

**BRIDGING THE DIGITAL DIVIDE:
ADVANCING CYBER ACCESSIBILITY FOR PERSONS
WITH DISABILITIES UNDER THE CRPD**

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ABSTRACT

Technology can break down boundaries, but it can also build obstacles if it is unavailable. Over the years, we have not given cyberspace accessibility the priority it needs. The issue of people not understanding the necessity of accessibility still exists today. The empowerment of persons with disabilities (PWDs) with their accessibility rights, including the ability to fight discrimination and create equal opportunities, it is imperative to understand the ever-growing significance of rapidly developing cyberspace technologies, the cyberspace transformation of the workplace and how these factors affect opportunities and challenges for their inclusion. In the rapidly evolving digital landscape, ensuring cyberspace accessibility for persons with disabilities (PWDs) is imperative. This paper explores the evolving meaning and application of articles related to cyberspace accessibility, emphasizing the need for revision to accommodate technological advancements. The Convention on the Rights of Persons with Disabilities (CRPD), a landmark human rights treaty, recognizes PWDs as rights holders, challenging traditional notions of equality and inclusion. However, the digital divide persists, exacerbating inequalities and hindering the full integration of PWDs into modern life. This article delves into the intricate relationship between cyberspace and PWDs, highlighting discriminatory algorithmic practices and evaluating the adequacy of existing articles. Pursuing inclusive cyberspace remains paramount in upholding the principles of justice, human dignity, and autonomy as we navigate the labyrinth of evolving technologies.

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1. INTRODUCTION

“Disability” is not a simple or uniform concept but a rich and varied mosaic of individual stories,¹ social norms, and changing perspectives. The history of disability is not a single story but a mosaic of many stories of human diversity. It’s a story of marginalization and belonging, rejection and embrace, challenges and achievements.² The international community has progressively acknowledged the imperative to perceive the oppression and exclusion faced by persons with disabilities through the lens of human rights violations.³ The valuation of individuals extends beyond functional utility, emphasizing the intrinsic self-worth inherent in each person. The acknowledgment of human dignity assumes significance as it serves as a poignant reminder that persons with disabilities possess a legitimate stake in and claim on society, irrespective of social or economic utility considerations. The value of human dignity reminds us that persons with disabilities are not only valuable for their social or economic contributions but also have a right and a role in society that must be respected. This human rights perspective on disability led to the creation of the Convention on the Rights of Persons with Disabilities (CRPD) by the UN General Assembly in 2006.

The CRPD, the first human rights treaty of the 21st century, changed the way we understand and define ‘disability’ and also challenged the ideas of equality, discrimination, and exclusion. The CRPD is based on the principles of justice, human dignity, and autonomy, and it sees persons with disabilities as ‘rights holders’ rather than ‘charity recipients,’ but in this age of the World Wide Web, the struggle for inclusion takes center stage as PWDs’ cyber landscape is fraught with barriers. The labyrinth of algorithms, seemingly impartial architects of our digital destiny, conceals a subtle prejudice that echoes in the corridors of code. The article is structured as follows: Part II starts with a brief overview of cyberspace and

¹ Frédéric Mégret, ‘The Disabilities Convention: Human Rights of Persons with Disabilities or Disability Rights?’ (2008) 30(2) Human Rights Quarterly 494, <<http://dx.doi.org/10.1353/hrq.0.0000>> accessed 12 January 2024.

² *ibid.*

³ Theresia Degener, ‘Disabled Persons and Human Rights: The Legal Framework’, in Theresia Degener and Yolán Koster-Dreese (eds), *Human Rights and Disabled Persons: Essays and Relevant Human Rights Instruments*, (Martinus Nijhoff Publishers, 1995) 9 <https://www.ohchr.org/Documents/Publications/HRDisability_en.pdf> accessed 20 January 2024.

its relationship to the PWDs, and then it introduces the core issue about cyberspace accessibility PWDs with the current scenario of cyberspace accessibility worldwide. Part III demonstrates how and why this discriminatory algorithmic practice is responsible for inaccessible cyberspace for PWDs, and then it further explains Whether CRPD addresses discriminatory algorithmic practices. Part IV briefly portrays the adequacy analysis of provisions related to cyberspace accessibility. Part V explains emerging technologies and future considerations. Part VI Concludes the article with recommendations.

2. CYBERSPACE ACCESSIBILITY FOR PWDS IN THE ALGORITHMIC AGE

The Algorithmic Age has heralded the era of artificial intelligence and machine learning algorithms that dictate how digital interactions occur, influence how decisions can be made, and regulate access to information. This has automated services online, personalized delivery of content, and redefined governance in cyberspace, fundamentally altering the way we experience and live in the digital world. The promise of such advances carries themselves in a very great deal of efficiency and innovation, but it also poses serious challenges, especially concerning the inclusivity or accessibility of cyberspace to Persons with Disabilities (PWD). The more algorithms will come to dominate the structure of the Internet; the more urgent the need becomes to make equal access to these digital spaces a priority for securing one's fundamental rights.

Today, the Internet is both a technological and socioeconomic space, and it has had such an impact on almost every aspect of human life that its regulation is increasingly seen as critical to protecting and preserving human rights and freedoms.⁴ It has utterly changed computers and communications in ways that nothing else has, and it is easily one of the most significant innovations of the twentieth century, with the most radical implications. International attorneys have debated cyberspace and the law governing its usage for several decades.⁵ Even if few would argue that the

⁴ Brantly, Aaron. 'Utopia Lost – Human Rights in a Digital World' (2022) *Applied Cybersecurity & Internet Governance* 1, 1-19 <<https://doi.org/10.5604/01.3001.0016.1238>> accessed 22 January 2024.

⁵ R. Deibert, 'Black Code: Censorship in the Digital Age' (2013) Harvard University Press <<https://journals.sagepub.com/doi/10.1177/03058298030320030801>> accessed 22 January 2024.

internet is essential in every part of modern life, we still require a cohesive description or theory of cyberspace. Even though 'cyber' has become a key term in the international lawyer's lexicon, the average lawyer needs to learn more about regulations.⁶ Given its actual structure, functioning, or even immense import, there are pressing cyber-issues vying for international attention today, such as cyber-governance, state sovereignty in cyberspace, cybercrimes, cyber-warfare, the treatment of cyberspace as *res-communis*, and most importantly, accessibility of PWDs in cyberspace. To cope with these cyber challenges, we must first grasp the essence of cyberspace. So, this part of the article begins by seeking answers to questions like what cyberspace is, the Mold of cyberspace, whether it is different for PWDs, and if so, to what extent is it different from 'real space'?

