Essays

Disability and Artificial Intelligence: Possible Connections

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ABSTRACT: Artificial intelligence (AI) is one of the most innovative and promising technologies, with applications ranging from healthcare to education and social services. In the field of disability, new AI-based technologies offer numerous benefits, such as greater autonomy, motor rehabilitation and new opportunities for accessibility and inclusion. Although there are ethical and social challenges, the application of AI in disability is one of the most promising areas for an inclusive society. Finally, the importance of an interdisciplinary and inclusive approach is emphasised as necessary to ensure equity and sustainability in the development of these technologies.

KEYWORDS: Disability; artificial intelligence; accessibility; inclusion; assistive technology

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1. The Term 'Disability': Etymology and Interpretative Frameworks

The concept of 'disability' has never been neutral or static: it is a category that reflects historical, cultural and political changes, as well as transformations in language and social practices. Talking about disability means questioning not only the bodies and minds that are classified as 'different' from a normative model, but also the linguistic devices, interpretative frameworks and systems of power that have constructed this category over time. Analysis of the the term, its etymological roots and its earliest defnitions allows us to understand how society has framed the issue, oscillating between logics of exclusion and attempts at inclusion.

At the same time, it is fair to say that the theories that have interpreted disability – from the medical-biological to the social model – have provided different interpretations to explain the difficulties encountered by people and to identify possible remedies. In this context, there are two models of reference:

- The traditional medical model, which focuses on individual deficits;

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- The social model and more recent perspectives, which focus on environmental and cultural barriers that limit participation.

This paper aims to explore the linguistic origins of the term 'disability', comparing them with other terms such as 'invalidity' and 'handicap', and to discuss early medical-biological conceptualisations, highlighting their limitations and social implications. These passages form the basis for understanding the need to rethink disability as a social construct, but also as a field in which language, power and rights are intertwined.

1.1. Linguistic Roots and Early Definitions

The etymology of words related to disability offers a first glimpse into how societies have historically interpreted physical or mental difference. The English word 'disability' comes from the combination of the prefix 'dis-' with 'ability', literally meaning 'absence of ability' or 'lack of capacity', with attestations dating back to the 16th century.[1] The privative element highlights a logic of deficit: defining someone by what they do not have, rather than by their actual abilities. This approach has long influenced the collective imagination, reinforcing the tendency to think of disability as a loss, a limitation or a defect. The term 'handicap', on the other hand, has completely different origins. It derives from the English expression *'hand in* cap', referring to a gambling game popular in the 17th century, in which advantages and disadvantages were balanced between players. It was later adopted in horse racing to indicate an artificially imposed disadvantage on a stronger horse in order to rebalance the race. Only later did it come to refer to a condition of personal or social disadvantage.[2] The use of this sporting and competitive metaphor is not neutral: talking about 'handicap' means placing the person in a logic of competition and comparison, as if they were inevitably 'less' than an established norm. In Italian, the term *invalidità* (disability) has played an important role, especially in the legal and healthcare fields. It derives from the Latin *invalidus,* meaning 'weak, not strong', and has been used in legal and social security systems to indicate the inability to perform certain work or social activities.[3] Here too, the logic is strongly focused on lack and inadequacy in relation to a socially recognised function. It is no coincidence *that* 'civil invalid' is still an administrative category today, used to define rights, pensions and benefits, but at the same time contributing to a stigmatising categorisation. These terms ('disability', 'handicap', 'impairment') show, therefore, how language has constructed bodily and cognitive difference in terms of deficiency, disadvantage and weakness. Although in recent decades the use of 'disability' has become widespread as a preferable and less stigmatising term, its etymological and historical roots continue to influence the way people are perceived and treated. As Hogan has observed, the words we use are not simply labels, but convey worldviews that guide policies, practices and social relations.[4]

[1] Etymonline, *Disability,* in *Online Etymology Dictionary*. https://www.etymonline.com/word/disability
[2] Etymonline, *Handicap*, in *Online Etymology Dictionary* https://www.etymonline.com/word/handicapped
[3] Treccani, *Disabled; invalid*, in *Vocabulary of the Italian language* (accessed 19 September 2025). https://www.treccani.it/vocabolario/disabile
[4] A.J. HOGAN, *Social and medical models of disability and mental health: evolution and renewal*, in *Canadian Medical Association Journal*, 191, 1, 2019, E16–E18.

