this idea had been brewing for a long time.

Firstly, back in 2015, I was doing my Bachelor’s Thesis Project when my advisor asked me to explore how I could make my thesis agenda and proposal very much “my own” and “Shruthi-like.” Back then, I did not connect it back to my cultural knowledge, but I did some explorative research through a design (RtD) project where I brought Carnatic Music (South-Indian Classical music; trained for 11 years), Mathematics (favorite subject), and Shape Grammar together to define Visual Grids based on “Taalam” (Rhythm) of Carnatic music. The creative focus of this project in addition to the offered due to the addition of a cultural knowledge drawing from music intrigued me in terms of how my own knowledge drawn from Indian culture could offer creativity in the selected design frames.

Secondly, in 2021, I gave a design prompt to challenge my design students, asking them to formulate design principles for Conversational User Interfaces (CUIs) considering the themes of Diversity, Equity, Justice, and Inclusion. I built on the design prompt based on me being a person of color and how most of the CUIs currently

built through NLP systems are based on the WEIRD (Western, educated, industrialized, rich and democratic) populations only. This exercise gave design students a different perspective of considering and exploring critical aspects in design, which I framed particularly from my roots of being a person of color. I used CUIs as a tool to investigate the inclusivity and promote the diversity of Conversational Technological artifacts. The results from the students' projects intrigued me because of the creativity and novelty they offered in solving this design space, where I was wondering if I would have come up with that prompt if not personally rooted from being a person of color (or just not experiencing culture just from the Western roots).

Thirdly, a discussion with a senior HCI professor about the history of design in HCI where our perspectives built an argument about how design is a "Wrapper" in HCI, but also defining only the elitist. But, my extension of the argument was how "design" as a field in HCI is very new to designers and researchers in the Global south (drawing from personal experiences) and that it is changing rapidly, when I consider my engagement in the field of HCI/design in the past decade. This conversation intrigued me to find out how the pollination of non-WEIRD researchers and designers is starting to ask critical questions based on their own cultural background and underpinnings.

The common thread running through all these stories is: how my own *cultural background* – a person from India, being a person of color, learning a cultural form of music – has tried to pull the threads of innovation and creativity for, through, and in design. That is when I started to reflect on examples I know about designers and

researchers who have used their own cultural backgrounds to frame their research agendas.

Definitions

Culture and HCI/ design

When I refer to culture, I am building on Birukou and colleagues' definition (Birukou et al., 2013) of culture represented through four categories: *knowledge, behavior, norms/rules, and beliefs*. There can be a range of assumptions and predispositions about how a person's culture is built. It can be argued that a researcher can be developing *new* cultural knowledge through changes in their life, such as embedding themselves in a certain culture for a long time. While I agree with these assumptions, in this chapter I have chosen to focus more on the rooted culture in which the researcher was either born, raised, or embedded as their foundation, when I refer to cultural knowledge. Researchers tend to build on local practices or culture based on geography, but in this chapter, I am going to extend the conversation drawing on some case examples where researchers have built on some concepts from their rooted culture, and show examples of innovation, creativity, and critical expansion of HCI practices, both at fundamental and theoretical levels. I further define what I mean by culture, as I present each case later in the chapter.

Design Precedent

Lawson (Lawson, 2004; Lawson & Dorst, 2013) describes *precedent* as one of the forms of design knowledge. As the knowledge that is dormant yet active and mostly, personal to

every designer, precedent is defined as “*accretion of decisions made over time and constraining future decisions, in design precedent refers to the store of experiential (episodic) memories each designer accumulates over time – expanding their future possibilities for actions or decisions*” (Boling, 2021). Not only through design decisions made through conducted projects or design generations, Goldschmidt (Goldschmidt, 2015) defines precedent as a “*stimuli*” of everything and anything that the designer “*encounters, randomly or intentionally, in any environment*” due to the very own nature of becoming a designer and having a “*prepared eye.*” Boling (Boling, 2021) lists various characteristics of a precedent about it being concrete, activating its value and relevance only when used, and possessing the ambiguous nature of its operationalization depending on the context of its use.

I build on both the formal and informal definitions of precedent, where one is informed through formal ways of conducting design and the other being built through stimuli through experiential aspects for the designer. Following these definitions, I build an argument, specifically for this chapter, where design researchers and designers build on their own cultural background, knowledge, rituals, beliefs, and related underpinnings. Here, I am framing the designer’s personal cultural background in which they have grown or majorly associate with as a design precedent, helping them to frame their research agenda. In cumulation of case-studies of different design researchers or designers, I argue how cultural diversity as a design precedent, contributes to the expansion and development of broader HCI research.

As a side note, what am I calling *design*? In this chapter, I tag on a range of activities, such as *design*, *research design* where researchers plan their research study at minute and theoretical levels; *product design* where designers use elements of design to generate tangible outcomes; and the *architecture of the tools they use* for their research agenda, or design activities.

Cases

In this section, I am going to present four case studies to illustrate how design researchers and designers build on their cultural backgrounds to shape their research agenda. I refer to a range of ways of shaping research agendas happening on multiple levels – from a *researcher positionality level*, which operationalizes differently in different research and design projects, *topic domain level*, chosen across all the research they conduct, or a specific *research project design level*, where the design frame, problem, or opportunity is drawn mainly from their cultural backgrounds.

The four cases presented below are a few of the examples I personally came across to frame this chapter. However, it is by no means an exhaustive list of HCI and design researchers and in fact, it barely scratches the surface. These case studies allowed me to illustrate and represent a broader idea of work where cultural knowledge is used as design precedent. Additionally, due to the lack of my in-depth knowledge, the presented examples are not representative of all the different cultures we could think of as these would certainly be infinite to fit in a single book chapter. However, it can definitely be used as a starting point to tag and identify more

researchers working towards critically expanding the scope of HCI and design research because they dig deeply into their rooted cultures and get the conversation rolling. *I build on this cultural aspect to Feminisms of Thought in the conclusion, as a disruption to the focus on WEIRD practices taken by researchers and designers.* Plus, I am hoping to mark this book chapter as a preface and just a stepping stone to build more such cases across the world of HCI and design researchers.

Case A: Cultural History as Critical Frameworks for Design | Ruha Benjamin

In this case study, I highlight Dr. Ruha Benjamin's work and focus on her engagement with the construct of race, racial discrimination, and exclusion in technology design. I built this case study where *culture* is referring to *"learned, accumulated experience. A culture ... refers to those socially transmitted patterns for behavior characteristics of a particular social group"* (from (Birukou et al., 2013) as cited in (Keesing, 1981)); in her case, specifically *race*. In her talk entitled "Which Humans? Innovation, Equity, and Imagination in Human-Centered Design" (Sigchi, 2021), Dr. Benjamin talks about technology design *"producing new forms of discrimination and exclusion."* She quotes everyday examples of black-colored robots being impacted by racism (Snow, 2018), questioning the mis-use of black race faces in police target practice, characterization of unprofessional looks to black women on Google searches, and lack of identification of black faces during the application of Zoom backgrounds. Through all these examples, she questioned the way race is

being treated in technology design. Her work of using race, especially "The Black Experience in Design" (Berry et al., 2022), is traced back to her multi-racial family background. On her website she said: "This family was my first classroom, where I became a student of race-ethnicity, gender, class, citizenship, and diaspora – an ongoing touchstone for questioning what 'comes naturally'" (Ruha Benjamin, n.d.). This is not the only famous example, but many other researchers, especially people of color, bring their cultural history of racial, social, and class-oriented conversations into the design of technology. I am not just talking about behaviors related to people of color, but even beyond to consider histories related to these non-WEIRD populations. This expansion and inclusion of "other" perspectives is what I tag as a part of empowered thought under the umbrella of Feminism.

Many researchers and designers work in similar spaces to: 1) elevate their racial background such as Dr. Timnit Gebru, contributing to algorithmic bias "for Black Lives" based on racial-based discrimination she faced by establishing DAIR (Distributed Artificial Intelligence Research Institute) (Tiku, 2021); and 2) incorporate their social background such as Dr. Neha Kumar and her team's efforts to empower women towards menstrual dignity in marginal contexts through her lab TanDEm (short for Technology and Design towards "Empowerment") (Neha Kumar, n.d.); all using cultural history as design precedent to frame their research agenda, question, and engage with technology design.

Case B: Cultural Behaviors as Tool for Inclusive Design Futures | Deepa Butoliya

In this case study, I engage with Dr. Deepa Butoliya's work where she speculates design futures (i.e., futures created through design interventions) through her concept of "Critical Jugaad." I build on this case study where culture is hinting towards "*the total socially acquired life-way or life-style of a group of people. It consists of the patterned, repetitive ways of thinking, feeling, and acting that are characteristic of the members of a particular society or segment of a society*" (from (Harris, 1993) as cited in (Keesing, 1981)). The "acquired life-way" I refer to in her work is "jugaad", defined as "*ingenious making practices from the Global South, a Hindi word for making, making-do, and survival in the face of scarcity of resources*" (Butoliya, 2019). *Jugaad* is not a specific concept to the Indian population, there are equivalents in many cultures such as DIY (Do-it-yourself) in the US or "Gambiarra" or "Jeitinho" in Brazil. But, for Butoliya, it is a culturally oriented practice that she leveraged to critically engage with design futures and ingenuity at the intersection of design, technology and culture. In her work, Dr. Butoliya uses Jugaad, drawing from her cultural background in India to study design knowledge from global perspectives and also local awareness. She expands jugaad into "critical jugaad" to "explore these marginal making practices as a post-critical investigation" (Butoliya, 2018). In her TED talk, she talks about design futures and how "*I did not see myself in one of those projected futures, so it was important to me to change those narratives*" (Butoliya, 2019). Triggered by the elitist nature of design practice, she brings (and critically expands) her own cultural knowledge and practices of Jugaad, which has an intense design value of using resources in scarcity as

a solution to investigate those design futures. She also takes the lead by changing the narrative of design futures using this cultural tool called Jugaad; which she re-purposed to taking it to the next dimension from just jugaad to do it more intentionally, as the formal systems are not made for marginalized communities and populations. Butoliya uses a cultural behavior or practice, not only as a form given to her design practice, but as a backgrounded tool with "*a form of imagining and engaging with formal systems*" (Butoliya, 2015).

Case C: Cultural Craft as Means to explore (Algorithmic) Design | Anuradha Reddy

In this case study, I talk about Dr. Anuradha Reddy's (Anuradha Reddy, n.d.) work where she explores heritage algorithms by foregrounding shape grammars in crafts to build tools to explore and learn algorithm design. In this case study, culture "*is that complex whole which includes knowledge, belief, art, law, morals, custom, and any other capabilities and habits acquired by man as a member of society*" (from (Tylor, 1871) as cited in (Keesing, 1981)). Her exploration started in using crochet as a means to critically explore the technological artifacts. In her projects "CryptoCrochet-Key" (Halfacree, 2021) and "Internet of Towels" (Figure 2), she uses crochet as a means to design and build computational objects to critically engage with hardware hacks within data-driven technologies. Figure 2 is one such computational object she crocheted using lenticular imaging and QR codes, called the Internet of Towels. In a conversation with her, she mentioned that this was one of her early experiments for understanding

how a culturally oriented craft, such as crochet, can offer hybrid potential to be innovative in exploring data-driven technologies in HCI design spaces. In the process, she narrated that she came across a range of researchers who build on various culturally oriented crafts such as music, weaving, wire-bending, etc., as mediums to explore shape grammars and algorithmic design. Some engage with vernacular algorithms (Bristow, 2018; Gaskins, 2021) where, for example, Tegan Bristow investigates more-than-binary computation potential in South African Zulu beadwork and Alex McLeans explore the idea of Algorithmic Patterns through music and weaving (McLean et al., 2021). In essence, these researchers collaborate to build design principles for creative technologies from a range of cultural craft forms. In the future, Dr. Reddy is planning to continue her current exploration of yarn-based practices (similar to embroidery craft culture in India) through a particular craft form named Banjara Embroidery from her native Indian city, Hyderabad, to understand how “color, fractal patterns and they [Banjara community] have alike symmetries, which can be appreciated and computationally explored.” In this case, many researchers such as Dr. Reddy have built on their own cultural crafts to add a creative and innovative side of exploring computational thinking and design. As quoted in a conversation with Dr. Reddy, she is employing pedagogies of critical making (Ratto, 2011) and craftivists (Greer, 2014) to elevate and leverage on her childhood interactions with the Banjara tribe and their vibrant culture, connecting two different phases of her life. Reflecting back on improving her childhood ways of learning math and science fundamentals, she crafts her

research agenda to include heritage algorithms as a tool to build creative pedagogical scaffolds for STEM+C learners. Cultural craft, a very evident element to define or represent a certain culture, is here being leveraged as a lens to explore design and design principles, leading to constantly building on conventional principles and expanding possibilities of formalizing design fundamentals.