2.1 The Mold of Cyberspace & PWDs

Cyberspace differs from a nation's boundaries in that it is delineated by screens and passwords rather than concrete markers. Despite being a physical artifact scattered across numerous countries,⁷ the virtual domain it produces is based on logical boundaries rather than geographical ones.⁸ These boundaries present themselves in various ways, including the connectedness of autonomous Internet networks, the divisions defined by the Domain Name System (DNS), and applications such as Facebook and X(Twitter).⁹ Although "Internet" and "cyberspace" are sometimes interchangeable, they are technically separate. Cyberspace, the global digital electronic telecommunications domain, refers to the complete spectrum of global networked information and communication systems, including those outside the Internet.¹⁰ The International Telecommunications Union (ITU), a UN telecommunications specialized agency, defines the "cyber-environment" as including users, connected

⁶ *ibid.*

⁷ Julie E. Cohen, 'Cyberspace as/and Space' (2007) Columbia Law Review p. 211 <<https://www.diva-portal.org/smash/get/diva2:1523985/FULLTEXT01.pdf>> accessed 25 January 2024.

⁸ *ibid.*

⁹ Cerf, Vint G. and Ryan, Patrick and Senges, Max, Internet Governance Is Our Shared Responsibility (2013). I/S: A Journal of Law and Policy for the Information Society, 10 ISJLP 1 (2014) <<https://ssrn.com/abstract=2309772>> accessed 26 January 2024

¹⁰ *ibid.*

computing devices,¹¹ applications, services, and systems that are directly or indirectly connected to the Internet, as well as the following generation network (NGN) environment.¹² This environment includes the software that runs on computing devices, the saved and communicated information, and the installations and buildings that house this equipment.¹³ Different organizations define cyberspace differently, with the US Department of Defense seeing it as a worldwide domain inside the information environment that includes interconnected information technology infrastructures.

The European Commission describes cyberspace as the virtual domain where electronic data from PCs worldwide circulates. Analysts underline the need to include the human aspect in most online definitions.¹⁴ Critics of the cyberspace metaphor claim that it has distracted focus away from perceiving the Internet as a simple communication network. These critics, frequently connected with "unexceptional theories," argue that online terminology impedes faithful and economically rational policymaking.¹⁵ Despite the contrast between cyberspace and physical space, these ideas emphasize their interdependence, claiming that acts in one might have implications in the other. A neutral perspective supports the notion that cyberspace is filled by genuine users who see it as distinct but linked to real space. Any viable cyberspace theory must reflect its direct impact on persons with disabilities and communities in real space. While cyberspace offers a distinct dimension from the real world, its deep connection to real space cannot be ignored.¹⁶ From this perspective, technology, including

¹¹ Ronald Diebert, 'Cybersecurity: The New Frontier' (2012) Great Decisions pp. 45-58 at p. 45 <<https://www.govinfo.gov/content/pkg/GOVPUB-D101-PURL-gpo78047/pdf/GOVPUB-D101-PURL-gpo78047.pdf>> accessed 27 January 2024.

¹² *ibid.*

¹³ Rain Ottis, Peter Lorrens, "Cyberspace: Definition and Implications" Co-operative Cyber Defense Centre of Excellence, Tallinn, Estonia (2010) <<https://nww.etis.ee/File/DownloadPublic/7d4914199237-4de0-b324-62d597a0c99f?>> accessed 27 January 2024.

¹⁴ Koulos T, 'A Digital Territory to Be Appropriated: The State and the Nationalization of Cyberspace' (2022) 1 Open Research Europe 119 <<https://open-research-europe.ec.europa.eu/articles/1-119>> accessed 27 January 2024.

¹⁵ *ibid.*

¹⁶ Riordan S, 'The Geopolitics of Cyberspace: A Diplomatic Perspective' (2019) The Geopolitics of Cyberspace 1 <https://brill.com/view/journals/rpdf/3/3/article-p1_1.xml> accessed 27 January 2024.

social media platforms and algorithms, is acknowledged as non-neutral, reflecting the designers' beliefs and aims embedded in their designs. As silent ethical gatekeepers, algorithms are essential in evaluating right and wrong in complex situations, emphasizing the enormous ethical considerations inherent in the technological world. Programmers must handle this moral burden, ensuring precise and consistent decisions. Biased algorithms have profound effects, especially for marginalized groups such as individuals with disabilities (PWDs). PWDs experience cyberspace inequality, as inaccessible technology prevents them from taking advantage of possibilities.¹⁷ This cyberspace restriction goes beyond websites and applications, affecting everything from insurance rates to social security benefits. In the Algorithmic age,¹⁸ inclusion rests on cyberspace accessibility. Giving them access to this cyberspace realm levels the playing field and offers up previously restricted options for accessibility.

3. DISCRIMINATORY ALGORITHMIC PRACTICES IN CYBERSPACE

Cyberspace is the virtual world of information and communication made possible by digital technologies. It provides unparalleled prospects for social, economic, and political development but presents severe challenges to human rights, justice, and democracy. One of these issues is the occurrence of discriminatory algorithmic practices, which refers to how algorithms or automated systems can yield unfair or detrimental outcomes for particular groups or people with disabilities.¹⁹ The rapidly evolving digital world, fueled by technology breakthroughs and the global impact of the COVID-19 epidemic, highlights a growing emphasis on digital inclusion and cyberspace accessibility. In the context of global demographics, it is noteworthy that approximately 15% of the world's

¹⁷ United Nations, Convention on the Rights of Persons with Disabilities (Article 9: Accessibility) A/RES/61/106.

¹⁸ The rapid evolution of digital technologies and the widespread integration of algorithms into various facets of modern life have ushered in an era often referred to as the "Algorithmic Age." The Researcher uses this terminology as a metaphor.