1.2. Early Medical-Biological Conceptualisations and Their Limitations

Alongside linguistic developments, early modern theories of disability focused primarily on a medical-biological approach. From this perspective, disability is interpreted as a direct consequence of physical, sensory or cognitive impairment. The focus is on the individual body: the 'cause' of the problem lies within the person, and the solution consists of medical treatment, rehabilitation or, where possible, correction of the impairment.

For most of the 20th century, the 'medical model' prevailed, in which the person was seen almost exclusively as a clinical condition. Consequently, having a disability meant that the person was 'sick' or 'defective' and society's task was to 'fix' them and restore them to a normal condition.[5] In this view, disability is therefore not a problem of social relations or external barriers, but a biological defect that reduces a person's abilities.

While this approach has fostered the development of disciplines such as rehabilitative medicine, physiotherapy and prosthetics, it has also had problematic consequences. This approach has undoubted merits, but anyone who has experienced a disability knows that reducing everything to a biological deficit means ignoring much of the daily experience, which consists not only of therapies and treatments, but also of relationships, environmental obstacles and cultural barriers. Firstly, it has contributed to reducing the person to their clinical condition, obscuring the complexity of their life experience. Secondly, it has legitimised welfare policies that have often reinforced isolation rather than promoting participation. As Hogan pointed out, the medical model has undoubtedly contributed to advances in rehabilitation, but at the same time it has conveyed a reductive view of the person.[6]

Furthermore, this perspective has fuelled the social perception of disability as a 'personal tragedy'. The difficulties encountered are not attributed to architectural, cultural or communication barriers, but to the individual's condition. The risk, Adam observes, is that this reinforces stigma: if the problem lies entirely with the person, then they become the bearer of a defect that justifies exclusion.[7]

It is therefore not surprising that, since the 1970s and 1980s, increasingly strong criticism of this paradigm has emerged. The disability movement, especially in the United Kingdom, has challenged the idea that disability is merely a biological consequence, calling instead for attention to social barriers and rights. However, the weight of the medical-biological model continues to influence policies and representations today, making constant critical deconstruction necessary.

1.3. Language as a Constructor of Reality: The Word 'Disability' as a Device of Power and Inclusion/Exclusion

Language does not merely describe reality, but also functions as a lens that magnifies some differences and obscures others. Talking about 'disability' therefore activates a set of meanings that are not neutral, but reflect power relations, ideologies and cultural models. In this sense, the word itself can function as a device capable of including or excluding.

[5] Z. ZAKS, *Changing the medical model of disability to the normalisation model of disability: clarifying the past to create a new future direction*, in *Disability & Society*, 39, 12, 2023, 3233–3260.
[6] A.J HOGAN, *op. cit.*, E18.
[7] S. ADAM, A. KOUTSOJLENIS, *Who needs the social model of disability*?, in *Frontiers in Sociology*, 8, 2023, 1305301.

Michel Foucault's reflections on the role of discourse are particularly illuminating: language is not only a tool for communication, but also a field in which practices of classification, control and normalisation are exercised.[8] Applied to disability, this means that the labels attributed to individuals, such as 'handicapped', 'invalid' or 'disabled', are not simply adjectives, but performative acts that contribute to defining who has the right to participate fully in social life and who is instead placed on the margins.

Adam observes that the power of language is also manifested in its ability to generate stigma. Being named using terms that evoke deficit or weakness means being constantly reminded of a lack, regardless of one's skills or aspirations.[9] This applies not only to the words used in legislative texts or medical diagnoses, but also to everyday language, the media and education. Every time a person is reduced to their condition, a hierarchy between 'normality' and 'abnormality' is reinforced.

At the same time, however, language can be a tool for emancipation. Choosing different terms, redefining categories, introducing concepts that value diversity rather than deficit, is a way to dismantle power relations and imagine new forms of inclusion. It is no coincidence that many movements of people with disabilities have called for the use of 'person-first language' (e.g., 'person with a disability' instead of 'disabled person'), emphasising the centrality of the person rather than the condition.[10]

However, the debate remains open and complex. Some activists prefer 'identity-first language' ('disabled person') because they interpret disability not as a negative characteristic to be mitigated, but as an aspect of identity that can become a source of pride and belonging to a community. In this sense, linguistic choice is itself a political act, reflecting tensions between assimilation and the assertion of difference.