FIGURE 2: Internet of Towels designed by Anuradha Reddy – A crocheted artifact that uses a lenticular image technique to reveal a QR code pattern only when it is viewed at a 45-degree angle.

Case D: Cultural Beliefs as Design Constraints | Shadi Kheirandish & Sara Nabil

In this case study, I talk about two design researchers’ work about how they build on their cultural beliefs as design constraints when they frame their design products. Here, I use Biskjaer and Halskov’s proposed concept of *decisive constraints* for design, which can act as both radical and creative enabler or hindrance,

often “*applying a radical, self-imposed creativity constraint to stimulate the process*” (Mose Biskjaer & Halskov, 2014). Again, I build on the same definition of culture as in the last case study, but from the perspective of how it is being used as an evident element in products.

First, researcher Shadi Kheirandish uses “*spirituality as a valuable thing in my life and because of my cultural background*” (quoted during an interview for (Gray et al., 2022)) in her work while designing an ethics-focused method called HuValue (Kheirandish et al., 2015, 2019). In this case, the researcher built on her own cultural beliefs to provide certain design constraints to shape the problem frame to formulate a design method to generate value-centric designs; these values specifically drawn from spiritual angles and targeting virtue ethics of the designers.

Second, design researcher Sara Nabil’s work in her lab on The Interioraction Design (*iStudio Lab*, n.d.) combined calligraphy with furniture design to represent dual-identities and peace around Western-Muslims. In their Pictorial (Nabil & MacLeod, 2020), Nabil and colleagues worked with a combination of English and cultural calligraphy Arabic script as a representation and visual constraint to build the interactive portions of a piece of furniture. Dr. Nabil also shared another design project with us, where she designed the ‘Sound Scarf’ (Figure 3) as a part of Soft Speakers (Nabil et al., 2021). It was the first hijab with embedded embroidered speakers within the fabric itself, to enable those who cannot use headphones or earpieces on top of or underneath their head-covering for religious or cultural purposes. In both these design cases, the designer built on cultural forms and

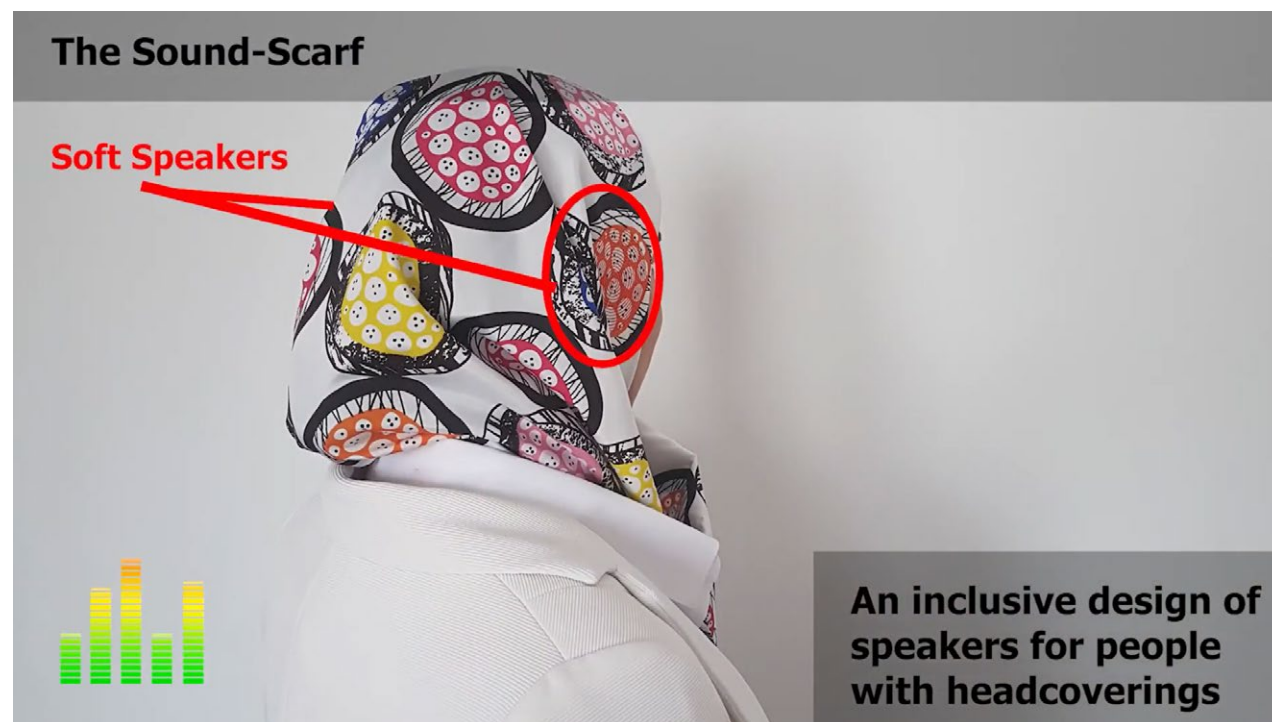


FIGURE 3: Sound Speaker designed by Sara Nabil - A sound scarf to be inclusive of Western Muslim women to embed speakers in their Hijaab.

experiences to build design products using technology to represent inclusivity and diversity. Here, designers used various *elements from their culture* – such as heritage in the form of calligraphy, practices in terms of wearing a certain clothing, and beliefs in terms of spirituality – *as design constraints* – such as design elements in their products or design frames to scope their projects. Their personal knowledge of their own cultural elements allowed the designers to easily connect and implement those design constraints in their design process and begin their creativity in a comfortable space, rather than learning an entire new precedent knowledge.

Discussion: Cultural Knowledge and its impacts

In this section of the chapter, I am building on the previous cases which illustrated how the cultural dimensions can be framed as a range of design precedents. In this particular section, I present my analysis of what this all means to the larger HCI and design research and practice. I answer the questions that I started to write this chapter with, namely: *How are the researchers building on their roots trying to tell us through their research agendas? What does personal cultural roots have to do with HCI and design research?*

Here, I analyze and summarize how the four cases presented showcase how cultural knowledge of the researchers impacted the kind of work they contribute to HCI and design research.

Elevating cultural elements in research design expanding HCI research. In the above examples, it is clearly illustrated how bringing in different

cultural elements such as race (as in Case A), societal norms (as in Case A), daily practice (as in Case B), crafts and heritage (as in Case C and Case D), cultural beliefs (as in Case D), and stereotypes (as in Case D), have enabled various kinds of opportunities to be brought into HCI and design research. Bringing in this range of elements has helped in questioning users and also the materials being included in technology (like in Case B), expanding use cases for the use of technology (like in Case C and D), and critically re-framing the repercussions of technology on society (like in Case A). Researchers have elevated their practice by incorporating elements of their own, that might not be represented the same by another researcher, given the personal, felt, and complex nature of everyone's relation to their cultural knowledge. Despite the complexities involved, these researchers have brought innovative and rooted opportunities, that have subsequently allowed them to provide a new perspective to traditional WEIRD thoughts that previously dominated HCI research and design. In all cases, we were able to observe a cross-pollination of theoretical frames which were naturally rooted in the researcher's own cultural background. Just to reflect on the prosperity of this practice; let's just counter our reflection to think about answering the question that guided this chapter: *What would happen to creativity in design frames if various cultural crafts, some submerged in originated history, are not brought into HCI and design? How will the HCI research and design boundaries grow if they are not considered and questioned in the way they were represented in the above four cases?* This cross-pollination and interaction of cultural knowledge by these researchers has led to innovation, creativity, criticality,

and a pragmatic outlook in HCI research and design across a range of use cases; in turn, opening up possibilities in HCI and design research that were previously not asked to be inclusive, or were simply WEIRD-focused.

Incorporating cultural aspects to build criticality in HCI and design thinking. In the above examples, we can imply how various cultural backgrounds, experiences, and beliefs have led the design researchers to bring those opportunities, mostly issues into design. For instance, in Case A, Ruha Benjamin's work drawing from race and similar researchers' work drawing from societal issues in their cultural setting has brought in an opportunity area to represent Third World problems (as in Case A), question current technology design (as in Case A), include unheard design perspectives (as in Case B), consider inclusivity in the selected design frames (as in Case D), elevate cultural history through design (as in Case C), and so on.

Building on "own" cultural knowledge leading to the feminisms of thought (FtT). In the above examples, we have seen how researchers draw from their own rooted cultural experiences, opportunities, practices, and often accidental critique of the space. This allows them to shift the focus from the domain of work represented through various cultures, to how the researchers were actively, provocatively, critically, and creatively thinking of the space. This is expanded on in the next section.

Conclusion: Feminisms of Thoughts (FtT)

As a conclusion to this chapter, I build on the case studies to also talk about how these kinds

of instances expand the field of HCI and design where young researchers like us bring our culture into the design work we do. I am trying to connect this back to portray a *feminist way* of looking forward in our field.

From a previously written article of mine, I define the "*Feminisms Through Design: A Practical Guide to Implement and Extend Feminism*" (Chivukula, 2020), where I define four angles (knowledge, methodology, self/community, and artifact) of using feminisms as design material. Through the cases presented in this chapter, I extend on this conversation to see how the *self-angle* (representing the researcher) projects *feminisms of thought* towards the other three angles (knowledge, methodology, and artifact, primarily drawing from culture). I would like to elevate the self-angle to shift the conversation from HCI and design theoretical innovations to the researchers behind such improvements and contributions. A researcher as a whole is a combination of the positionalities that they build from their personal, societal, and rooted cultures. I want this chapter to be a tribute to elevate all the feminisms of thought and practices brought forward by HCI and design researchers, especially women, in expanding the horizons of possibilities in technology design and critique.

Feminisms of Thought being represented through:

Recognizing non-representation and forms of activism to carve that space for themselves. Here, Feminisms of Thought (FtT) is represented through the agency and activism of researchers and designers carving a space by/for themselves to create their own agenda by

drawing from their own cultural precedent. FtT encourages younger researchers to ask critical questions built on their own knowledge and to feel comfortable with the discomfort of carving their own space, one of which can be from their rooted culture. For instance, in Case B and Case C, researchers Butoliya and Reddy are constantly carving their own space in order to expand the traditional elitist design world, than any other non-feminist way.

Promoting innovation, inclusivity, and responsibility through the diversity of cultural knowledge and background. Here, Feminisms of thought (FtT) is elevated through the diversity brought into HCI and design research and practice that is drawing from culturally rooted knowledge and experiences of researchers from different parts of the world. For instance, in Case A and Case D, researchers Benjamin and Nabil are critically questioning and developing inclusivity in design which when multiplied and collectively looked at, only makes society inclusive in technology design.

Encouraging cross-pollination of ideas to build the larger research agenda for HCI design. Here, Feminisms of thought (FtT) is projected to trace the trajectory of HCI and design research and practice for the need and encouragement of bringing in cross-cultural perspectives and critique to the current practices. This is a two-way exchange from individual researchers and the collective HCI research community, to encourage the critical questions and novelty in disruption through cultural knowledge that younger researchers bring to the space.