¹⁹ Manuel Castells, *The Network Society* (2011) "Wiley-Blackwell, exploring the impact of networks and communications technologies on global society and economics", <<http://socio.ge/downloads/komunikaciisteoria/eng/Castells%20Manuel%20The%20Network%20Society.pdf>> accessed 29 January 2024.

population,²⁰ as indicated by a 2023 report, comprises over 700 million people with disabilities in Asia and the Pacific alone, accounting for 60% of the global population with disabilities,²¹ estimated at 650 million. Legal ramifications also highlight the challenges, with 3,255 lawsuits concerning cyberspace accessibility filed in federal court in 2022.²² These lawsuits specifically address the incompatibility of websites with screen readers, impeding access for plaintiffs with disabilities. The Centre of Internet and Society's report sheds light on the accessibility landscape, revealing that 7,800 websites of the Government of India, 5,815 present accessibility barriers, and 1,985 are non-functional.²³ Moreover, the report needs to be more accurate in navigation markup on over half of the websites, with only 52 providing the option to alter colors. Japan has witnessed a surge in accessibility-related lawsuits, with a notable increase from over 2,800 cases in 2019 to nearly 3,500 in 2020.²⁴ The trend continued in 2021, with over 11,000 ADA Title III lawsuits filed, marking a 4% rise from the previous year and a staggering 320% increase compared to 2013. Additionally, Bangladesh recorded over 600 filed cases in this context.²⁵

This section specifically examines the leading cases regarding cyberspace accessibility. Significantly, in 2015, the National Association of the Deaf (NAD) filed a lawsuit against the Massachusetts Institute of Technology (MIT) and Harvard University, alleging violations of the Americans with Disabilities Act and Section 508 of the Rehabilitation Act and Title III of the Americans with Disabilities Act (ADA).²⁶ The case focused on the

²⁰ '2023 Global Survey Report on Persons with Disabilities and Disasters' (UNDRR, 10 October 2023) <<http://www.undrr.org/report/2023-global-survey-report-on-persons-with-disabilities-and-disasters>> accessed 9 February 2024.

²¹ *ibid.*

²² Ravindran S, 'Website Accessibility Lawsuit Filings in 2022 Set a New Record' (Codemantra, 26 March 2023) <<https://codemantra.com/website-accessibility-lawsuit-filings-in-2022-set-a-new-record/>> accessed 9 February 2024.

²³ *ibid.*

²⁴ Crownpeak, 'Ada Lawsuits Surge: Expert Insights on What the Data Reveals' (Crownpeak, 29 May 2021) <<https://www.crownpeak.com/resources/blogs/ada-lawsuits-surge-expert-insights-on-what-the-data-reveals/>> accessed 9 February 2024.

²⁵ *ibid.*

²⁶ *National Association of the Deaf v Massachusetts Institute of Technology* 3:15-Cv-30024 (D. Mass.) | Civil Rights Litigation Clearinghouse <<https://clearinghouse.net/case/14353/>> accessed 31 January 2024.

insufficient availability of accurate and complete captioning for online course materials, which denied those who were deaf or hard of hearing equal access to free online programming. Both actions, *NAD v. Harvard* and *NAD v. MIT*, were resolved through consent decrees in February 2020, with Harvard suffering significant legal fees.²⁷ In 2012, the National Association for the Deaf (NAD) brought a case against Netflix in Massachusetts, establishing the precedent for ADA website compliance litigation against online corporations. This court case seeks to compel Netflix to accommodate customers who have hearing difficulties or are deaf. The presiding judge favored NAD, stating that existing online services were not immune from ADA regulations. The resulting settlement required Netflix to provide closed captions for all online streaming content within two years, along with a payment of \$755,000 in attorney fees and costs.²⁸ In 2017, Juan Carlos, a visually challenged citizen, filed a complaint against Winn-Dixie Stores, Inc. under Title III of the Americans with Disabilities Act of 1990. The judges found the website a "place of public accommodation" under the ADA, determining that Winn-Dixie violated the plaintiff's rights by designing it inaccessibly for screen readers. The court-mandated remedial actions included bringing the website up to WCAG 2.0 AA standards, allocating \$250,000, introducing annual employee training on website accessibility, assuring third-party content accessibility, and implementing a complete web accessibility policy.²⁹

The current promise of cyberspace as a level playing field is unfortunately undermined by discriminatory algorithmic practices that disadvantage people with disabilities (PWDs). These hidden algorithms, often embedded within complex systems, can have significant consequences, limiting access to crucial information, opportunities, and participation.

²⁷ U.S. District Court for the District of Massachusetts, *National Association of the Deaf v. MIT*, No. 1:15-cv-00257-NMG (D. Mass. Feb. 6, 2020) <<https://angeion-public.s3.amazonaws.com/www.SmartphonePerformanceSettlement.com/docs/Declaration+of+Mark+J+Dearman+in+Support+of+Named+Plaintiffs+Motion+for+Final+Approval+of+Proposed+Settlement+and+for+Attorneys+Fees+Expenses+and+Service+Awards.pdf>> accessed 31 January 2024.

²⁸ U.S. District Court for the District of Massachusetts, *National Association of the Deaf v. Netflix, Inc.*, No. 1:11-cv-11963-DJW (D. Mass. Nov. 15, 2012) <<https://dredf.org/legal-advocacy/nad-v-netflix/>> accessed 31 January 2024.

²⁹ U.S. District Court for the Southern District of Florida, *Juan Carlos Ramirez v. Winn-Dixie Stores, Inc.*, No. 1:17-cv-23424-JLK (S.D. Fla. Oct. 26, 2018) <<https://casetext.com/case/bullard-v-winn-dixie-stores>> accessed 31 January 2024.