The use of the word 'disability' as a device of power is also evident in institutional practices. As Zaks' studies (2024) show, defining a person as 'disabled' in a medical-legal context can mean giving them access to services, support and rights, but it can also pigeonhole them into a rigid classification system that risks limiting their autonomy. It is an ambivalent language: on the one hand, it opens up possibilities, but on the other, it produces exclusion.

This ambivalence shows that simply replacing one word with another is not enough to radically transform social reality. Rather, we need to work on the meaning attributed to terms and the practices that accompany them. Ultimately, the language of disability is not just a semantic issue, but a field of political and cultural struggle, in which processes of recognition and exclusion are at play.

1.4. From Individual Deficit to the Relationship with Barriers: The Social Model of Disability

Criticism of the medical-biological model has paved the way for new interpretations, including the so-called 'social model of disability'. Originating in the 1970s in the United Kingdom, mainly thanks to the work of Michael Oliver, this approach represented an essential turning point: disability is no longer seen as a simple consequence of an individual impairment, but as a product of physical, cultural and institutional barriers that hinder people's full participation in social life.[11] According to the social model, physical or cognitive differences are not in themselves an insurmountable problem: it is society that creates exclusion through environments designed for able-bodied people. A prime example is architectural barriers:

[8] M. FOUCAULT, *Discipline and Punish: The Birth of the Prison (Italian translation)*, Turin, 1996.
[9] S. ADAM, A. KOUTSOJLENIS, *op. cit*., 1305301.
[10] A.J HOGAN, *op. cit*., E18.
[11] M. OLIVER, *Social Work with Disabled People*. Basingstoke, 1983.

anyone who has pushed a wheelchair, even if only as a tourist in a historic city, knows how a simple staircase can become an insurmountable wall.

Hogan points out that the social model has had the merit of shifting the discourse from 'personal tragedy' to collective responsibility. It is no longer a question of 'fixing' the person, but of transforming society so that it becomes truly inclusive.[12] This perspective has had a huge impact on policy s for the rights of persons with disabilities, inspiring fundamental documents such as the UN Convention on the Rights of Persons with Disabilities (2006).

However, the social model is not without its critics. Adam notes that, while it has raised awareness of social barriers, it sometimes risks underestimating the physical and medical dimensions. Some persons with disabilities point out that pain, fatigue or physical limitations cannot be explained solely as the effect of social barriers. In this sense, the most recent interpretations refer to 'hybrid' models, which bring together biological and social dimensions, avoiding reductionism.[13]

Zaks (2024) proposes considering disability as a complex and situated phenomenon that requires the integration of different perspectives. On the one hand, it is necessary to recognise clinical conditions and provide appropriate medical and rehabilitative interventions; on the other hand, it is essential to eliminate barriers and discrimination. The challenge lies in overcoming the clear opposition between the medical model and the social model, building a truly inclusive and multidimensional approach.

The shift from individual deficit to the relationship with barriers has therefore marked a paradigm shift: disability becomes a matter of social justice and rights, not just health. This change paves the way for contemporary reflections on the use of language, inclusion practices and, as we will see in the next chapter, new technologies – in particular artificial intelligence – as tools capable of redefining the boundaries of autonomy and participation.

2. The New Frontiers of AI in Disability

In recent years, artificial intelligence (AI) has become an integral part of everyday life, gaining increasing relevance in many sectors. AI is a technology designed to find, store, process and provide information to users to help them. By imitating human intelligence, it is capable of simulating certain functions, such as problem solving.[14] Today, thanks to its rapid and continuous evolution, it is one of the most promising solutions for improving the quality of life of people with disabilities. AI-based solutions can improve and facilitate the performance of daily activities, open up new possibilities for learning, communication and social participation, and help overcome barriers that until recently seemed insurmountable.[15]

AI is not just an additional technological support, but has applications in many areas of disability, offering innovative tools that promote individual autonomy and reduce inequalities. In particular, in the field of healthcare and rehabilitation, it is emerging as a valuable resource in assessment, diagnosis and treatment

[12] A.J. Hogan, *op. cit*., E18.