Feminisms of thought definitely comes with its own *Disclaimers*:

Firstly, this is not to encourage a space to equate someone's personal life (built and rooted in a culture) with their work, but to *make* their research agenda comfortable with in their own thoughts, *draw* from the body of knowledge that they already have, and *encourage* them to repurpose it.

Secondly, this does not mean that only specific researchers are currently engaging in FtT either, but rather that every researcher is a part of the FtT in some polarity, and I only encourage everyone to always regard FtT as an encouraging framework for building research agendas.

Thirdly, FtT encourages multiple notions drawing from personal and rooted culture knowledge, which can come with its own risk of multiple perspectives fighting against one another. As much as researchers and designers carve their own spaces, which collectively will have multiple of those dents, FtT must aim to protect the (intellectual) clashes these dents can produce to one another, given the cultural fights. As much as optimism is encouraged through FtT, it is required to deliberately, consciously, and cautiously be aware of the boundaries of these thoughts in practice.

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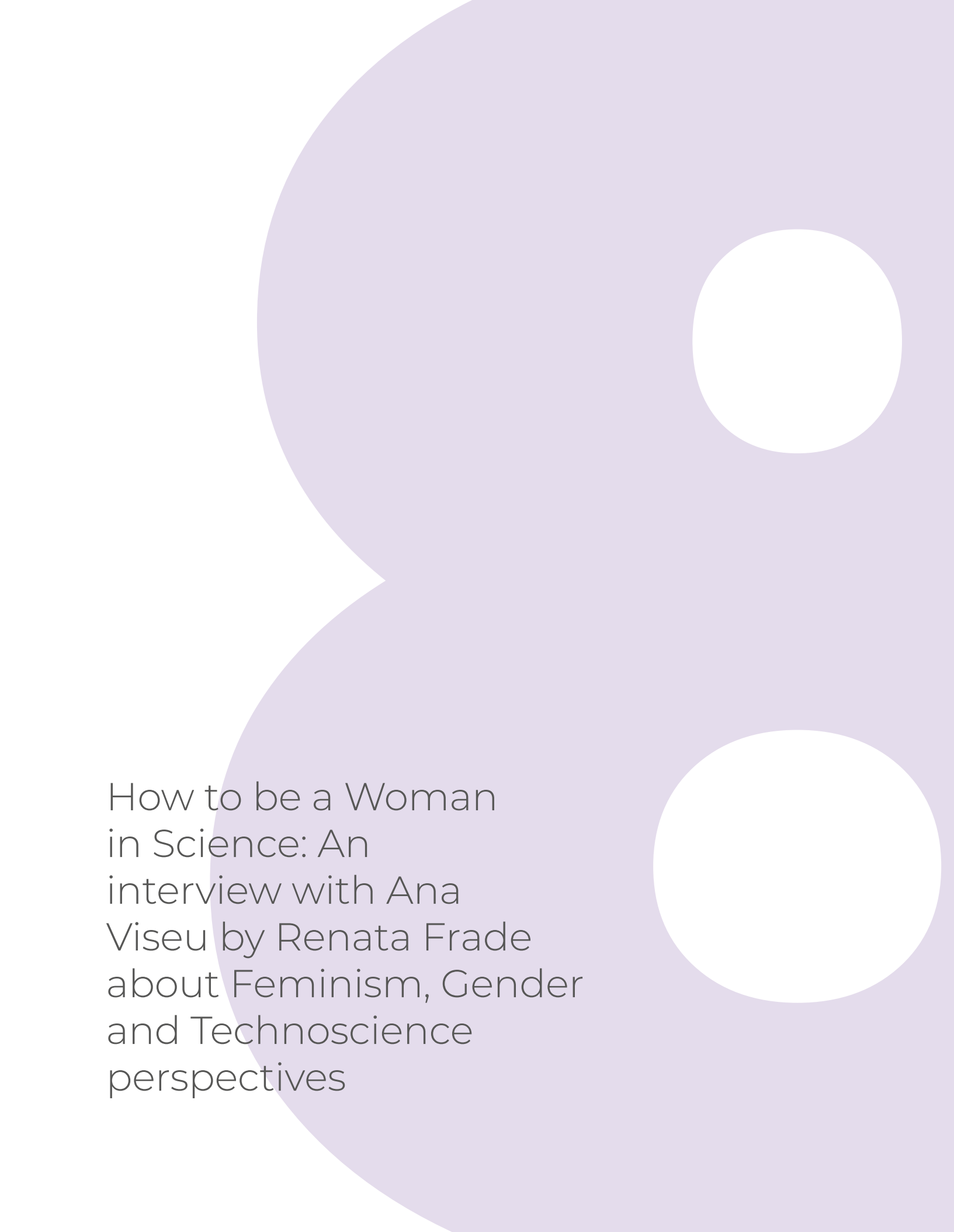
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The background features a large, light purple circle on the left side, partially overlapping a larger, darker purple circle on the right. Two smaller white circles are positioned on the right side, one above the other, both overlapping the darker purple circle.

How to be a Woman
in Science: An
interview with Ana
Viseu by Renata Frade
about Feminism, Gender
and Technoscience
perspectives

How to be a Woman in Science: An interview with Ana Viseu by Renata Frade about Feminism, Gender and Technoscience perspectives

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Abstract

In this interview Professor Ana Viseu, one of Portugal's most important science and technology studies scholars, discusses her fascinating professional and personal trajectory in the country and abroad, offering an original and innovative perspective on what it means to do science. In addition to being a model for new generations of scientists, in this interview with Renata Frade, Ana Viseu examines aspects related to her interdisciplinary work and ample experience in scientific projects, publications and teaching, and how these relate to issues such as diversity, inclusion and, challenges and achievements to women in science and technology. In this interview, Prof. Viseu engages with concepts central to her work such as, feminist

technoscience, actor-network theory, cyborg anthropology and care so as to show how these can be used to better understand technoscientific innovation and particularly, how emergent information and communication technologies are envisioned, used and regulated and how they transform and create new realities, entities and worlds.

Keywords: nanotechnology; technoscience; feminism; care; gender studies; women in science.

“The strength of my dreams is so strong, that exaltation is reborn from everything, and my hands are never empty”. Sophia de Mello Breyner Andresen is a Portuguese writer and this quote is one of my favorites and I think it fits Ana Viseu's profile very well: a Portuguese scientist with a courageous, outstanding, unique

academic and professional path. One of my most wanted goals while curating and editing this book was to find a very important female STEM role model. I think I was very fortunate, because what you as my readers will attest to, is not only her successful career in research in Portugal, Canada, and United States, among others, but also that she is a woman with a similar background to mine, with many intellectual outlooks in common. We are both Portuguese citizens raised in American countries, we come from Social Communications Bachelors, we both developed studies in technoscience and techno-feminism and believe in interdisciplinary Social Sciences and Technology Studies as a means to understand and propose new paths to understand the entanglements of tech with society and vice-versa, such as digital platforms, for example.

Jenkins, Ito, Boyd (2016) said “I do not think technologies are participatory; cultures are. Technologies may be interactive in their design; they may facilitate communications between many people; they may be accessible and adaptable to multiple kinds of users; and they may encode certain values through their terms of use and through their interfaces. But ultimately, those technologies get embraced and deployed by people who are operating in cultural contexts that may be more or less participatory”. When we think about online activism, technofeminism, interaction design, or design justice, for instance, we cannot forget the mutual relationship between social dimensions and tech development and impact on people. Ana Viseu’s research not only embraces this huge

complexity on tech projects, especially in relation to nanotechnology and ‘bodily’ technologies, but also points out new conceptual paths such as her perspective on the concept of care.

According to her auto-biography⁵⁸, Ana Viseu is an Associate Professor at Universidade Europeia and a member of ICNOVA - Communications Institute of Faculdade de Ciências Sociais e Humanas at Universidade Nova de Lisboa. In 2011, she became a Marie Curie Fellow and in 2013 she resigned from York University (Canada), where she worked as an Assistant Professor in the Dept. of Communications. Her Ph.D. thesis developed at University of Toronto in 2005 examined the multiple and conflicted meanings of bodily augmentation through wearable computers. She was also a Cornell University Research Associate in the USA. In 2019, Ana Viseu was honored by *Ciência Viva* (Portugal’s National Agency for Scientific and Technological Culture) as one of Portugal’s top 100 Female Scientists and was elected as a Member Council of the *Society for Social Studies of Science* (4S) in 2018.

In my point of view, this interview has important characteristics, such as:

1 - To be a documentary and historical record for current and future generations of the path of a female role model in Academia, particularly in issues related to diversity and social inclusion, feminism and technoscientific culture.

2 – To explore theoretical contributions in the field of ‘science and technology studies’ (STS), feminist technoscience; pioneer in studies of emerging technologies such as wearable computers, care and nanotechnology.

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3 – To highlight some of the challenges of being a female and a Portuguese researcher that must be overcome and consecrated in funded studies and awards.

4 – To discuss Gender issues in general and particularly those pertaining to technoscience.

5 – To present Ana Viseu's innovative qualitative (mostly ethnographic) methods to study how emergent information and communication technologies are developed and an article published in one of the most renowned scientific publications in the world, *Nature*, for instance.

In this interview, I was able to exchange, learn and be surprised by Ana Viseu's inspiring biography and history. She is a researcher who is synonymous with scientific rigor and who will certainly leave important legacies and inspirations, especially for female researchers.

Renata Frade: You completed a B.A. in Communication Sciences (Faculty of Social and Human Sciences, Universidade Nova de Lisboa and between 1995-1996 studied at Roskilde Universitetscenter, Denmark/Erasmus). You hold an M.A by the European Master in Interactive Communications, Telecommunications and Multimedia, Department de Comunicació Audiovisual i de Publicitat, Universitat Autònoma de Barcelona, Spain, and also hold a Ph.D. from the Ontario Institute for Studies in Education (OISE), University of Toronto, Canada. Your thesis title is "Augmented Bodies: The Visions and Realities of Wearable Computers" (with external examiner Joseph Dumit, MIT).

How did you choose this academic route? Was there anyone, a family member, who had inspired you?

Ana Viseu: I would love to say that I always knew what I wanted to be/do, but that is not the case. My path has been serendipitous and shaped by many: family, friends, places, mentors, institutions, funding opportunities, technological developments, and luck, to name a few. All these factors and relationships made me who I am today.

This being said, as I go back in my mind, my thoughts turn to my stepfather, Eduardo, and to Nicaragua. When I was a teenager, we moved to Nicaragua because of my stepfather's work. He worked for the United Nations and, at a time when the world was not yet global, he was. Because of that and because I attended an American high school filled with people from all over the world, my existence also became global. This stuck with me in more than one way: In Nicaragua I became fluent in English and Spanish (which made it easy to study in Spain and North America); and, at an age when peer-pressure was high and the need to conform higher, I suddenly had friends with many different ways of doing and being. At that time Portugal was a homogenous, conservative and still a very insular country and in Nicaragua I discovered (it really was a discovery!) that most of what I held as *the* way to do things was actually just *one* way to do them. Sociocultural norms are powerful and seem self-evident and living in Nicaragua showed me that they are very much constructed. In Nicaragua, I saw that there is not one world but multiple worlds that we enact, reify, transform and (attempt to) impose on others. This freed me, it made me attuned to difference, and piqued my interest in studying distinct enactments of culture.

I am not sure if this is why I became an academic, but I do know that it is why I ended up living abroad for so many years and why I study technoscientific cultures.

Renata Frade: Your professional and academic path is marked by the interdisciplinary and ample experience and perspectives in scientific projects, publications, classes. You worked with engineers, natural scientists, artists and designers. Your ability to cross disciplinary boundaries provide you with a flexibility and ability to communicate in lay language. It also inspires your teaching outside normal disciplinary boundaries and practices. You are also an expert on ‘responsible research and innovation’ which requires the ability to work in interdisciplinary projects.

How did the choice for a plural and dense theoretical-empirical vision that encompasses several disciplines come about? Could you explain how this trajectory was? What were and still are the biggest challenges of a scientist with this profile?