Several prominent authors delve into this problem. Zuckerman argues that the current internet structure, driven by algorithms prioritizing engagement and profit, inherently fosters discrimination and exclusion. He emphasizes the need for a more inclusive internet that caters to the diverse needs of all users, including PWDs.³⁰ Eubanks similarly criticizes how algorithms often reflect and amplify existing societal biases, leading to discriminatory outcomes for marginalized groups like PWDs. She uses an example of recruitment algorithms prioritizing specific keywords, inadvertently excluding qualified candidates with disabilities who use different languages to describe their skills.³¹ O'Neil further warns about the dangers of "algorithmic justice" frameworks, which present themselves as objective while masking inherent biases within data and algorithms. This can lead to discriminatory outcomes disguised as neutral and accurate decisions.³² Zuboff echoes this concern, highlighting how tech companies leverage algorithms to extract data and manipulate user behavior, creating a system of control and oppression that can exacerbate existing inequalities for PWDs.³³ The lack of accessibility in websites, apps, and other digital platforms is a glaring example of this algorithmic discrimination. Ironically, even the UNCRPD website itself is inaccessible to PWDs. Other prominent examples include Facebook, WhatsApp, popular shopping apps, government websites, inaccessible CAPTCHAs, educational institutions' websites, and online library TV programs.

In biased Data Sets, Algorithms learn and make decisions based on the data they're trained on. If this data is biased (e.g., lacking alt text or primarily featuring non-disabled users), the resulting algorithms might not recognize or cater to the needs of PWDs. Imagine an image recognition algorithm

³⁰ Mark Zuckerberg, building a More Inclusive Internet (2019), Facebook Newsroom blog post, <<https://about.fb.com/news/2019/03/vision-for-social-networking/>> accessed 31 January 2024.

³¹ Virginia Eubanks, Automating Inequality: How High-Tech Tools Profile, Police, and Punish (2018) St. Martin's Press <<https://dl.acm.org/doi/10.5555/3208509>> accessed 31 January 2024.

³² Cathy O'Neil, Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy (2016) Allen Lane <<https://edisciplinas.usp.br/mod/resource/view.php?id=4666080>> accessed 31 January 2024.

³³ Shoshana Zuboff, 'The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power' (2019) Public Affairs <<https://www.amazon.in/Age-Surveillance-Capitalism-Future-Frontier-ebook/dp/B075D6HPW7>> accessed 31 January 2024.

trained on pictures with only stairs; it might fail to identify accessible entrances with ramps, leading to inaccurate navigation information for users with mobility impairments.³⁴ In Unintended Algorithmic Biases, Algorithmic processes can introduce unintentional biases through assumptions and correlations, even with seemingly unbiased data. For example, an algorithm prioritizing user engagement might disproportionately recommend complex content unsuitable for users with specific cognitive disabilities. Think of a news recommendation algorithm focused on clickbait headlines pushing content with flashing lights or rapid movement, potentially triggering seizures for users with photosensitive epilepsy.³⁵ Accessibility Testing Gaps: While algorithms can automate various testing processes, they might not effectively assess accessibility. Traditional screen readers or automated testing tools may not catch all accessibility issues, particularly those related to user experience and interaction. A computerized accessibility test might pass a website despite its poorly designed keyboard controls, effectively excluding users with limited mouse dexterity. While not the sole factor, failing to consider accessibility during algorithmic design is demonstrably discriminatory towards PWDs. This algorithmic discrimination in cyberspace demands immediate attention and proactive solutions to ensure a truly inclusive and accessible digital world for all.³⁶

3.1 Algorithmic Discrimination and Disability Rights: Testing the Limits of the CRPD

Theresia Degener, a prominent scholar in the field of disability rights, posits that the Convention on the Rights of Persons with Disabilities (CRPD) lacks a distinct emphasis on the intersectionality of technology and disability. Her advocacy extends towards a more expansive interpretation of the CRPD, incorporating the dynamic impacts of

³⁴ Suresh Venkatasubramanian, 'The Moral Calculus of Algorithmic Bias: Fairness and Disadvantage in Machine Learning' (2018), <<https://fairmlbook.org/pdf/fairmlbook.pdf>> accessed 31 January 2024.

³⁵ Emily M. Bender and Timnit Gebru, 'On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?' (2021) <<https://dl.acm.org/doi/10.1145/3442188.3445922>> accessed 31 January 2024.

³⁶ W3C Web Accessibility Initiative (WAI), Understanding WCAG 2.1: Techniques for WCAG 2.1 (2024) <<https://www.w3.org/WAI/WCAG21/Techniques/>> 01 February 2024.

technologies such as artificial intelligence (AI) on individuals with disabilities.³⁷ In their collaborative work titled “Rethinking Disability Rights Protections in Response to Algorithmic Bias”,³⁸ Michael Ashley Stein and Penelope J.S. Stein argue that³⁹ the evidentiary threshold imposed on individuals to establish discrimination within algorithmic systems is excessively demanding.⁴⁰ They put forth novel frameworks specifically designed to address issues of algorithmic fairness. Gerard Quinn and colleagues draw attention⁴¹ to the intricate challenge of attributing discriminatory outcomes to a particular decision-maker or entity within the realm of complex algorithmic systems.⁴² The CRPD focuses significantly on overt, intentional discrimination that can be identified with enough proof.⁴³ Such direct instances, however, seem more manageable for this treaty when it comes to the categories of disability-targeted initiation.⁴⁴ Algorithmic bias, however, is often inadvertently by biased datasets and other limitations of technology themselves, which make the application of normal legal frameworks used in intent discrimination really difficult.⁴⁵ There is hardly much scope in CRPD for in-depth analysis of the technical intricacies of an algorithm or machine

³⁷ *ibid.*

³⁸ Stein, M. A., & Stein, P. J. S. (2023). Rethinking Disability Rights Protections in Response to Algorithmic Bias. *Stanford Technology Law Review*, 27(2), 221-264. <<https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://law.stanford.edu/courses/law-bias-andalgorithms/&ved=2ahUKEwiR7oOfjtOEAXU9zjgGHbyyCnIQFnoECBEQAQ&usg=AOvVaw0P6F4ddZJHWuMZ6XqLKsZU>>12 February 2024.

³⁹ *ibid.*

⁴⁰ *ibid.*

⁴¹ Bossewitch J, Brown LX, Gooding PM, et al. Digital Futures in Mind: Reflecting on Technological Experiments in Mental Health & Crisis Support. SSRN; (2022) <DOI:10.2139/ssrn.4215994>14 February 2024.