[13] S. Adam, A. Koutsojlenis, *op. cit*., 1305301.

[14] I. Senadheera, P. Hettiarachchi, B. Haslam, R. Nawaratne, J. Sheehan, Kj. Lockwood, D. Alahakoon, Lm. Carey, *AI Applications in Adult Stroke Recovery and Rehabilitation: A Scoping Review Using AI*, in *Sensors (Basel)*, 24, 20, 2024, 6585.

[15] V. Kumar, S. Barik, S. Aggarwal, D. Kumar, V. Raj, *The use of artificial intelligence for persons with disability: a bright and promising future ahead, in Disability and Rehabilitation*, in *Assistive Technology*, 19(6), 2023, 2415–2417.

processes, making interventions personalised and effective.[16] Paying attention and intervening early in the course of atypical development has a significant positive impact in limiting the difficulties of the individual, the negative impact on families and containing costs for the individual.[17]

Today, there are numerous artificial intelligence applications available in this field that can support functional recovery and adapt to the specific needs of each individual.

Islam and colleagues (2018) explored the use of artificial intelligence in rehabilitation processes. In their study, they developed a system based on machine learning techniques, aimed at predicting self-care difficulties in children with physical and motor disabilities.[18] This approach allowed therapists to identify problems early, make more accurate clinical decisions, and optimise healthcare time and costs.

Song and colleagues applied AI to support the diagnosis of children with autism spectrum disorder and intellectual disabilities, and Yperman and colleagues (2020) developed a machine learning model aimed at increasing the accuracy of the Autism Diagnostic Observation Schedule (ADOS-2) in the assessment of ASD.[1920] These data are particularly useful considering that the diagnosis of ASD continues to present challenges and the complexity of the cognitive profile in people with ASD .[2122]

Nicolas Blanc and colleagues (2019) used computer vision and machine learning to design a tool that helps people with disabilities get around town, suggesting the most suitable routes based on their disability.[23]

Current applications of AI

Disability	AI-based technologies	Main benefits	Critical issues and limitations
Motor disabilities	Exoskeletons, smart prostheses, autonomous mobility systems	Improved mobility and autonomy	Inequalities in access: digital divide and technology costs

[16] D. Lee, S.N. Yoon, *Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges,* in *Int. J. Environ. Res. Public Health*, 18, 2021, 271.

[17] R. Ferrara, L. Iovino, M. Di Renzo, P. Ricci, *Babies under 1 year with atypical development: Perspectives for preventive individuation and treatment,* in *Frontiers in Psychology*, 13, 2022, 1016886. See also R. Ferrara, F. Damato, L. Iovino, F. Marti, R. Latina, C. Colombi, P. Ricci, *ESDM intervention in severe preschool autism: An Italian Case report, psychological and social medicine reflections*, in *Ital. J. Paediatr.,* 5, 2024, 1-7.

[18] B. Islam, Nim. Ashafuddula, F. Mahmud, *A machine learning approach to detect self-care problems of children with physical and motor disability,* in *21st International Conference of Computer and Information Technology (ICCIT). Piscataway: IEEE*, 2018, 1-4.

[19] C. Song, Zq. Jiang, Hu. Lf *et al.*, *A machine learning-based diagnostic model for children with autism spectrum disorders complicated with intellectual disability*, in *Front Psychiatry*, 13, 2022, 993077.

[20] J. Yperman, T. Becker, D. Valkenborg *et al., Machine learning analysis of motor evoked potential time series to predict disability progression in multiple sclerosis,* in *BMC Neurol*, 20, 1, 2020.

[21] R. Ferrara, R. Nappo, F. Ansermet, P. Ricci, F. Massoni, G. Carbone, A. Sparaci, E. Nonnis, L. Ricci, S. Ricci, *The impact of DSM-5 on the diagnosis of autism spectrum disorder,* in *Psychiatric Annals*, 51, 1, 2021, 38-46.

[22] R. Ferrara, F. Ansermet, F. Massoni, L. Petrone, E. Onofri, P. Ricci, T. Archer, S. Ricci, *Autism Spectrum Disorder and intact executive functioning,* in *Clinica Terapeutica*, 167, 2016, 96-101.

