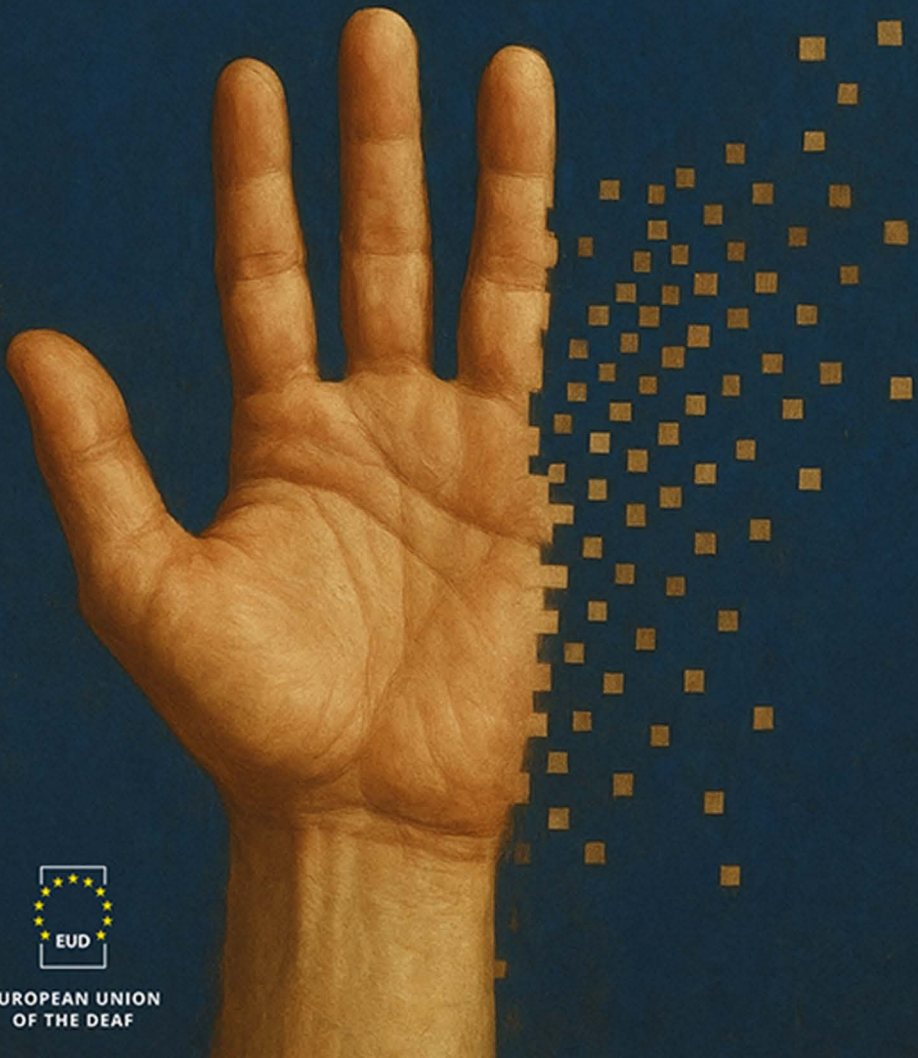
Sign Language in the Era of Artificial Intelligence

Prof Dr Filipe Venade de Sousa



EUD
EUROPEAN UNION OF THE DEAF

Sign Language in the Era of Artificial Intelligence
Prof. Dr Filipe Venade
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Published by:
European Union of the Deaf
Rue de la Loi / Wetstraat 26/15
1040 Brussels, Belgium

Typesetting: David Hay and Delphine le Maire
Cover Design: David Hay

ISBN-13: 978-90-83573-20-5
Printed in Belgium

This project was supported by a fellowship from Signly, with cooperation from Overseas Interpreting. The opinions therein are those of EUD and the author.

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ACKNOWLEDGEMENT

I would like to express my sincere gratitude to the European Union of the Deaf (EUD) and to Signly, whose generous support has been instrumental in making this publication possible. Their commitment to advancing accessibility and inclusion through innovation has been invaluable to this work.