Ana Viseu: Let me start by situating my reply: I finished my BA in Communication Sciences in the nineties, and, at that time, a number of important things were taking place that shaped my trajectory. This was a time when Portugal was making an important commitment to funding post-graduate scientific education (unfortunately this is no longer the case). I applied for, and was fortunate to receive, funding to go abroad and pursue my research from my MA to

my postdoc. Without this national investment in me and my studies, my career would certainly have been very different. At the same time, the late nineties were a time when the world was changing rapidly: the internet went mainstream and was so novel that it came enveloped in possibilities - this was a time of utopian discourses of a new and improved techno world, and it was also a time of realization that the shift to ‘online’ brought with it changes to identities, bodies and agencies that needed studying.

One of the best things that happened to me and was key to my trajectory, was that I did my PhD at the Ontario Institute for Studies in Education⁵⁹ (OISE) in the Department of Human Cognition and Applied Psychology. As I stated earlier, from an early age I had an interest in culture and in understanding how distinct people construct and enact their worlds differently. At OISE I was exposed to a mode of reasoning that helped me stem away from essence and liberal individualism and into relational thinking. I was introduced to thinkers like Vygotsky (1962, 1981) or Luria (1974, 1994) who posit that cognition is a sociocultural process – thought is first social and only later internalized – and that our tools and practices shape us and our cognition. This resonated with what I already knew about McLuhan, and his notion that “We shape our tools, and thereafter our tools shape us” (cited in Lapham, 1994, p. xxi; see also Culkin 1967). Together, it meant that in a very real sense we are *in* and *with* the world, and that the shift towards new information and communication technologies has profound transformative effects.

⁵⁹ The Ontario Institute for Studies in Education (OISE) which is part of the University of Toronto.

From here on, it was a bit like falling into Alice's rabbit hole: I wanted to think further about the relationship between humans and technology and I started reading 'science and technology studies' (STS). With STS, I learned about the co-shaping of science, technology and society, and about thinking of technoscience as a culture, authority, and expertise. I then came across Actor-Network Theory (ANT) and it again opened up a new world for me. It allowed me to take objects seriously, not only in their ability to shape us and our consciousness, but in their ability to act on their own accord. I am talking here of the work by foundational ANT scholars such as Latour and Woolgar (1979), Callon (1986), Law (1991), or Akrich (1992). Latour's *Aramis, or the Love of Technology* (1996) is still one of my favorite books. ANT's emphasis on the agency of non-humans, on agnosticism, on generalized symmetry, on following the actors, on identity as a result of the shape of the networks we inhabit, have all been incredibly important for my work. ANT gave me a vocabulary and a method to think about reality as composed of heterogeneous networks of humans and nonhumans. It seems almost trivial today, but the idea that the objects *act* within the world and that if we want to understand science and society, we have to take nonhumans seriously in their worlding practices, was profoundly ground-breaking for me. Feminist technoscience thinkers – like Donna Haraway, Susan Leigh Star and Lucy Suchman, and many others – further complicated these notions by

introducing to the possibility of studying science and technology as sites of power, inequality, and exploitation, but also as sites for responsibility, accountability, gender, affect and care. Feminist technoscience has done tremendous work exploring science and technology as sites of worldly (re)configuration, of implosion, of boundary-making. My goal has been to contribute to this work, to use emergent information and communication technologies as sites to examine the multiple realities that we are forever building, negotiating and attempting to impose on others. Having found these strange worlds, I never left.

I would remiss if I did not emphasize that throughout my career I have been privileged to work with amazing professors, colleagues and students who in different capacities trained, mentored, challenged, taught and supported me⁶⁰. Feminist theory is keen on relationality, and I am quite aware that I have not done this alone: I am sustained by the many relationships that shaped who I am today.

In the book *The Fuzzy and the Techie: Why the Liberal Arts Will Rule the Digital World*, the venture capitalist and Stanford political science degree Scott Hartley defends the importance of social sciences, especially the liberal arts, in technological development and in the STEM areas (Science, Technology, Engineering and Maths). He created two concepts for professionals and researchers: fuzzy

⁶⁰ I cannot do justice here to everyone who has contributed to my journey, but I would be remiss if I did not mention a few key professors, mentors and colleagues who at different points in my life have been there *for* and *with* me. I am forever indebted to – in no particular order, Michel Ferrari, Keith Oatley, Andrew Clement, Lucy Suchman, Derrick de Kerckhove, Bruce Lewenstein, Aryn Martin, Mike Pollard, Natasha Myers, Maria Puig de la Bellacasa, Michelle Murphy, Ulrike Felt, Noortje Marres, and Francisco Rui Cádima, and so many others.

(belonging to the Humanities, whose importance in a world ruled by algorithms and big data is to provide tools that allow creating contexts and responses to social complexities) and techie (engineers and people who have studied computer science, which have always been associated with innovation and disruption). With an also interdisciplinary view, the author believes that solving complex problems and innovation is related to social problems and that human-centered design is central to projects in the present and future.

You advocate along a similar academic line. On your website⁶¹ you mention: “Anchoring my thinking in cultural studies of technoscience, feminist technoscience and science and technology studies. I specialize in ethnographic studies of technoscientific innovation. In the media and policy realms, what I do is sometimes called ‘social and cultural implications of science and technology.’ Engineers refer to it as ‘human-factors research’, but these terms are deceptively simple. In my research, I strive to characterize and retain the complexity of our relations to technoscience, examining how distinct techno-sciences materialize, reify and transform particular understandings and imaginaries of the world. I seek to represent and often intervene in these strange hybrid worlds”.

How has the reception to these academic works with this very different and differentiated profile been, nationally and internationally?

Ana Viseu: Let me start by saying that I have not read this book and that my years of

studying high-tech have made me cautious about using Silicon Valley authors and categories. This being said, I wholeheartedly agree that the social sciences are vital both to innovation and to our understanding of said processes. There are authors - some feminist like Donna Haraway, Lucy Suchman or Karen Barad - and others not like Sheila Jasanoff and Brian Wynne - that give us nuanced and incisive understandings of how the social sciences contribute to our understanding and shaping of science, technology and society. With this short preamble, let me take a step back to answer your question (with apologies for the overlap with the previous answer).

I find my intellectual home in two areas that have many interfaces: Communications and STS (‘science and technology studies or ‘science, technology and society’). I will focus here on the latter as it shapes much of my thinking and it is not so well known (at least, and unfortunately, in Portugal). For me, and I realize this is not consensual, STS is an interdisciplinary discipline or perhaps an interdisciplinary field. At its core, STS is about recognizing that science and society are not distinct spheres, but are instead continuously shaping one another. From an STS perspective, reality is neither natural nor a given, it is the product of particular actions and choices. Using STS as a lens allows researchers to simultaneously observe the worlding practices of different actors (social, technical, human and nonhuman). However, we must acknowledge that not all actors are equal. Feminist technoscience is vital here because it brings to the fore the issues of power and politics: Who gets

61 <http://anaviseu.org>

to define and who is defined? Who benefits and who is excluded? Who does the speaking and who cannot speak? Who configures and who/what is reconfigured? This is where I have been for the past many years, grappling with these questions as they apply to emergent technologies, their practices – both of development, use and governance – and our identities, bodies and agency.

Now, the late-nineties – when I started my PhD – were a time when we were beginning to examine the many transformations that arose from ‘being online’. Much of the mainstream thinking was utopian (think for instance of Barlow’s *Declaration of the Independence of Cyberspace* [1996]) and we were flooded with hype and visions of quick techno fixes to societal problems (unfortunately, this is still a prevalent discourse). It was at that time that I came upon a phenomenon that piqued my curiosity. It seemed to me, that the latest technological ventures no longer focused on building machines that imitated human beings, like the traditional artificial intelligence efforts, but rather on producing machines that augmented humans with their own strengths. This reversal interested me. Instead of imitating the ability of humans, the focus was on bringing what machines do best, their “infallible logic”, to augment humans.

Wearable computers seemed the perfect site to investigate these issues. In 1999, the dot-com bubble had not yet burst, and a climate of unbridled, visionary and revolutionary technological rhetoric dominated mainstream discourse. With their promises of personal empowerment through the technology’s “smartness”,

continuous access to information, seamless mobility, and the creation of personal/body networks, wearable computers condensed and materialized many of the tenets that rule contemporary Western societies. Furthermore, by being hosted on the body, wearable technologies brought to the fore issues of embodiment, agency, and personhood.

And so, my journey into the field of wearable computers – and more generally, into personal emergent technologies – was initiated. I should say that I study emergent technologies with a mixture of admiration and apprehension. I feel admiration and respect for those who spend their time creating new ways of transforming, improving or augmenting humans and our world; those who spend their time defying well-established categories; those who are not shy of putting forward their often strange, geeky or extreme views of the future. However, and for the exact same reasons, I cannot stop myself from being apprehensive about the kinds of future such visions entail and the types of assumptions they are based upon.⁶²

My work has been dedicated to examining the strange worlds of emergent ICTs – their future oriented discourses, their funding, their practices, and their enactments in the world. I am interdisciplinary because my background exposed me to different disciplines and I understood quickly, that each had something to offer me; but I am also interdisciplinary because to study emergent technologies (and to study our incredibly complex world, I would say) we need to spend time learning about the world of engineers, technologists, scientists, technicians,

62 The arguments presented in this and the last two paragraphs are extracted from my doctoral dissertation (Viseu, 2005).

users, et cetera, and to do that ... well, it is important to have an open mind to different modes of thought, distinct ways of being and disciplining the world.

However, I don't want to romanticize interdisciplinarity. Interdisciplinarity is hard to do and hard to be! I would say that there are at least two main issues that should be highlighted: structural and personal.

In terms of structure, it comes as no surprise that academia is still organized around disciplines and being interdisciplinary makes it harder to justify your presence and your work. This was not so much of an issue in Canada and the US because STS and its contributions to our understanding of the world have a much stronger presence there, but I have found it to be problematic in Portugal where academia is still quite conservative, where STS is still fringe, and where lack-of-disciplinarity is often used as an excuse not to recognize you and your work. In fact, the entire process of being an academic in Portugal is predicated upon belonging to a particular discipline and, in the most archaic twist, the disciplines that do 'exist' are institutionally defined (the infamous CNAEF - *Classificação Nacional de Áreas de Educação e Formação* [CNAEF 2005]). All this while espousing a rhetoric of the need for interdisciplinarity to approach today's problems (XXIII Governo 2022). It seems to me that in Portugal, we always live in a strange paradox where on one hand, we are immersed in institutional discourses of boundless faith in technological innovation as a catalyst for social improvement, while on the

other hand, we create and maintain a system that is very distrustful of its human actors (do not forget that researchers and faculty in public universities are public servants) and is therefore designed to keep their actions and identities in check with restrictive and at times obstructive labels, categories, regulations and bureaucracy. Successive governments proclaim to want to foster innovation by strengthening the bonds between academia and industry and society, while at the same time insisting on a conservative, old school and incredibly stiffened and controlled academia. In this sense, it was easier for me to both work and get recognition for my work abroad.

Spending the bulk of my academic career abroad was key to my path not only because, as I said, there is a wider recognition of the importance of STS as a way of thinking about the world, and this gave me the freedom to explore the emergent worlds I am interested in, without having to worry about disciplinary boundaries, but also because these worlds (of high-tech and innovation) are more easily available abroad. It is also why I have spent most of my career in Communications Departments because communications and our media keep undergoing radical changes and these departments are therefore welcoming of difference and new ways of thinking. I should add that in the years since I returned to Portugal, I have been very fortunate to work in institutions that embrace my work, but I would be naïve if I said that there have not been opportunities that I have missed because of this.⁶³

63 I do want to acknowledge again that I was very fortunate to receive funding from Portugal's national funding agency to pursue my studies abroad, which is in itself evidence of the recognition of interdisciplinary work. But, as I said earlier, Portuguese funding for research has since then been severely decreased and is now mainly directed towards STEM (science, technology, engineering and mathematics).