⁴² *ibid.*

⁴³ Convention on the Rights of Persons with Disabilities (CRPD) | Division for Inclusive Social Development (DISD)” <<https://social.desa.un.org/issues/disability/crpd/convention-on-the-rights-of-persons-with-disabilities-crpd>>14 February 2024.

⁴⁴ *ibid.*

⁴⁵ Algorithmic bias in Education Ryan S. Baker, university of ... <<https://osf.io/preprints/edaxiv/pbmvmz/download>> accessed 14 February 2024

learning system.⁴⁶ Some legal scholars, in fact argue that a much nuanced understanding is necessary regarding how algorithms actually make decisions, the possibilities of bias in that process and specific safeguards in relation to the technology.⁴⁷ As a non-binding legal instrument, CRPD primarily depends on monitoring and reporting mechanisms but leaves most of it open to interpretation and under-enforcement within increasingly complex matters such as algorithmic bias.⁴⁸ The CRPD is drafted in 2006, which was before the time which many of sophisticated algorithms became common. It lacks an explicit consideration of algorithmic discrimination, since that makes it hard to discuss recent developments.⁴⁹ Some scholars argue that the principles of non-discrimination and equal access found in the CRPD could potentially be relied upon towards challenging algorithmic bias and discrimination; however, there is much legal interpretation and further development needed before it could be applied to such complex algorithms.⁵⁰

The European Union is among the active regions in the world that are engaged in the business of finding out how the existing legal frameworks, as CRPD, could be adopted to address algorithmic discrimination effectively.⁵¹ It also involves the efforts to produce really specific tools and guidance for assessing and minimizing the bias that would exist in algorithms.⁵² Scholars believe that ongoing evolution should be called

⁴⁶ Simon J, Wong P-H and Rieder G, “Algorithmic Bias and the Value Sensitive Design Approach” (Internet Policy Review, May 11, 2021) <<https://policyreview.info/concepts/algorithmic-bias>> accessed 14 February 2024.

⁴⁷ *ibid.*

⁴⁸ “Implementation of the CRPD and Its Monitoring Mechanisms | HI” <<https://www.hi.org/crpd/en/implementation-of-the-crpd-and-its-monitoring-mechanisms>> accessed 14 February 2024.

⁴⁹ Kelly-Lyth A, “Algorithmic Discrimination at Work” (2023) 14 European Labour Law Journal 152 <<https://doi.org/10.1177/20319525231167300>> accessed 14 February 2024.

⁵⁰ *ibid.*

⁵¹ EU Framework for the UN Convention on the Rights of Persons with Disabilities (European Union Agency for Fundamental Rights, November 18, 2024) <<https://fra.europa.eu/en/cooperation/eu-partners/eu-crpd-framework>> accessed 14 February 2024.

⁵² Bariffi FJ, “Artificial Intelligence, Human Rights and Disability” (2021) 26 Pensar - Revista De Ciências Jurídicas 14 <<https://doi.org/10.5020/2317-2150.2021.12704>> accessed 14 February 2024.

forth regarding the CRPD and related legal instruments to specifically challenge any potential threats with which algorithmic discrimination poses, especially rights of persons with disabilities.⁵³ Broadly speaking, therefore, after analyzing these articles, general comments, and in-depth scholarly arguments, the CRPD does not deal directly with discriminatory algorithms,⁵⁴ but its general provisions and some specific articles on accessibility, non-discrimination, and access to information can be interpreted as covering this increasing concern.⁵⁵ The rapid evolution of technology and its manifestation in potential bias may lead to calls for further interpretation and clarification in future within the CRPD framework

4. ENSURING CYBERSPACE ACCESSIBILITY: A CRPD-CENTERED ANALYSIS

Cyberspace accessibility is not only a tool for increasing the participation and inclusion of persons with disabilities in society, as stated in the introduction to this article; following the implementation of the UNCRPD, it has also been elevated to the status of human rights for people with disabilities. The Preamble to the Convention, in paragraph (v), explicitly recognizes “the importance of accessibility to the physical, social, economic, and cultural environment, to health and education, and information and communication, in enabling people with disabilities to enjoy all human rights and fundamental freedoms fully.” Article 3 of the UNCRPD mentions “accessibility”⁵⁶ as one of the Convention's general principles. Article 9 of the UNCRPD⁵⁷ and other substantive articles go into greater detail on this. Article 9(1) demands the adoption of all measures necessary to ensure accessibility on a progressive basis.

⁵³ *ibid.*

⁵⁴ Bariffi FJ, “Artificial Intelligence, Human Rights and Disability” (2021) 26 *Pensar -Revista De Ciências Jurídicas* 14 <<https://doi.org/10.5020/2317-2150.2021.127041>> accessed 14 February 2024.

⁵⁵ *ibid.*

⁵⁶ Article 3 of the Convention on the Rights of Persons with Disabilities.

⁵⁷ Article 9 of the Convention on the Rights of Persons with Disabilities.

In General Comment No. 6 of “Article 5:⁵⁸ Equality and non-discrimination”, adopted on 9 March 2018, the UNCRPD Committee affirmed, consistently to what was already established in General Comment No. 2 on accessibility,⁵⁹ that.

“Accessibility is a precondition to achieve de facto equality for all persons with disabilities. For persons with disabilities to effectively participate in the community, state parties must address accessibility of the built environment, public transport, and information and communication services (emphasis added), which must be available and usable for all persons with disabilities equally with others”.

It also confirmed that accessibility duties for organizations can be performed progressively but must be done unconditionally. Article 9(2)(a) requires States Parties to set accessibility requirements. This provision allows Parties to delegate the writing of technical standards to non-state authorities. The UNCRPD tacitly recognizes that technical specifications and accessibility standards were primarily created in booklets, studies published by "think tanks," or "private" norms elaborated by standardization bodies. In its General Comment No. 2,⁶⁰ the UNCRPD Committee urged States Parties to implement mandatory accessibility standards and ensure that those standards are "by the standards of other States parties to ensure interoperability about free movement within the framework of liberty of movement and nationality (Article 18) of persons with disabilities".⁶¹ The Convention makes no distinction between public and private ownership of buildings, transportation, or technology. Article 9(2)(b)(d) requires States Parties to ensure that private entities provide accessible services and facilities.⁶²

The UNCRPD Committee states, "As long as goods, products, and services are open or provided to the public, they must be accessible to all, regardless of whether they are owned and provided by a public authority or a private

⁵⁸ Article 5 of the Convention on the Rights of Persons with Disabilities.