[23] N. Blanc, Z. Liu, O. Ertz *et al.*, *Building a crowdsourcing-based disabled pedestrian level of service routing application using computer vision and machine learning*, in *2019 16th IEEE Annual Consumer Communications & Networking Conference (CCNC). Piscataway: IEEE*, 2019, 1-5.

Sensory disabilities	Voice recognition for the hearing impaired, computer vision for the blind/visually impaired	Reducing communication and social barriers	Algorithmic bias, technological dependence
Neurodevelopmental disorders	Augmentative communication platforms, personalised learning tools	Support for inclusion in education, work and society	Technological dependence and technology costs
Cognitive disabilities	Virtual assistants and predictive systems for memory support and daily life management	Improving independence and quality of life	Ethical issues: privacy, informed consent, reliability

These applications reflect the predominance of the medical model in the literature, favouring technological solutions aimed at managing health conditions and neglecting the social and environmental factors of disability. The reduced integration of the social model in research on artificial intelligence highlights the need for a broader and more inclusive approach that takes into account the obstacles that people with disabilities experience in their daily lives.

The World Health Organisation has identified digital technologies, including artificial intelligence, as key tools for promoting the inclusion of people with disabilities. These solutions transform access to and management of health services, thereby improving the efficiency of care. The WHO, in particular, emphasises two priorities: adopting a systemic approach to ensure health equity and adherence to international accessibility standards.[24]

Scientific literature shows that people with disabilities value their direct involvement in the development of technological interventions, especially when this recognises their dignity, autonomy and lived experiences. Therefore, in order to broaden our understanding of disability, it is essential to promote truly interdisciplinary research between artificial intelligence specialists and disability scholars, and a central aspect of this process is the direct involvement of people with disabilities.[25] Their active participation allows for the development of artificial intelligence systems that respond concretely to their needs. Integrating their perspectives not only helps to reduce the biases inherent in technological systems, but also ensures that AI is used as a tool to promote equity, justice and social inclusion. In this way, it is possible to fully exploit the transformative potential of artificial intelligence and reduce the risk that these solutions end up excluding rather than promoting inclusion.[26]

[24] WORLD HEALTH ORGANIZATION, *Global report on health equity for persons with disabilities,* 2022.

[25] E. UMUCU, *Artificial Intelligence and Health Equity for People with Disabilities: An Integrated Framework for Disability-Inclusive AI Design,* in *Inquiry: a journal of medical care organisation, provision and financing*, 62, 2025. See also A. ROMAN-URRESTARAZU, R. VAN KESSEL, *Inaccurate prevalence estimates impacts autism policy: A letter to the editor in relation to "Global prevalence of autism: A systematic review update*" by Zeidan *et al.*, in *Autism Res*, 15, 7, 2022, 1184-1186.

[26] C. EL MORR, B. KUNDI, F. MOBEEN, S. TALEGHANI, Y. EL-LAHIN, R. GORMAN, *AI and disability: A systematic scoping review,* in *Health Informatics J*, 30, 3, 2024.

In conclusion, the integration of an inclusive, ethical and sustainable approach is necessary for artificial intelligence to truly meet the needs of people with disabilities.
In this regard, scientific literature has highlighted that autistic people encounter multiple barriers in accessing health services and, very often, professionals do not know how to manage problematic behaviours during routine medical examinations.[27]
It is essential to develop and review guidelines, protocols and regulations to ensure compliance with accessibility and inclusion standards. Despite the potential of artificial intelligence to improve the quality of life of people with disabilities, several challenges remain. The main ones include high costs, technological limitations and the ethical and social implications of its use. In order to fully exploit the benefits of AI, collaboration between the research community, professionals, institutions and communities is crucial, so that AI can be transformed into a truly enabling resource, capable of promoting autonomy, inclusion and a better quality of life for people with disabilities.