Personal identity issues are no less troublesome. As a social scientist, working in high-tech and doing interdisciplinary research too often means performing lonely, undervalued, service work. This is hard and it wears you down. The difficulty is not only with the interface with the 'hard' sciences. If I am being honest, I am often plagued by insecurity about not knowing enough about a particular (social science) discipline. It is not easy to live every day with this discomfort. In both instances, it is vital to find a like-minded community. I would finish by saying that, for me, this discomfort, though costly and unpleasant, has also made me a better researcher because it forces me to be humble. It makes me more sensitive to others and observant of nuances and detail. But it definitely has not made my life easier!

Renata Frade: According to *Diário de Notícias* (2021), between 2019 and 2020 the number of graduates recorded in Portugal: 86,000 graduates, most of them women. The data is from the Ministry of Science, Technology and Higher Education. More than half of the graduates (57%) were in STEAM areas (Science, Technologies, Engineering, Arts and Mathematics), with a 20% growth in degrees in information and communication technologies.

According to PORDATA (Contemporary Portugal Database, organized and developed by the Francisco Manuel dos Santos Foundation), in 2021 there were 42.5% of female students enrolled in higher education (Science, mathematics and computing), and 64.2% in 1991. The percentage of higher

education graduates these subjects was 47% in 2020 and 59% in 1994.

The document "Igualdade de Género em Portugal – Boletim Estatístico 2021 /Publicação da Comissão para a Cidadania e a Igualdade de Género - CIG e da República Portuguesa) - Educação, formação e ciência" reveals that in 2020, for every 100 people with higher education, 61 were women and 39 were men. The number of women without any level of education (about 356 thousand) was higher than that of men (about 121 thousand). Both in enrolment and in higher education completion, the number of girls was greater than that of boys in all areas, except in services, engineering, manufacturing and construction industries and in information and communication technologies (ICT).

In 2020, the percentage of women working in technology companies was 19%, representing a decrease of 5.3% compared to 2012. In terms of training in the ICT sector, 81% were men and only 19% were women. Inequality is even more pronounced than it was almost ten years ago. The data are from Eurostat, released by Joana Ferreira, from *Eco Sapo* (2021).

You are a Portuguese scientist and teacher. In your personal and professional experience, have you ever thought about giving up in the face of entering and staying in the academic world, especially when you joined projects and studies in STEM domains?

Could you please give your opinion on possible solutions to reverse this diversity, inclusion, entry and development of women in science and technology issues in Portugal? What are the biggest challenges and achievements?

Ana Viseu: The numbers you cite here are striking, but before going into them, let me comment on the shift from reporting on STEM (science, technology, engineering and mathematics) to STEAM (science, technology, engineering, *arts* and mathematics). I am curious to know when and why Portugal started utilizing this new acronym. It certainly does not seem to be accompanied by a funding commitment to the arts (funding constituting a flawed but nonetheless tangible way of measuring importance). In fact, FCT (Fundação para a Ciência e Tecnologia) does not even report the 'Arts' as a scientific domain when discriminating the funding results of its 2021 call⁶⁴. Moreover, if you look at what is currently being funded, you will see that the engineering, technology and the natural, exact sciences (STEM) get 54.9% of the pot⁶⁵. If you add medicine that amount rises to 72.8% of the total funding. So, when the Ministry of Science, Technology and Higher Education puts out data on STEAM it is disingenuous. As a qualitative researcher, I always tell my students that numbers and statistics are often deceiving. They are given to us a proof of reality; they seem authoritative and neutral but they are the product of the (often political) decisions that bring them into existence. In Portugal – and unfortunately, we are not alone in this – we are witnessing a serious, sustained and detrimental disinvestment in non-STEM areas.

This being said, let me answer your question. The numbers you cite here are worrying, because they describe a country where less and less women are choosing STEM in higher education - from an enrolment of 64.2% in 1991, to one of 42.5% in 2021. This represents a drop of over 20%! If

you combine it with statistics showing that there are lower numbers of women working in tech now (19%) than there were in 2012, the overall picture is grim and frightening. It is scary for me as a woman, but it should worry us all as citizens because diversity and representativity are vital to building worlds that are livable, equitable and just. In class, I use Lessig to explain this to students. In 1999, Lessig famously argued that “in cyberspace, code is law”. What this means is that just like legislation materializes how we want to live together as a society, so does code. Both codes are political because both represent, codify and materialize choices and values: they define who we are, who we want to be, and what can(not) be done. But, while legislation is shaped by our elected representatives (and these should/must be diverse too!), code is a kind of private law, made by corporations and guided by their own self-interests, which then affect us all because being online is not a choice and nowadays there is barely a boundary between on and offline.

Code is power and so it matters greatly who is writing it (both the computational and legislative kinds). Anais Nin famously said that, “we see the world not as it is but as we are”. If those writing code are not diverse and representative of distinct modes of being and living – and I do not mean only in terms of gender but also race, religion, political beliefs, et cetera – then the code they produce will further exclude these groups making them evermore marginal and invisible. In this particular case, if we want our increasingly sociotechnical societies to address women’s issues, women have to be at the table and at the computer.

64 Portugal’s national science funding agency

65 <https://former.fct.pt/noticias/index.phtml.pt?id=694>

Let me say a few words about how being a woman has influenced my own path. I start by stating the obvious which is that my female body has forever shaped my reality and identity; it is not possible for me to fathom who I would be if I had a different body⁶⁶. On top of this, sexism is systemic which makes it so common to the point of paradoxically becoming invisible. This means that, like for many other women, I have a hard time pinpointing specific ways in which my gender had an impact. I do recall a few, even some recent ones, but they seem trivial. However, I will say that looking back on my trajectory, I realize that I was very fortunate to have studied and started my career in North America where there are clearer lines for how (not to) behave. In Europe – and certainly in Portugal – this is frequently mocked as an American obsession with being politically correct that borders on paranoia. I have heard it criticized for constraining socialization and liberty. Without wanting to sound naïve about the abuses that take place in academia in both the US and Canada – I have colleagues who underwent serious and sustained harassment – I would say that the existence of clear rules helps ameliorate the problem, it certainly did for me. What is noteworthy – and extremely depressing – is that I only realized how freeing and vital this was when I returned to Portugal, where these rules do not exist and where suddenly I found myself in contexts where sexism and homophobia were rife and normalized. This troubles me deeply and I think we have much to learn from our colleagues from across the ocean. This is a place to start. Calling out sexism rather than dismissing it as jokes, or part of our cultural background. With age, and as I progressed in my

career, I have started doing it but I am aware it is not enough. My other modest contribution is that as a Professor, I make a point of discussing issues of gender, discrimination, Othering, power and representativity in the classroom. And I am encouraged by the shifts I have seen happening. Every year, in class, I raise awareness of how gender, inequality and discrimination is materialized in the world around us – in the objects we use, in the laws and computational platforms and software that govern us. We discuss issues of power and its relationship to diversity, representativity and gender-quotas, among others. When I first started teaching in Portugal, it was disheartening, few students were interested in these issues, and I always had students (often females) arguing that gender was not an issue at school or in the workplace, that our world is a meritocracy, and that diversity should not be nudged through gender quotas, to name a few. But this has changed and with each passing year I see more students who are interested in researching gender and power issues, including a growing number of men. We discuss how it can be otherwise, and I encourage my students to look for alternatives and intervene there. Sometimes this feels like it is enough, others it does not. I am nonetheless encouraged to see it happening in a country like Portugal, where sexism is often so deeply entrenched as to seem ‘normal’.

Renata Frade: Your curriculum and profile credit you as a role model to inspire and motivate young scientists and women interested in researching and working in the technological job market. Do you take any action

⁶⁶ I subscribe to the notion of ‘embodied cognition’ that makes AI dreams of ‘minds in vats’ impossible.

in your routine aimed at this motivational goal? What does it mean to be a Portuguese scientist today? When did you start your academic-professional career?

Ana Viseu: There are a number of things I incorporate in my practice as a scientist. First and foremost, as I mention above, I make a point of including and discussing issues of power and technoscientific politics in my classes. For instance, in my research methods classes (and I teach many of these), I start by expanding the definition of Science. We discuss science as a culture, a profession and a source of authority; we unpack notions of Objectivity and the importance of situated knowledges; we discuss the history of science – the shift towards experimentation but also, and importantly, who got (and gets) to be a scientist and who did not; we discuss what science does in the world, how it is constructed, but also how not to fall into relativism, et cetera.

In other classes, I make sure to discuss gender, representativity, diversity and discrimination. We not only examine how these affect us today, but also historically. We engage in a discussion of how values get materialized and incorporated into objects, spaces, laws and online platforms. We talk about our responsibility to engage, and the importance of imagining and contributing towards better alternatives. We discuss the importance of engaging with technology, understanding how it works and what it does. As I said earlier, when I started teaching in Portugal, my students did not care much and often pushed back. This was a surprise for me, because in Canada students were

extremely aware and interested in these issues. In Portugal they often said gender was not an issue, they spoke against quotas, they argued that meritocracy is not only possible, but also a neutral judgement. But over of the years I have been teaching here, this has changed. I am tremendously encouraged by the fact that every year more and more of my students bring up these issues themselves. I have more and more self-proclaimed feminists in class. All of this gives me hope. I know, like all professors do, that many of my students will not do anything with what I tell them. But some will and that is a great measure of change for me. That is a palpable impact I can make in the world.

I don't have many students interested in pursuing a career in academia or science, but when I do teach research methodologies, there are a few things I say that I believe are important for junior scholars. I emphasize and explain that doing research is not neutral, nor is it a matter of studying and describing the world. Research – and the methods and theories we utilize – is an act of creation, an act of shaping and creating realities. This means, at least, three important things: the first is that we should, in as much as we can, choose sites and themes we care about, that matter to us. This is needed because doing research is so often an uphill battle that having a will to intervene and engage is important for our personal motivation. The second is that as researchers, we must be humble and remind ourselves that our participants are the experts and we the novices. Last but not least, we should always strive to give back to those we study, to those who share their time, knowledge and worlds with us. I don't mean giving back in a grandiose way ("making the world a better

place” is a Silicon Valley slogan) but in some tangible way. This should be designed into our project, rather than being an afterthought.

There are some specificities about Portugal that also important to note. Being a scientist in Portugal is tough and too often precarious. Professors have very high teaching loads and the ability to do research is a luxury. English is the lingua franca of science and that constitutes a barrier for many people. Funding is scarce for all of us, but if you are in the social sciences or humanities, it often feels like an unsurmountable barrier because hardly any money allotted to these areas. The funding scarcity is, in my experience is a global problem, but in Portugal it is compounded by its unpredictability. There seems to be a lack of long-term strategic planning on the part of policy-makers and national funding agencies and so scientists never know if/when there will be a call for funding and therefore cannot adequately prepare for it. To make matters worse, our policymakers always seem to be fascinated by the latest hype, by following someone else’s steps, rather than setting our own (planned and strategic) path, which means that researchers keep having to shift their research agendas to fit the latest fad. This is dispiriting. Not to finish on a pessimistic note, I would also say that as the world becomes a globalized part of the isolation that Portuguese researchers often suffered from, being in the margins of Europe, has been ameliorated. It is easier to participate and lead European projects, collaborate with international colleagues and take part in ongoing global debates. In this sense, there has never been a better time to be a scientist in Portugal.

Renata Frade: Science and technology studies, feminist technoscience, cyborg anthropology, ethnography, emergent technologies, body-machine interaction, innovation studies, politics of technology, identity and agency and cultural studies of science are some of the scientific domains that characterize you as a researcher. Could you talk about works in these domains that you have developed? What are your biggest academic or intellectual influences, the main theoretical foundations and research methods that you have developed that have been awarded and recognized?