⁵⁹ United Nations Committee on the Rights of Persons with Disabilities. General Comment No. 2 (2014); Adopted by the Committee at its eleventh session 31 March–11 April 2014, CRPD/C/GC/2; United Nations Committee on the Rights of Persons with Disabilities: New York, NY, USA, 2014.

⁶⁰ *ibid.*

⁶¹ the Convention on the Rights of Persons with Disabilities, Article 18.

⁶² *ibid* Article 9(2)(b)(d).

enterprise". This interpretation of Article 9 is based on the obligation to promote and uphold the ideals of nondiscrimination and equality. Article 9(2), paragraphs (f) and (g) are particularly relevant to our examination because they address information accessibility.⁶³ They do not use the term "Cyberspace accessibility" but rather require that State Parties "promote other appropriate forms of assistance and support to persons with disabilities to ensure their access to information" and "promote access for persons with disabilities to new information and communication technologies and systems, including the Internet". In addition, Article 9(2)(h) requires states to "promote the design, development, production, and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost".⁶⁴ These clauses must be interpreted in conjunction with the general obligation outlined in Article 4(1)(g) and Article 21 UNCRPD, establishing the right to access information.⁶⁵ The last provision contains a non-exhaustive list of examples of steps that should be implemented to ensure freedom of opinion and expression. Among other things, it requires States Parties to ensure that information given by public or commercial service providers and intended for the general public is available in accessible formats (which includes accessible websites). It urges States Parties to ensure that individuals with disabilities can access information "promptly" and "without additional cost". As observed by Cera, the last requirement requires that accessible information be delivered at no more significant expense than information for non-disabled users, and, hence, it should not impose any more costs on people with disabilities.⁶⁶ Article 21 also calls for acknowledging, accepting, and promoting people with disabilities using sign languages, Braille, augmentative and alternative communication, and all other accessible ways, modes, and communication formats. This means cyberspace must be compatible with and support these different communication channels. In this regard, the UNCRPD Committee has explicitly stated that "accessibility in the context of

⁶³ *ibid* Article 9 (2) (f)(g).

⁶⁴ *ibid* Article 9 (2)(h).

⁶⁵ Article 21 of the Convention on the Rights of Persons with Disabilities.

⁶⁶ Ferri D and Favalli S, 'Web Accessibility for People with Disabilities in the European Union: Paving the Road to Social Inclusion' (MDPI, 12 June 2018) accessed 01 February 2024.

communication services includes the provision of social and communication support".

The UNCRPD contextualizes cyberspace accessibility as a core element of the right to independent living ensured by Article 19 of UNCRPD. Furthermore,⁶⁷ the UNCRPD Committee, in its General Comment No. 5 on living independently and being included in the community, clearly affirmed that "to ensure that the realization of a standardized minimum support level sufficient to allow the exercise of the right to live independently and be included in the community", State Parties must, among other things, "develop, implement, monitor and sanction non-compliance with legislation, plans, and guidance on accessibility requirements for basic mainstream services to achieve societal equality, including participation by persons with disabilities within social media, and secure adequate competence in information and communications technologies to ensure that such technologies are developed, including based on universal design, and protected".

Overall, the UNCRPD places web accessibility in the context of human rights. However, in this Algorithmic age, the actual scenario differs because as we move forward, scholars should reread and imagine the word "Web Accessibility" as "Cyberspace accessibility" for further border interpretation. After all, "Information and Communication Technology, Including the Internet" is a much broader terminology.

5. EMERGING TECHNOLOGIES AND FUTURE CONSIDERATIONS

Charles Babbage created a "difference engine" to calculate polynomial values with British government funding.⁶⁸ He designed a machine for general-purpose computation. John McCarthy invented the term "artificial intelligence" in 1956. With the expansion and development of technology, its use has been more productive as data volume has expanded, algorithms have advanced, and there has been an improvement in computer system

⁶⁷ Supra (n66) Article 19.

⁶⁸ A. Chaboud, E. H., 'The Need for Speed: Minimum Quote Life Rules And. Algorithmic Trading Australia' (2015) Federal Reserve Board<<https://assets.publishing.service.gov.uk/media/5a7c4848e5274a1b00422b77/12-1063-eia1-minimum-quote-life-maximum-order.pdf>> 02 February 2024.

storage and power.⁶⁹ The rising use of artificial intelligence is intended to encourage human cognitive abilities in computer programs. Artificial intelligence is primarily concerned with mind and reasoning; rational thinking is required to operate like humans.⁷⁰ Artificial intelligence has proven to be one of the most game-changing and contentious projects science has presented in our lifetime.⁷¹ AI has contributed to medical, financial, transportation, and leisure decision-making processes. It has always been clear that certain intelligent robots have outperformed human specialists.⁷² This raises the question of why and when this should remain in the decision-making process. One possible solution is to rely on human intuition and experience to recognize common errors that can have severe consequences.⁷³ However, if we look at the same case today, the above argument will no longer hold because technology has advanced to a far greater extent. We must recognize and assess if our system is ready to adapt to the technology changes we are implementing.⁷⁴ Can we imagine Robbo-judges and robot juries, or are we just behaving as science-fiction fans? We must think beyond what is depicted in Hollywood films and science fiction novels.⁷⁵ Artificial intelligence is a much brighter concept, and it is not frightening. It has contributed to every field, particularly the medical and legal sectors.

⁶⁹ Sheikh, H., Prins, C., Schrijvers, E. (2023). 'Artificial Intelligence: Definition and Background. In: Mission AI. Research for Policy' Springer, Cham. https://doi.org/10.1007/978-3-031-21448-6_2 02 February 2024.

⁷⁰ Russell, Stuart J., and Peter Norvig. 'Artificial Intelligence: A Modern Approach', (2010) Pearson Education Limited <https://people.engr.tamu.edu/guni/csce421/files/AI_Russell_Norvig.pdf>02 February 2024.