My heartfelt thanks go to all the individuals and organisations who have contributed their expertise, insights, and dedication. In alphabetical order by surname, I would like to thank:

Robin Angelini, Charlotte Berthier (efsli), Alexandre Bloxs, Caro Brosens, Annika De Maeyer, Dr Maartje De Meulder, Hannes De Durpel, Sandra Duguid (ENSLT), Dr Sarah Ebling, Neil Fox, Dr Hilde Haualand, Sofia Isari, Matt Kirby, Delphine le Maire, Lisa Lepp, Tom Lichy, Dr Johanna Mesch, Dr Joseph Murray (WFD), Dr Rehana Omardeen, Frankie Picron, Dr Christian Rathmann, Dr Péter Zalán Romanek, Daniel Škrip, Vladimír Šimon, Andy Van Hoorebeke and Davy Van Landuyt.

I also thank the following organisations for their written inputs and support:

Svaz neslyšících a nedoslýchavých osob v ČR (SNN v ČR) – Czechia, Irish Deaf Society (IDS) – Ireland, and Ente Nazionale per la protezione e l'assistenza dei Sordi (ENS) – Italy.

Each of your contributions—whether through workshop participation, written submissions, or organisational support—has enriched this report and reinforced our collective commitment to protecting and promoting sign languages and Deaf rights. It has been a privilege to collaborate with such a diverse and dedicated group.

FOREWORD

By Sofia Isari, President of the European Union of the Deaf

Dear colleagues, partners, and members of the deaf community,

It is my great honour to welcome you to this important and timely initiative led by the European Union of the Deaf, thanks to the sponsorship of Signly, on the ethical, legal, and human rights dimensions of Artificial Intelligence in Sign Languages.

As AI technologies rapidly evolve, we stand at a critical juncture. These technologies offer exciting possibilities for greater accessibility, yet also carry risks that must be clearly understood and addressed. For deaf people across Europe, the impact of AI is not just technical—it is deeply linguistic, cultural, and human. It affects how our languages are represented, how our identities are perceived, and how our rights are respected.

This report, along with the contributions gathered from our members and allies, reflects a strong and united message: AI must not be developed without our input. Deaf people must be at the centre of every stage—from design to deployment. Our experiences, our sign languages, and our rights must be safeguarded by frameworks rooted in co-creation, transparency, and full compliance with the UN Convention on the Rights of Persons with Disabilities.

I am proud of the leadership shown by our deaf researchers, organisations, and communities in Europe who are working tirelessly to ensure that users of national sign languages are not left behind in the digital age. We also acknowledge the valuable support of our allies who stand with us in calling for

ethical standards, inclusive innovation, and the protection of our linguistic and cultural heritage.

Let us work together—across borders, sectors, and disciplines—to shape a future where artificial intelligence serves as a tool for equality, not exclusion.

Thank you for your commitment, and I look forward to continuing this journey with all of you.

Warm regards,
Sofia Isari
President
European Union of the Deaf

PREFACE

This publication, *Sign Language in the Era of Artificial Intelligence*, builds upon the introduction of the present volume. It brings together legal, academic, and community perspectives from across the EU at a time when the rapid growth of Artificial Intelligence (AI) is reshaping—and directly impacting—the conditions for communication, accessibility, and human rights for deaf people.

AI is already being integrated into public services, education systems, and digital platforms, and its use is expanding throughout European society. The European deaf community is no exception. Yet this broad shift towards AI risks threatening the already fragile status of sign languages. Increasingly, companies are investing in automated translation tools and AI-generated avatars, presenting them as cost-effective alternatives to professional and accredited national sign language interpreters. However, these developments often fail to meaningfully involve deaf communities or reflect the linguistic and cultural integrity of sign languages. When AI is developed without such foundations, it risks reinforcing exclusion rather than addressing it. In other words, even significant financial investment will be wasted if the resulting tools are not accepted or welcomed by deaf communities. It is therefore essential to adopt a co-creation approach, ensuring ownership by the European deaf community.

While the recently adopted **EU Artificial Intelligence Act** sets clear obligations, its provisions remain limited when it comes to safeguarding the linguistic and cultural rights of deaf communities and their national sign languages.