Ana Viseu: These are all different labels that I have used at different times to identify and categorize my research. I am not very good at categorizing because I am more interested in connections, so these stem from attempts to highlight these connections and the interdisciplinarity that we discussed in earlier questions. In other words, they are all part of the same ‘object’, but point to distinct features of it. Often when I give a talk about my research, I get to the end and someone asks if X is good or bad (X can be wearable computers or nanotechnology, among others). Other times, I am accused of being anti-technology. Neither is true. I was never interested in moral, normative judgments about technology. In fact, I am so fascinated by technoscience that I have spent years studying it! There is a quote by Latour (2002) that I use frequently where he states that,

The question to be asked from [techno]sciences, is not if they are or not constructed, but rather, ‘how is it manufactured?’, ‘how can you verify that it is well constructed?’. “Here is where

negotiations could begin: with the question of the right ways to build (Latour 2002: 40).

This is what I try to do. I use qualitative – mostly ethnographic – methods to study how emergent information and communication technologies are developed, governed, and used. What worlds are being produced *through and within* emergent technologies? Who gets to define them? What actors and sociotechnical imaginaries are, to use Callon's words (1986), enrolled and mobilized? How are these enacted, by whom and with what effects? And importantly, how could it be otherwise? What other figurations, configurations and worlds can we envision and foster? I have focused these critical examinations on techno-sciences that posit the body at the interface between biology and information. In other words, I explore how information and communication technologies reify and transform particular concepts of personhood, embodiment and agency.

I am following here in the footsteps of numerous communications, STS, and feminist technoscience scholars. All have shown how concepts such as technology, media, embodiment or personhood are not static, given or natural. For instance, we tend to think of a body as an entity demarcated by its skin boundaries, but what a body is, where it starts, where it ends, what it can do, and how it is seen (by ourselves, by others, by science) is everchanging. I am thinking here for instance, of Bowker and Leigh Star's (1999) book on *Sorting Things Out* where they describe, among others, the workings of the apartheid system to decide who was/was not white. Or Lock's (2002) description of how the concept of 'death' – both in its medical and lay versions - has been

transformed by technological innovation. Closer to my work, I am thinking of Hayles' (1999) argument on cybernetics and "how information lost its body" helped me think deeper about how technologies that are purportedly designed for bodies (like wearable computers) have also lost their bodies, as they become information. I am thinking of the work by Suchman (1987, 2007) who examines how the premises that underly discourse of artificial intelligence and robotics are based on particular understandings of the neoliberal subject. I am thinking of Dumit's (1997, 2003, 2004) work on the circulation of scientific and medical facts and how we fashion (voluntarily even) our identities based on them. I am thinking of Foucault's work (e.g., 1990) on sexuality, on discourse and the will to knowledge (among others). And I am, of course, thinking of Haraway's "we are all cyborgs now" (1991) where she convincingly shows how nowadays our bodies are theorized through technoscience, and recrafted with the tools of communications and control technologies (164). I could (perhaps should?) go on, suffice to say that there are many others who should be acknowledged here.

There is an exercise I like to do with my students to get them to understand the entanglements of technoscience and the body: I ask them if genes play a part in their connections to their parents. The answer is always 'yes'. I ask if they think genes are important in shaping who they are. Again, the answer is 'yes'. Then, I ask them if they know what genes are. Normally they don't. I do this to show them how our understanding of who we are, of our bodies and identities is technoscientific. And they get it. This is STS in practice. It is also a sort of cyborg anthropology.

I added another dimension to my research on emergent technologies when I was studying nanotechnology: the issue of technoscientific governance. Because of shifts in science policy, there has been a push to integrate social scientists in large, publicly-funded, technoscientific projects, and I was one of the first social scientists to be hired in one such position. I was both a token representative of the public and a protector against said public. This led me to start thinking more deeply about scientific governance and politics. There is an important strand of STS studies on technoscientific governance, and I will not cite them all here, suffice to say that authors like Wynne (2007), Jasanoff (2011), Guston (2011), Nowotny et al (2001) or Lewenstein (2005) were tremendously influential in my thinking. Together they all reflect on how what counts as knowledge, what role is given to the public, and how we can make technoscience more democratic and accountable.

On a side note, and because I believe this may be useful for junior scholars, I would say that we often speak of our research and our paths within science and academia as focused, organized and tidy. We certainly engage in this clean-up behavior when writing grant applications. But research is often messy and opportunistic: there is funding for a particular issue, there is the possibility of access to a site, there is hype surrounding a new phenomenon, there is a personal investment in a topic. Whenever possible, we should use these opportunities as starting points. I have been rather successful in doing so, and I am grateful for that.

Renata Frade: Technological Feminism has yielded a vast existing production in the area of

STS (Science and Technology Studies), which intersects with Gender Studies. STS investigates how political and cultural values influence technological advancement and scientific research, as well as, conversely, scientific and technological influences on society. The Feminist Technology Studies (FTS, Feminist Technological Studies) reinforce the need to engage technology with feminist praxis, in the search for the development of theoretical and methodological tools for the analysis of technology and gender simultaneously, in equal depth.

One of the main concepts of technological feminism came with Donna Haraway, the “Manifest for Cyborgs” in 1985, a work that became a turning point for the emergence and evolution of a post-feminist technology period. The cyborg is a cybernetic organism, resulting from a hybrid of machine and organism, a creature of social reality and fiction, it implies the collapse of pre-established binary relationships (nature / culture; human / machine; subject / object; man / woman) and, therefore, it produces a releasing effect.

You seek to collaborate with colleagues and students focused on science and technology studies, feminist technoscience, actor-network theory or cyborg anthropology approaches to critically examine the practices of technological development and use, particularly in regard to information and communication technologies, emergent techno-sciences. How these theoretical and conceptual domains unfold in a cyborg anthropological work?

Ana Viseu: Over the years, I have come to wear my feminist identity closer to my skin both in

my research and in my teaching. This has been not only liberating but also generative. I should start by explaining that, like many other feminist scholars, the brand of feminism I espouse is not only concerned with women or gender. It is concerned with all the bodies and beings that are marked as the Other. Some of these are women, but others are people of color, disabled people, immigrants, refugees, the poor, or non-human animals. Like many other feminists, I am interested in understanding the logics of power through which knowledges and 'the norm' are defined, the imaginaries and practices that drive the futures we will collectively inhabit, and in exploring alternative configurations for better and more livable worlds. I am not dogmatic or constrained by particular strands of theory. I align closely with scholars, self-described as feminists or not, whose goal is to promote responsible and accountable worlding practices that emphasize equality, relationality and responsibility, that recognize unequal positionalities and forces, and that ask how it can be otherwise by imagining and intervening in the configuration of our realities.

As you mention above, I often describe my work as a kind of "cyborg anthropology" (Downey, Dumit & Williams 1985) in that it theorizes and encourages participation in contemporary culture by examining the definitions, boundaries and relationships between humans and machines. My takeaway from Haraway's manifesto is that cyborgs have histories, they are not innocent nor universal, and that *we* are responsible for who/what they are. I have often used this as a starting point for my research, because if 'we are all cyborgs now' as Haraway states, then one of my research goals is to examine the

kind of cyborgs are we becoming, and, importantly, the kind of cyborgs we want to become.

Let me use the example of wearable computers to explain how I engage with this notion and how it shapes my understanding of our relationship with the technoscientific worlds we inhabit. I conducted an ethnography of a pilot study to equip telephone repair and maintenance field technicians with wearable computers. What became clear through my research is that a telephone repair technician equipped with a wearable computer is a different entity than one without a wearable computer. All the actors in my research agreed with this starting point: the wearable computer manufacturer, management and the field technicians themselves. Now, the question is, what kind of person (cyborg) are they becoming? And that is where things get interesting. For management and wearable developers, these technicians would be improved – better communication capacities, increased productivity, more empowered workers. Management paradoxically insisted that the wearable technology would augment the capacities of workers, while simultaneously not changing their identity. In other words, they would be transformed (for the better), but still the same as ever.

Now, while this was going on, field technicians – the actual users of wearable computers – had a different experience. They quickly understood that the new wearable technology they were asked to use profoundly changed their job and their identity. It transformed them into information that could be tracked, it transformed the way their productivity was measured, it even transformed the practices

of the job itself. Moreover, while information is weightless, wearable computers aren't and therefore they produced bodily transformations. In sum, while managers and developers understood wearables as empowerment, technicians experienced them as forms of control. More importantly, while managers described any changes deriving from their use as superficial, technicians knew it changed their identities. What technicians realized, though they did not verbalize it as such, is that this was not the kind of cyborgs they wanted to become. And so, they engaged in all manners of resistance and subversion.

This research continues to inform my thinking on emergent information and communication technologies and technoscience in general. Let me highlight two important issues: First, field technicians, like STS scholars, understood that technologies are not neutral, they transform; like ANT scholars, they understood that the incorporation of this new actor into their network changed its identity and agency; and like feminist technoscience scholars, they understood that agency is relational and that power issues are part of these relationships. I am, of course, artificially separating these three things – STS, ANT and feminist technoscience – when in reality, they overlap. Second, the rhetoric of wearable computer developers and the managers involved in this study is a staple of information and communication technologies discourse: new and emergent technologies will empower, enhance, and augment us, but at the same time we remain the same neoliberal subjects, that is, individual, natural and separated from technoscience, and we are also still very much in charge. I have always appreciated

this irony of a profound recognition of non-human agency (the best ANT defenders), while simultaneously falling back on strong neoliberal humanism.

Renata Frade: In *The Atlas of AI* (2021), Kate Crawford says “AI is neither artificial nor intelligent, it is both embodied and material, made from natural resources, fuel, human labor, infrastructures, logistics, histories, and classifications. AI systems are not autonomous, rational, or able to discern anything without extensive, computationally intensive training with large datasets or predefined rules and rewards. In fact, artificial intelligence as we know it depends entirely on a much wider set of political and social structures. At a fundamental level, AI is technical and social practices, institutions and infrastructures, politics and culture. Computational reason and embodied work are deeply interlinked: AI systems both reflect and produce social relations and understandings of the world”.

How does the advancement of artificial intelligence development in platforms, artifacts and technological products impact ethical and moral issues in projects related to the body and in the power relations in society in your projects? Could you talk about the impacts of data on techno-sciences?

Ana Viseu: Already in 1991, Haraway wrote that, communications sciences and modern biologies are constructed by a common move - the translation of the world into a problem of coding, a search for a common language in

which all resistance to instrumental control disappears and all heterogeneity can be submitted to disassembly, reassembly, investment, and exchange. (Haraway 1991: 164)

This statement seems prescient of our times. It is not only about AI. It is, I believe, first and foremost about data. We currently live in a cybernetic world that is made of data⁶⁷. Data has emerged as the common language, the great equalizer: all actions (online and offline) are translated into data that is then used to understand, anticipate, and manipulate us, and as Haraway announced, thereby reducing the possibility of resistance to instrumental control. Like AI, data appears to us as disembodied, invisible, and omnipotent, but it is neither. It relies on people, expertise, infrastructures and institutions. It needs processing and storage. Data is made of knowledge, politics, power, economics, social structures and cultural practices.

I would say that first and foremost, we need more work on the many and varied dimensions and impacts of data. There is already excellent work on this, for instance, a number of researchers have done incredible work on algorithms (Gillespie 2010, Striphos 2015), on manipulation of behavior (Schull 2014), on the datafication of childhood (Mascheroni & Siibak 2021), on the smartification of our homes (Bridges 2021), on the invisible human work that sustains this real time datafication (Gray and Suri 2019), and of course, on the creation of *Surveillance Capitalism* (Zuboff 2018), to name a few. But we need more. We need to examine the who, how, when, where why of data collection and processing;

we need to examine and make visible the imaginaries that guide us and who gets to set them; we need to learn to study algorithms that are largely secret and opaque; we need to study how data is used to reify, shape and transform our social organization and with what implications; we need to insist on responsibility, transparency, accountability and justice. In sum, we must better understand, again, the worlds we are creating and the cyborgs we are becoming.

My modest contribution to this problem, the issue I am grappling with nowadays concerns *difference*. I argue that STS and feminist technoscience scholars have done an amazing job of creating theories, methods and vocabularies that allow us to simultaneously examine and describe humans and nonhumans. We have highlighted the co-shaping of society and technology, emphasized ‘generalized symmetry’ (Callon 1986: 200) between social and technical actors. This is important work but, in our largely opaque cybernetic world of data, where identity equals action equals data equals manipulation, I find it increasingly pressing to find ways to retrieve and highlight difference – between humans and (some) nonhumans - as a mode of analysis, of subversion and of resistance. This is one of the things that occupies my thoughts these days.