⁷¹ Bostrom, Nick. 'Superintelligence: Paths, Dangers, Strategies' (2014) Oxford University Press, <https://global.oup.com/academic/product/superintelligence-9780199678112> 03 February 2024.

⁷² *ibid.*

⁷³ Brundage, Miles, 'The Malicious Use of Artificial Intelligence: Forecasting, Prevention and Mitigation' <<https://global.oup.com/academic/product/superintelligence-9780199678112>>03 February 2024.

⁷⁴ Hildebrandt, M. (2020) 'Artificial intelligence and the future of law: New tools, new challenges, new ethics' Edward Elgar Publishing. <<https://www.elgaronline.com/edcollchap/book/9781803921327/chapter26.xml>> 03 February 2024.

⁷⁵ *ibid.*

5.1 From Assistive Tech to AI: The Next Step in Disability Rights

Technology may function as a force multiplier, helping to solve some of society's most persistent challenges, whether climate, water, or agriculture. Similarly, artificial intelligence (AI) can transform the lives of people with impairments.⁷⁶ There is an increase in the use of computers for hearing, seeing, and reasoning with fantastic accuracy. AI is very promising, and it can help people with visual, learning, hearing, mobility disabilities, and cognitive and mental health disorders perform better in scenarios relating to modern life, jobs, and human interactions.⁷⁷ It is distressing to note that just one out of every ten people with disabilities has access to assistive technologies and products. Looking at the global picture, 15% of the world's population is disabled in some way, and the prevalence of people with disabilities is exceptionally high in developing countries.⁷⁸ The number is tremendous, yet exposure to AI technologies needs to be improved. Technology is quite beneficial in making people with disabilities more accessible. Smartphone apps, in particular, assist users with navigation, transportation, and commerce.⁷⁹ It is distressing to note that just one out of every ten people with disabilities has access to assistive technologies and products. Looking at the global picture, 15% of the world's population is disabled in some way,⁸⁰ and the prevalence of people with disabilities is exceptionally high in developing countries. The transition from keypads to touch screens on keyboards, tablets, and phones, as well as the use of voice assistance and commands via the internet, have improved the accessible environment for people with disabilities and older

⁷⁶ World Economic Forum, Global Future Council on Artificial Intelligence, 'AI for Good: Harnessing the Power of Artificial Intelligence for Positive Impact' (2020), <<https://www.weforum.org/communities/global-future-council-on-artificial-intelligence/>>03 February 2024.

⁷⁷ *ibid.*

⁷⁸ Assistive Technology Industry Association, 2020 U.S. assistive technology market report (2021), <<https://www.emergenresearch.com/industry-report/us-assistive-technology-for-disabilities-market>>03 February 2024.

⁷⁹ Lazar, A., & A. Coucoumis. (2011). Disability and computing use: First 50 years and beyond. *ACM Computing Surveys* 43(3) <<https://inroads.acm.org/article.cfm?aid=2968453&doi=10.1145%2F2968453>> 04 February 2024.

⁸⁰ Microsoft, AI for Accessibility website, <<https://www.microsoft.com/en-us/accessibility/innovation>>04 February 2024.

adults.⁸¹ Many individuals have utilized Amazon's Alexa, Apple Homepage, and Google Now, among other recently released devices. Voice-activated personal assistants (VAPAs) have served as next-generation technologies and are progressing beyond that. VAPA is now widely available on smartphones and iPad devices.⁸² Interactions with VAPAs are becoming more specialized, personalized, and friendly as AI advances, allowing us to communicate directly with them rather than through our phones, laptops, tablets, and appliances.⁸³

The World Institute on Disability (WID) highlights the great potential that lies in artificial intelligence (AI) as a transformative tool to promote inclusion and accessibility for persons with disabilities.⁸⁴ By using AI's capability to detect visual, auditory, and linguistic signals, a wide range of possibilities is open to those that face a range of challenges.⁸⁵ Today's technologies work to produce large data sets that capture all aspects of inclusion, hence paving the way towards a more inclusive society.⁸⁶ An excellent example of this transformative process is in applying auto-caption AI, a fundamental resource for deaf or hard of hearing individuals, to provide instant access to speech in their natural rhythm patterns.⁸⁷ Also,

⁸¹ Gartner, *Emerging Technologies and Trends Impacting Accessibility* (2023), <<https://www.gartner.com/en/doc/emerging-technologies-and-trends-impact-radar-excerpt>>04 February 2024.

⁸² *ibid.*

⁸³ Lazar, A., & A. Coucoumis. (2011). *Disability and computing use: First 50 years and beyond*. *ACM Computing Surveys* 43(3). (Discusses historical and evolving trends in accessible computing) <https://on.acm.org/t/the-evolution-of-accessibility/248705> February 2024.

⁸⁴ United Nations, "Building an Accessible Future for All: AI and the Inclusion of Persons with Disabilities" (United Nations Western Europe, December 3, 2024) <<https://unric.org/en/building-an-accessible-future-for-all-ai-and-the-inclusion-of-persons-with-disabilities/>>06 February 2024.

⁸⁵ Touzet C and OECD, "Using AI to Support People with Disability in the Labour Market: Opportunities and Challenges" (Stijn Broecke and others eds, OECD 2023) report No. 7 <https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/11/using-ai-to-support-people-with-disability-in-the-labour-market_e9463967/008b32b7-en.pdf>06 February 2024.