2.1. AI-Enhanced Assistive Technologies

In recent years, artificial intelligence (AI) has established itself as one of the main drivers of transformation in assistive technologies. Whereas prostheses, wheelchairs and support systems were once relatively static tools, AI now allows for a degree of adaptation and customisation that was previously unthinkable. Assistive technologies enhanced by machine learning algorithms make it possible to better respond to individual needs, anticipate requirements and optimise the use of resources.
A recent study conducted in Saudi Arabia highlighted the impact of AI-based assistive technologies on the daily lives of children with Down syndrome. The results show significant improvements in mobility and the ability to perform daily activities independently.[28] It is not just a question of increasing the efficiency of devices, but of promoting a greater sense of independence and social participation. This aspect is crucial: intelligent assistive technologies do not merely compensate for a deficit, but help to redesign the relationship between the individual and their environment.
A particularly promising field is that of robotic prostheses and intelligent movement systems. As Giansanti observes, the integration of AI into prostheses not only allows motor functions to be replicated, but also enables desired movements to be predicted and anticipated, making interaction more natural. [29] Through sensors and machine learning algorithms, prostheses can adapt to the user's habits, recognise patterns and modify their operation in real time. Looking ahead, this means reducing the cognitive effort required and improving the quality of daily life. Imagine, for example, a child who, thanks to a smart prosthesis, can finally grasp an object without having to think about every single movement: that simple gesture

[27] R. Ferrara, L. Ricci, P. Ricci, L. Iovino, S. Ricci, F.M. Damato, G. Cicinelli, R. Keller, *How autistic women are aware of their body and take care of their health? Focus on menstruation cycles and gynaecological care,* in *Clinica Terapeutica,* 175, 3, 2024, 168-175. See also R. Ferrara, P. Ricci, F.M Damato, L. Iovino, L. Ricci, G. Cicinelli, R. Simeoli, R. Kelle, *Pregnancy in autistic women and social medical considerations: Scoping review and meta-synthesis,* in *Frontiers in Psychiatry*, 14, 2023, 1222127.
[28] R. Alanazi, A.S Alanazi, S. Alqazlan *et al*., *Assessing the impact of AI tools on mobility and daily assistance for children with Down syndrome in Saudi Arabia,* in *Scientific Reports*, 15, 2025, 30826.
[29] D. Giansanti, A. Pirrera, *Integrating AI and Assistive Technologies in Healthcare: Insights from a Narrative Review of Reviews*, in *Healthcare*, 13, 5, 2025, 556.

encapsulates the difference between technology that compensates and technology that truly frees up everyday life.

A further development concerns autonomous navigation systems for people with visual or motor disabilities. Ahmmad and colleagues have shown how AI can be used to create multimodal interfaces, based on voice, touch and visual feedback, which guide the person through urban spaces, reducing risks and increasing independence. In this case, technology not only breaks down a practical barrier, but also redesigns the relationship with the city, making it more accessible and liveable.[30]

The potential is enormous, but some critical issues also emerge. Alanazi and colleagues point out that the costs of these devices and their unequal distribution can accentuate social inequalities: those who can afford intelligent assistive technologies gain a significant advantage, while others risk being excluded. These innovations, therefore, while emancipatory, raise urgent questions of distributive justice.[31]

2.2. Communication and Language

A second area in which AI is breaking new ground is communication. For many people with disabilities, the ability to express themselves and interact is hampered by linguistic, sensory, or cognitive barriers. In this context, AI-based technologies offer a number of innovative solutions, such as:

- Augmentative and alternative communication (AAC);
- Automatic sign language translation.

In education, Kooli shows how speech recognition and synthesis tools can support students with motor or hearing difficulties. Through machine learning algorithms, these tools transform speech into written text, or text into natural speech, facilitating classroom participation and access to teaching materials. These are concrete examples of how AI can promote educational inclusion, transforming contexts that have traditionally excluded or marginalised.[32]

It is easy to get excited about these advances, but it is legitimate to wonder what might happen if the technology were unable to truly reflect the richness of real sign languages. Another point for reflection concerns the automatic translation of sign language, which is a rapidly expanding field of research. Baumgärtner and colleagues highlighted the potential of computer vision and gesture recognition techniques to translate sign language into text or speech in real time.[33] However, they also pointed out some critical issues, namely:

- Sign language is not universal, but varies nationally and culturally;
- The available datasets are often limited and unrepresentative.

This carries the risk of developing inaccurate systems that do not reflect the linguistic and cultural complexity of deaf communities.

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[30] J. AHMMAD, O.A. AL-DAYEL, M.A. KHAN *et al*., *AI-assisted technology optimisation in disability support systems using fuzzy rough MABAC decision-making,* in *Scientific Reports*, 2025, 18335.