When I am not thinking about difference, I am preoccupied with examining the sociotechnical imaginaries and material instantiations of the old dream of ubiquitous computing and connectivity ‘all the time, everywhere’. I am involved in a project that examines domestic engagements with the internet-of-thing, and

⁶⁷ I would love to read a history of how we went from ‘information’ to ‘data’.

I have proposed a project that will examine ‘smart shops’ to understand the visions behind them, their implementation, and how they are used.

Renata Frade: In one of your most emblematic, important and recognized texts, *‘The Politics of Care in Technoscience’* (2015), published in the renowned *Social Studies of Science*, there is an exposition of the concept of care as an asymmetrical exercise in power relations, in the discipline of bodies, for example. It exposes the relationship of care with feminist theories, such as you brought in the work of Carol Gilligan, in the 1980s, who drew attention to “a notion of ‘an ethic of care in which care was feminized, devalued, overlooked, or rendered invisible by materially and morally privileging mind over body, public over private, reason over emotion, and waged labor over unpaid care work. Later studies began to recognize deeper stratifications in care work, profoundly racialized and classed dimensions (Collins, 1990). Contemporary works in science studies aimed at recovering the contributions of neglected actors such as women scientists (e.g. Abir-Am and Outram, 1987; Keller, 1985; Rossiter, 1984) or the ‘invisible technicians’ (Shapin, 1989) who made epistemically significant contributions to science by caring for ‘big men of science’ as well as their instruments, their specimens, and their data (Cooper, 2008; De Chadarevian, 2002; Pycior et al., 1996)”.

This work also relates how “feminist science studies scholarship drew attention to how researchers in STS come to care about

the lives they study and the worlds in which they intervene”. In your point of view care is deployed as a means for technoscientific governance. You observed a growing trend of STS researchers in state-funded science as an exercise of caretaking, “trained in the ethical, legal, and social implications are employed to take care of science”.

Would it be possible to frame this concept in the fourth wave of feminism, cyberfeminism, or would it be part of a new movement or trend to develop science projects with a broader, more diverse and inclusive approach? Could you talk about how, since this concept was presented in scientific publications, it has been a cornerstone of your projects and other researchers’ case studies?

Ana Viseu: This article, which was written as an introduction to a special issue on the *‘The Politics of Care in Technoscience’* that I co-edited with Martin and Myers (2015), has indeed inspired numerous colleagues. The idea to create it came out of a workshop that we organized at York University (Canada) in 2012. The workshop was extremely successful in getting us all to start unpacking this notion that has a complicated history. Care is a generative concept because of its ambiguity: it is generally cherished as a positive, thoughtful practice while at the same time being devalued and made invisible because it is understood as a feminine endeavor. We wanted to draw out this ambiguity and understand how else it was being mobilized. Care – the ability to enact it or mandate others to do so – is, we started to understand, a technique of power (see, Viseu

2015; Murphy 2015). The special issue drew out these many meanings of care. I should say, and I think my co-authors share this feeling, that I did not expect the notion of 'care' to strike such a deep nerve in STS. It generated a great amount of amazing work and I am both humbled and grateful for this. Looking back, it is almost as if many of us in STS were looking for another way to examine and theorize our engagements with the worlds we study and create, as well as the worlding practices that constitute them.

For me personally, this concept was incredibly generative. I had been grappling for a number of years (yes, years!) with my experience with nanotechnology. Care provided a means to make sense of it, not in a negative and merely critical way, but in a way that highlighted the deep, structural power asymmetries that were built into it and how this was (is) done by design, but rather as a means of governance. When I started thinking about with 'care' it became obvious this was the right concept.

You ask if the concept of 'care' can be framed within cyberfeminism or if we intended it as part of a new movement to make science more democratic. I would say both. The goal, at least for me, is not to set a path for this concept but rather to have other scholars use it in productive ways and these can pertain to fourth wave feminism, to help develop a more inclusive science, to creating alternative configurations that are more just, to call attention to those who are still invisible, among others.

Renata Frade: One of the main technological feminism concepts is technofeminism (Wajcman, 2006). According to the author," it

conceives a mutually conforming relationship between gender and technology, in which technology is the same time as the source and consequence of gender relations. Gender relations materialize in technology. Wajcman has a constructivist view of technology as a sociotechnical network, and recognizes the need to integrate the material, discursive and social elements of technoscientific practice. (...) In technofeminism, politics is a characteristic and a necessary extension of the analysis of the red. The relationship between social analysis and social transformation projects is what marks the fundamental difference between conventional technoscience studies and technofeminism".

We live in a platform society, under the influence of algorithms, which has caused some problems of prejudice, racism, for example. How can projects be designed to impact target audiences taking these facts into account, protecting minorities? **How science produces knowledge, also considering gender issues with technology and feminism as fundamental assumptions of care in times when humans are increasingly hybrid beings with machines and that the platformization and algorithmization of society has caused, at different levels, biases of prejudice, racism, injustices against minorities?**

Ana Viseu: I am not a fan of one size fits all solutions; we cannot come up with one solution (or parameters) that will solve the many and distinct problems we are currently faced with. In your question, you name a few: prejudice, racism, injustice, algorithmization, and

platformization. To these I would add environmental concerns, and to be honest, there are so many others. It is not possible (nor perhaps desirable) to build parameters that cover all of these issues because we inhabit “a world of many worlds” (Blaser & de la Cadena 2018), populated by distinct beings and forces.

This does not mean we should do nothing; on the contrary. It is incumbent on us, all of us, to be mindful of others, both in our practices and discourses. Feminist intersectionality (Crenshaw 1989) among others, has shown clearly that we are not positioned equally in the world, our exposure to and experience in it is different, and so is our agency. So, I would start with some basic STS, technoscience feminist thinking, and I cite here from van Dooren (2019) because he lays it out brilliantly,

Our worlds are not pre-existing, static entities. They are becomings that must be put together – from the inside – by, through, as the embodied imaginings, presences, and intra-actions of innumerable beings and forces. [...] Of course, to say that worlds are made is not to imply that any of us – or any coalition we might form – can unilaterally ‘decide’ how they will be made. But it is to acknowledge the various forms of agency, of very real if always thoroughly constrained influence that each of use – and not just the human ‘us’ – has in the shaping of what is.” (8)

In other words, we shape the world with our actions, but as we do so, we are constantly shaping and constraining the agency of others. The question is how to craft worlds that allow distinct life forms to flourish. This is particularly important in our contemporary worlds where,

for instance, a few high-tech companies/platforms have assumed positions of unrivalled (and largely unchecked) power (Gillespie 2018).

When it comes to designing sociotechnical systems and platforms, I believe we must ensure that users are involved upstream, and that those users come from diverse backgrounds. We must ensure that the public good prevails, and this may entail more regulation, but it also limits the scope of data collection by ensuring that companies collect only the data they need, rather than attempting to capture as much information (data) as possible, as they currently do. We must be aware that by making choices, we are always excluding and be certain that we exclude purposefully and not accidentally. We must keep in mind that technology is not neutral, but rather a materialization of values and beliefs, that it constrains or enables lives and modes of living. We must be mindful of our responsibility to create worlds where many can live and flourish.

But even as we do all this, we must make mindful choices about who/what we are caring for/about. Environmentalists have been grappling with this for a while, so let me turn to van Dooren (2019) for help. In his book, *The Wake of Crows*, Van Dooren (2019) uses these animals to guide us through “possibilities for living and dying well with others – human or not – in an increasingly uncertain world” (2). Dealing with crows, he shows us, is different in different parts of the world: sometimes the goal is learning to cohabitate, other times it is ensuring that ravens do not eat other threatened species, and others still have focused on the eradication of crows in the name of global trade, to name a few. Environmentalists, van

Dooren explains, have long understood that caring for one animal, one species, one way of life, may harm others. This can lead to despair, inaction, or lack of care. Instead, van Dooren reminds us that our worlds are always “partially shared” (Haraway 1991, cited in van Dooren 2019: 60) and offers a practice of “situated pluralism” (55). We recognize Haraway’s inheritance here, that of “situated knowledge” (1999) where she reminds us that all knowledge has a source and is therefore always partial (thus avoiding the notion of universal truths). To this van Dooren, adds that situated pluralism offers “only the ethic-political promise of paying attention in necessarily partial, ongoing and multiplicitous ways – without the possibility of any pre-given or, indeed, ever-to-arrive authorized set of principles or procedures for doing so. Paying attention as the basis of efforts to make connections and craft new possibilities together” (2019: 60). This is where I would end, in recommending a practice of situated pluralism that is not pre-given, but rather decided on, by paying attention to the need and possibility of collectively inhabitable worlds.

Renata Frade: In an article published on the Arts & Humanities Entrepreneurship Hubs website, Alonso (2019) says that despite the fact that the number of students in the Humanities is decreasing every year, they are fundamental in a technological society. I highlight statements published in this piece by Nicholas Negroponte (founder of the Massachusetts Institute of Technology’s Media Lab) “Humanities are the most

important thing you can study”, Jaron Lanier (American computer philosophy writer, considered one of the virtual reality’s creator) about a new definition of internet “We cannot have a society in which, if two people wish to communicate, the only way that can happen is if it’s financed by a third person who wishes to manipulate them”, and the bestselling author, Yuval Noah Harari “It’s very important to be aware of the dangerous scenarios of new technologies. The corporations, the engineers, the people in labs naturally focus on the enormous benefits that these technologies might bring us, and it falls to historians, to philosophers and social scientists who think about all of the ways that things could go wrong”.

Your research projects focus “on the ethnographic study of the discursive and material practices of development, use and governance of emergent (and contested) sciences and technologies that interact with the body”⁶⁸. Here I want to draw attention to research related to nanotechnology, as it is framed in the concept of care that we discussed earlier, in an integrated vision of a social scientist and also centered on a feminist work on science and technology, how different modes of governance are developed, applied and evaluated.

According to you (Viseu, 2018), “integrated social scientists are asked to care for nanotechnology research and development by learning how to observe but not disturb”. You mention in this work political and economic implications in research, such as “return-on-investment”, public questioning of the direction of technoscientific development, a waning of

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confidence in the self-regulation of science, a renegotiation of relations between science, the state and citizens.

After years of research and defence of ethical and legal parameters related to the development of technoscience, what would be the legacies left by your innovative vision as a researcher? What are the milestones still to be accomplished in academic development? What is the impact of this vision and advocacy as a scientist on government and private projects?

Ana Viseu: I will start by saying that there should absolutely be involvement of users and the public, social sciences and humanities in technoscientific projects. But this isn't saying much. In Western countries, the notion of paying attention to social dimensions, of involving the 'public', of responsible research and innovation has become so common place as to be banal. Most if not all natural scientists know that in order to get their grant proposals approved, they *must* at least pay lip service to these issues. The question then, is how are these ideas and ideals actualized and enacted? And, perhaps more to the point, how *should* they be actualized and enacted?

The problem starts with understanding what social sciences and humanities are and what they can do. For instance, in this question you cite Harari's assessment that "it falls to historians, to philosophers and social scientists who think about all of the ways that things could go wrong". I take issue with this statement: it is reductive and places us in the position of the nay-sayers who come after the fact. Neither is true.