⁸⁶ *ibid.*

⁸⁷ Luciaclemares and De Andrade S, "How Artificial Intelligence Is Transforming the Lives of Hearing Impaired and Hard-of-Hearing People" *Telefónica* (January 30, 2025) <https://www.telefonica.com/en/communication-room/blog/artificial-intelligence-transforming-lives-hearing-impaired-hard-hearing-people/> 07 February 2024.

the introduction of self-driving cars, created in line with Universal Design Principles, is a promising revolution for those that face challenges related to traditional driving, hence improving mobility and freedom of action.⁸⁸ Other new technologies, such as face recognition and image recognition systems, also work to become crucial tools for visually impaired or low vision individuals, improving their mobility and interaction in their environments.⁸⁹ Also, language comprehension technologies provide great support to those that face cognitive impairments, hence making it possible for their comprehension of sophisticated information.⁹⁰

An important milestone in this field is Neuralink's recent feat, in which a computer chip the size of a coin was inserted in a human brain, hence creating a brain-computer interface (BCI).⁹¹ This new technology holds great potential to revolutionize the lives of people with disabilities, creating new ways of communication and interaction in their worlds. The rapid advancement of artificial intelligence brings a myriad of challenges, mainly in terms of privacy and ethical issues.⁹² The challenges have also attracted attention from various entities, such as public, private, and business sectors, in addition to institutions such as the WID. One of the key challenges is that AI models can perpetuate existing biases, hence perpetuating the marginalization of particular demographic groups.⁹³ Also, the lack of representative inclusion of people with disabilities in the datasets used to train AI raises serious questions regarding their potential exclusion from the benefits of these technologies.⁹⁴

There is also a growing concern that a focus on speeding up AI development can overlook fundamental aspects such as accessibility,

⁸⁸ *ibid.*

⁸⁹ Fernando S and others, "Image Recognition Tools for Blind and Visually Impaired Users: An Emphasis on the Design Considerations" [2024] ACM Transactions on Accessible Computing <https://doi.org/10.1145/3702208> 07 February 2024.

⁹⁰ *ibid.*

⁹¹ Neuralink, "NeuraLink – Pioneering Brain Computer Interfaces" (Neuralink) <<https://neuralink.com/>>09 February 2024.

⁹² *ibid.*

⁹³ Ferrara E, "Fairness and Bias in Artificial Intelligence: A Brief Survey of Sources, Impacts, and Mitigation Strategies" (2023) 6 Sci 3 <<https://www.mdpi.com/2413-4155/6/1/3>>09 February 2024.

⁹⁴ *ibid.*

security, safety, and elimination of bias. People with disabilities risk being overlooked during data collection and machine learning training processes, hence widening existing gaps.⁹⁵ The privacy rights of people with disabilities also become a key concern, raising questions regarding the processes used for collecting, using, and protecting their personal data.⁹⁶ In order to meet these challenges, the World Institute on Disability (WID) recommends active engagement of those having a deep knowledge of disability culture and accessibility issues in developing AI standards. Their knowledge of implicit biases and their mitigation is key to ensuring that people with disabilities are accurately represented in coming data sets.⁹⁷ By incorporating such perspectives in designing and applying AI, there is a potential to move towards a future of increased accessibility, in which the benefits of innovations become accessible to everyone.⁹⁸ The World Institute on Disability highlights the transformative power of AI as a key enabler of inclusion and accessibility for people with disabilities. By using AI's capabilities to decipher visual, audio, and linguistic signals, a wide range of possibilities arise for those having different challenges to face. The emergence of new technologies is helping to build inclusive data sets, hence enabling the creation of a more inclusive society.

6. CONCLUSION

The complex coexistence of disability appears as an intricate narrative consisting of personal stories, social conventions, and shifting perceptions. Over time, the narrative surrounding disability includes elements of exclusion, inclusion, adversity, and triumph. In the year 2006, the international community recognized the need to understand the adversity

⁹⁵ Ferrara E, "Fairness and Bias in Artificial Intelligence: A Brief Survey of Sources, Impacts, and Mitigation Strategies" (2023) 6 Sci 3 <<https://www.mdpi.com/2413-4155/6/1/3>>10 February 2024.

⁹⁶ *ibid.*

⁹⁷ Kirmer S, "Disability, Accessibility, and AI" (Towards Data Science, January 13, 2025) <<https://towardsdatascience.com/disability-accessibility-and-ai-0d5ab06ec140/>>10 February 2024.

⁹⁸ Schleicher A and others, "THE POTENTIAL IMPACT OF ARTIFICIAL INTELLIGENCE ON EQUITY AND INCLUSION IN EDUCATION" (OECD EDUCATION WORKING PAPERS SERIES, 2024) report No. 23 <https://www.oecd-ilibrary.org/docserver/15df715b-en.pdf?expires=1730901830&id=id&accname=guest&checksum=73C1BEFC0686BB214C6A4C8170C3BE05> 11 February 2024.

experienced by persons with disabilities through an approach grounded in human rights, resulting in the creation of the landmark Convention on the Rights of Persons with Disabilities (CRPD). In traversing the algorithmic era across digital realms, an active narrative discloses the adversity experienced by persons with disabilities. Algorithmic biases rooted in digital constructs result in an insidious, ubiquitous form of discrimination rooted in foundational code. The quest for accessibility across digital realms, as detailed here, represents necessary efforts aimed toward preventing exclusion while, concomitantly, creating an inclusive society. Digital realms, defined by constructs disparate from those found across the physical sphere, offer distinct challenges across persons with disabilities. A disparate application of algorithmic approaches, accelerating over time, worsens these difficulties, varying from issues surrounding website accessibility to Social Security benefits allocation. Credible examples depict the adversity surrounding inclusion across digital realms, representing an environment fraught with difficulties and impediments.

The CRPD, while pioneering in its human rights approach, does not explicitly address discriminatory algorithmic practices. However, its ideals of accessibility, equality, and nondiscrimination serve as the framework for understanding and tackling these new difficulties. The sufficient examination of the CRPD's provisions on cyberspace accessibility emphasizes their critical significance in defining the digital world for people with disabilities. Looking ahead, developing technologies, notably artificial intelligence, can create greater inclusivity for people with impairments. These breakthroughs, which range from auto-captioning for the hearing challenged to brain-computer connections, have the potential to be transformative. However, the ethical implications of these technologies and potential biases must be carefully considered to avoid perpetuating inequality. Recognizing the intersectionality of disability in the digital domain is critical for creating a more inclusive future. By removing discriminatory algorithmic practices, responsibly adopting emerging technologies, and strengthening the CRPD's foundations, we can pave the path for cyberspace that genuinely reflects the diversity and rights of all individuals, regardless of ability. As we come to the end of this inquiry, the plea for a technologically inclusive world echoes, reminding us that the path to equality knows no borders, whether in the physical or virtual spheres.