[31] R. ALANAZI, A.S ALANAZI, S. ALQAZLAN *et al*., *op. cit*., 30826.

[32] C. KOOLI, R. CHAKRAOUI, *AI-driven assistive technologies in inclusive education: benefits, challenges, and policy recommendations,* in *Sustainable Futures*, 10, 2025, 101042. See also R. ALANAZI, A.S ALANAZI, S. ALQAZLAN *et al*., *op. cit*. 30826.

[33] L. BAUMGARTNER, S. JAUSS, J. MAUCHER, G. ZIMMERMANN, *Automated sign language translation: The role of artificial intelligence now and in the future*, in *Proceedings of the 6th International Conference on Computer-Human Interaction Research and Applications*, 2020, 237-244.

New approaches based on deep learning architectures, such as spatio-temporal transformers, are improving performance. Ruiz and Martinez show how these models can take into account both movement over time and spatial relationships between body parts, increasing the accuracy of machine translation . Despite progress, the problem of poor participation by deaf people in the development of such technologies remains: without their direct contribution, there is a risk that the systems will reproduce prejudices and reductive views.[34]

Looking ahead, the combination of AAC and machine translation could open up completely new avenues of communication. Wearable devices, mobile apps and multimodal interfaces promise to make interaction more fluid and natural, breaking down barriers that have limited access to information and socialising for centuries. Once again, however, the effectiveness of these tools will depend on their ability to include the real diversity of users and respect cultural specificities.

2.3. Digital Accessibility and Inclusion

There is no doubt that digital technology has become the main environment for socialisation, work and political participation. Ensuring accessibility means ensuring citizenship, and AI, in this context, is a powerful tool for creating more inclusive digital environments.

The most obvious applications are voice recognition and speech synthesis systems. As Giansanti points out, advances in natural language processing have made voice interfaces increasingly fluid, allowing people with motor difficulties to control electronic devices without having to use their hands.[35] At the same time, speech synthesis has reached levels of naturalness that facilitate understanding, reducing the feeling of artificiality. Digital inclusion also depends on these more natural interaction experiences, which reduce the perceived distance between people and technology. Anyone who has tried a voice assistant knows how liberating it can be to simply say 'turn on the light' or 'open the file' and see the action take place without having to lift a finger. For a person with motor difficulties, this simplicity is not a detail: it is autonomy that is gained every day. [36]

Another area of great interest is the automatic generation of subtitles, image descriptions and accessible texts. Ahmmad et al. describe AI-based systems that not only transcribe audio in real time, but also generate image descriptions for blind users. This feature is essential not only for enjoying multimedia content, but also for accessing information on social media, educational platforms and institutional websites.[37] The ability to make the invisible visible – through textual descriptions of visual content – represents a significant advance for inclusion.[38]

However, digital accessibility is not just a technical issue. As Scully points out, it is also a political and ethical field: deciding which bodies and minds to include in training datasets means determining who will truly benefit from these technologies. When AI is trained primarily on 'neurotypical' speakers or voices without particular inflections, it risks failing to recognise input from people with speech impairments or

[34] C. Ruiz, F. Martinez, *Spatio-temporal transformer to support automatic sign language translation*, 2025.
[35] D. Giansanti, A. Pirrera, *op. cit*., 556.
[36] J.L. Scully, *Disability and AI: Much more than assistive technologies*, in *Science, 389*, 2025. See also D. Giansanti, A. Pirrera, *op. cit*., 556.
[37] J. Ahmmad, O.A. Al-Dayel, M.A. Khan *et al., op. cit*., 18335.
[38] J.L. Scully, *op. cit*., 389. See also J. Ahmmad, O.A. Al-Dayel, M.A. Khan *et al., op. cit*., 18335.

strong accents. This is what Scully calls 'algorithmic ableism': the systematic exclusion of non-conforming experiences, which ends up reinforcing existing discrimination.

Finally, digital accessibility also requires consideration of infrastructure: fast internet connections, up-to-date devices and accessible software are not evenly distributed. Without careful public policy, there is a risk that AI-based assistive technologies will remain the privilege of the few, turning the promise of inclusion into a new factor of social exclusion.[39]

[39] J.L. SCULLY, *op.cit.*, 389.