In the articles you cite (published in 2015 and 2018), I provide some ideas for what to do, but I recognize this is not a problem with an easy fix. Research as a whole, is being simultaneously shaped by many different forces: there is less and less funding for research, and this money is often channelled and concentrated on big science issues. This is problematic, as these big science projects are too often geared towards the natural sciences who are then the main drivers of the work and recipients of funding. The asymmetry is built into the very funding system. There is also an increased emphasis on proving the usefulness of research. This is, in some degree understandable, we are after all often speaking of public funding, but in my opinion, usefulness is too manifested as instrumental utility. There is the idea that research has to provide returns but that, of course, begs the question, returns for whom and for what? If an issue afflicts a small community, is it still deemed useful? How about ethnographic studies that take years to produce and are not generalizable: are those useful? Another problem pertains to evaluation which has become a matter of metrics, deliverables and consensus. Evaluation is fundamental but we must insist on the specificities of different fields/disciplines/methodologies/studies and recognize that different partners have different goals. Importantly, we must recognize that success does not have to mean consensus, but instead encourage discussion. Unfortunately, I would say that currently, most if not all of these issues, tip the scale against the social sciences and humanities.

You start the question citing Lanier, and Negroponte. Lanier is a computer scientist.

Negroponte was a big proponent of techno fixes for social problem – let us not forget the ‘one computer per child’ initiative. Harari is a So, I will end by saying that it is ironic, to say the least, that neither one is a social scientist. Ironic but also telling.

Renata Frade: In a courageous article written by you for *Nature* (Viseu, 2015), you report, in first person, ethical, moral, personal and professional issues experienced in three years developing projects as social scientists at the Cornell NanoScale Science and Technology Facility in Ithaca (New York) and the US National Nanotechnology Infrastructure Network. You consider this experience “a futile and frustrating time” and, in your report, mention that “work alongside the nanotechnology scientists, I naively expected that my expertise as an ethnographer would be useful. I was prepared to study the culture of a laboratory and to probe its interaction with wider society. Instead, the other scientists seemed to see my role as one of managing a narrow list of “possible researcher” and followed my instructions and ticked boxes, then I would bless them as ‘social and ethical’, and they would be free to do their work with no concerns. I was routinely (wrongly) introduced as an ethicist and was expected to find minimal, non-disruptive ways of dealing with social and ethical issues”.

What were the ramifications and impacts of this article on your career and if it had inspired other people to face similar issues from a position close to yours?

Ana Viseu: Let me start by thanking you for calling it courageous. The *Nature* piece was based on

a larger article published on *Social Studies of Science* and both were extremely hard to write. In fact, I spent years writing the article and was continuously plagued by self-doubt and self-criticism. In hindsight, I needn’t have worried. The article was extremely well-received within the social sciences. I had worried that people would think that my experience was the fruit of my incompetence, but instead I had many colleagues reach out to me, talking about their similar experiences, colleagues who found in my article a way to process their experience, and a reference to cite in their work. I also had colleagues tell me that now, when they are invited to collaborate in large technoscientific projects, they ask their natural sciences colleagues to read the article and make it clear to them that they are not willing to be ‘the carers’. In all these ways, this article has been impactful. But the reason why I needn’t be nervous is because just like the power asymmetries that are built into policies of integration of social and natural sciences, the main reaction from the natural sciences was no-reaction, it was apathy. There may be consequences or reactions that I am not aware of, but to the best of my knowledge, there was no impact at all on the natural sciences colleagues, nor on policymakers or funding agencies. Unfortunately, I have not seen any institutional, policymaking, or funding attempts change the dynamics and goals of collaborations between social and natural sciences.

Renata Frade: What are your biggest motivations and goals as a scientist? What achievements are considered the most relevant ones?

Ana Viseu: There are many things that I enjoy about being a scientist. I get to spend my time

thinking and reading and that is an incredible luxury. If and when I am lucky, I get to make a difference in the world with my writing – by helping shape policy, by calling attention to existing problems, by contributing to our understanding of the world, by giving back to those who participate in my research. On top of this, I am immensely fond of teaching. I enjoy being in the classroom and thinking with students. I find it incredibly rewarding to help them start to develop their own independent thinking, to see them start to foster their curiosity and question the world, and if nothing else, become more aware, more participative citizens.

As for what I enjoy doing the most, I realize this might come across as false modesty, but it is participating in outreach events. One of the most memorable things I have done was participate in a small workshop on nanotechnology that took place in Gagliato, a small village in Italy. The workshop was composed of 4-5 nanotechnologists plus me and one night we organized a public event for the residents. It was framed as a mixture between a roundtable and conversation, and was scheduled to take place in a public square in the center of the village at 9pm. The event started late, more than one hour late, but no one left. Everyone came and square was filled with families, grandparents, parents, children, teenagers. And they were so curious. We were still there at midnight, all of us in a public square, in a small village in Italy discussing nanotechnology. I absolutely loved it.

I am lucky to be frequently invited to participate in events organized by Ciência Viva – Portugal's National Agency for Scientific and Technological Culture. They do absolutely amazing work and I am always humbled and honored to take part

in their events. Just this month, I took part on a panel discussing digital privacy and citizenship. And I loved it, like I always do.

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Professor Judy Wajcman is Emeritus Professor of Sociology at the LSE. Until 2022, she held the Anthony Giddens Chair in Sociology. She is a Fellow at The Alan Turing Institute, where she leads the Women in Data Science and Artificial Intelligence research project. She has been a Visiting Professor at the Oxford Internet Institute and is a member of the AI100 Standing Committee.

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Professor Wajcman's scholarly interests encompass the sociology of work and employment, science and technology studies, gender theory, temporality, and organizational analysis. Her work has been translated into Chinese, French, German, Greek, Italian, Korean, Japanese, Portuguese, Spanish and Russian. She has been President of the Society for Social Studies of Science (2009-2011).

Professor Wajcman is a Fellow of the British Academy. She has an honorary doctorate from the University of Geneva. She is the recipient of the William F. Ogburn Career Achievement Award of the American Sociological Association (2013). In 2018, she received the Oxford Internet Institute's Lifetime Achievement Award 'in recognition of her contributions to the field of the social study of science and technology'. In 2021, she was awarded the John Desmond Bernal Prize by the Society for the Social Studies of Science.

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Her motivation for studies in the technological field was more emphasized 11 years ago, when she became a technology entrepreneur and developed mobile and web projects. Fifteen years ago she'd got to know transmedia theory and was a student of its main theorist, Prof. doctor Henry Jenkins, at M.I.T. (Massachusetts Institute of Technology, USA). During 2015 and 2017 she had been an activist, speaker and volunteer for the international women in tech NGO Girls in Tech Brazil. She's been a keynote speaker (such as Gartner symposium), speaker, consultant, mentor and teacher at feminist, human rights, diversity and inclusion, transmedia, new media, communication events and for private and governmental companies and institutions such as Instituto Superior de Economia e Gestão da Universidade de Lisboa (ISEG), ThoughtWorks, Universidade Anhembi Morumbi, She's Tech conference, Porto Feminist Festival, Olabi, Mulheres no Comando.

She writes technology articles for press media such as Mídia Ninja, MobileTime and Digitaltalks. She is the author of 13 fiction and non-fiction books by Brazilian and international publishers such as Unesp, Rocco, Springer, Patuá, Ria Editorial (Portugal), Livros LabCom.IFP (Univ. Da Beira Interior, Portugal). She took UX courses at the California Institute of Arts and USP. She was a Science and Health reporter for InfoGlobo. Graduated in Social Communication at the PUC-Rio (where she took courses in computing at the Rio DataCentro laboratories), Master in Literature at the UERJ (book market thesis approved with distinction).

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Passionate about Sciences, Education, Arts, and Literature, Ana S. Moura has kept a research publication track in several academic areas (e.g., ecotoxicity prediction; medical social networks), while being a published author of speculative fiction, namely in the fields of Alternate History and Science Fiction, under the pen name AMP Rodriguez. Founding member of 'Invicta Imaginaria', she co-coordinated the first anthology of a new speculative fiction subgenre, the Winepunk, released in February of 2019. Prior to becoming a published author of speculative fiction, she was already an author of elementary and high school handbooks in the areas of Physicochemical studies, the latter within the context of national exam preparation. She also co-edited the Handbook of Research on Determining the Reliability of Online Assessment and Distance Learning, released in November, 2020. Her first long feature as co-writer, 'Revolução (sem) Sangue', to be released in 2024, was a Winner Film Lab (Feature Gems Pitching Forum) at FEST - New Directors New Films International Film Festival, in June 2022.

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PATRÍCIA GOUVEIA is an artist, designer, scholar, and curator with more than twenty years of research experience in arts, design, gaming, and interaction. She has been working in Interactive Arts and Design since the 1990s. Her research focuses on games, playful media, interactive fiction, digital arts, and speculative feminism as places of convergence. She is an Associate Professor at University of Lisbon Fine Arts Faculty (Faculdade de Belas-Artes da Universidade de Lisboa, FBAUL) and an integrated researcher at ITI, Institute of Interactive Technologies at LARSyS, Laboratory of Robotics and Engineering Systems (ITI/LARSyS) at Instituto Superior Técnico (IST) in Lisbon. Co-creator of the project Game Arts and Gender Equity (GAGE 2020-2023) and co-curator of the Playmode exhibitions in four major cities in Brazil (CCBB 2019-2023: Belo Horizonte, Rio de Janeiro, São Paulo, and Brasília) and in Lisbon, Portugal (MAAT 2016-2019). She was Associate Professor in the department of Interactive Media (Games and Animation) at Noroff University College (2014-16) in Kristiansand, Norway. Invited Assistant Professor at the Faculty of Social and Human Sciences at Nova University (Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa FCSH/UNL, 2007-14) and Assistant Professor at Lusophone University of Humanities and Technologies (Universidade Lusófona de Humanidades e Tecnologias, ULHT, 2008-13) in Lisbon. From 2006 to 2014 Patrícia edited the Mouseland blog. In 2010 she published the book *Digital Arts and Games, Aesthetics and Design of the Ludic Experience* (Artes e Jogos Digitais, Estética da Experiência Lúdica, Ed. Universitárias Lusófonas), a synthesis of her doctoral thesis. She has published several book chapters and scientific articles. She has supervised more than 30 master's, doctoral and postdoctoral theses.

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Luciana Lima has a PhD in Psychology from the University of Porto, Portugal. She is a researcher at the Interactive Technologies Institute (ITI/LARSyS). Her academic background includes Arts, Education Sciences and Psychology. She has more than ten years of teaching experience in Brazilian universities. She was a guest professor in the Game Design and Digital Animation undergraduate course at the School of Media Arts and Design of the Polytechnic Institute of Porto (2017-2019). In 2023, she published a book entitled “Thinking Gender through Digital Games”, where she presents the results of the research carried out between 2020 and 2022 in the scope of her post-doctoral studies in Multimedia Art at the Faculty of Fine Arts of the University of Lisbon. Her main research interests involve gender equity in technological areas, diversity and inclusion in the digital games industry, and the hegemony of games as an interactive, technological and artistic cultural product. Luciana Lima is the co-creator of the Game Arts and Gender Equity (GAGE) project which aims to map the evolution of female participation and integration in the Portuguese digital games industry.

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I am a Visiting Assistant Professor at the Luddy School of Informatics, Computing, and Engineering, IU Bloomington. In 2021, I completed my Ph.D. at Purdue University under the guidance of Dr. Colin M. Gray and was working as a Research Assistant in UX Pedagogy and Practice Lab. In the past, I was working as Senior UX Researcher and Designer at Samsung R&D Institute, Bangalore. I have completed my Bachelor in Design from the Indian Institute of Technology (IIT), Guwahati, India where I had an academic experience in HCI, design, and engineering. My interest lies in the intersection of Human-Computer Interaction (HCI), User Experience Design, Ethics and Values, and critical qualitative research.

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Ana received her doctorate in 2005 from the University of Toronto, with a thesis that examined the multiple meanings of physical and cognitive augmentation through wearable computers, from the visionary discourses of developers to the conflicted experience of implementation on the ground. She subsequently held a 3 year position as a Research Associate at Cornell University with the Cornell NanoScale Facility (CNF), and the Department of Science and Technology Studies. While at Cornell she was the "in-house" social scientist at CNF, and collaborated with practitioners to examine the social and ethical dimensions of nanotechnology research and development.

Her work has been published in a number of books and journals, mostly recently *Nature* and *Social Studies of Science*. She has also participated and organized a number of outreach activities that seek to bring science to the publics.

Reference

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