For this reason, the European Union of the Deaf commissioned Prof. Dr Filipe Venade to produce an exploratory report on the current state of AI and sign languages in Europe. The report's central message is unequivocal: when it comes to sign languages, AI must be governed by a human-rights-based approach—one that fully recognises the cultural and linguistic characteristics of sign languages and reaffirms deaf communities as right-holders, capable of choosing their own tools and futures rather than being passive recipients of externally designed innovations.

The report also introduces the concept of *Deaf Digital Rights* and highlights the importance of using AI to support deaf-centred technological development, rather than treating AI merely as a tool for accessibility. Ultimately, AI should serve as one option among many available to deaf people—not as their only option.

This publication, although presented in book format, is not a traditional book. It is a compilation of three key components—interconnected yet standalone.

First, the **Ethical Framework** outlines the minimum conditions necessary to ensure that AI technologies are safe, inclusive, and co-designed with deaf communities. This document is intended for developers and companies seeking to develop AI systems that involve sign languages. It provides practical guidance on the do's and don'ts of such an undertaking.

Second, the **Declaration of Principles** sets out eleven concrete commitments to guide developers, public authorities, EU institutions, academia, and civil society in ensuring that AI truly includes deaf people and national sign languages.

Finally, the **Exploratory Report** offers an in-depth analysis of the current landscape of AI and sign languages. It is structured into three parts: conceptual foundations, multidisciplinary insights, and legal frameworks. The report concludes with recommendations for developing inclusive and rights-based AI for deaf people and their national sign languages. The report is enriched by national contributions from both academia and civil society, providing valuable examples of lived experience and existing policy gaps across Europe. Both the report and the external contributions are complementary. This report represents the first of its kind in the field of AI and sign languages and it highlights the need for continued research and development in the future.

This publication is not just a technical resource; it is a call to action. It insists that AI development and deployment must reflect the lived realities of deaf people. AI can only advance equality if it is built *with* and *for* deaf communities—not imposed upon them. The content of this volume is intended to inform future political and legal action, grounded in evidence, expertise, and community consultation.

I would like to thank all the contributors to this publication who made its release possible, and I wish you an insightful and engaging read.

Frankie Picron
Executive Director
European Union of the Deaf

ETHICAL FRAMEWORK ON AI AND SIGN LANGUAGE

Deaf Digital Law as a Foundational Principle

Any application of AI in the context of sign language must adhere to the principles of *Deaf Digital Law* – a developing legal framework aimed at regulating and safeguarding the equitable and ethical use of digital technologies by and for deaf people. Its purpose is to uphold deaf people's right to full digital citizenship and participation in the digital sphere.

1) AI as a Tool for Inclusion, Not Substitution

AI must function as a driver of inclusion, complementing rather than replacing national (and regional) sign language interpreters. It must not undermine the indispensable role of human professionals in critical communication settings, particularly those involving legal, medical, educational, and democratic participation.

2) Balancing Innovation and Cultural Preservation

Technological development must be pursued in tandem with the preservation and respect for sign language as an element of intangible cultural heritage. The deployment of AI in this context should enhance, not erode, the linguistic and cultural richness of deaf communities.

3) Empowerment Through Accessible Participation

AI technologies should be harnessed to promote the full participation of deaf people across all sectors of society — education, healthcare, employment, civic engagement, and digital environments — ensuring their language rights and removing barriers to access in public and private life.

4) Human Rights-Centred Design

The development and deployment of AI systems must respect the principles of equality, non-discrimination, accessibility and proportionality in all areas of everyday life. They must actively prevent harm and ensure that sign language users are not marginalised in the design or outcome of AI systems.

5) Deaf Technologies as Universal Design

AI should be understood not merely in terms of accessibility but as a pathway to innovate “deaf technologies” — technological solutions rooted in deaf experiences that offer broader societal benefits. Such developments should follow the principles of universal design.

6) Co-Creation with Deaf Communities

AI systems involving sign languages must be developed through meaningful and sustained collaboration with deaf

communities. Co-creation ensures that technological innovation contributes positively to the present and future of sign languages and aligns with the needs and values of deaf communities.

7) Intersectional Approaches to Fairness

Deaf people often experience intersectional forms of discrimination, including on the basis of disability, language, ethnicity, and gender. AI systems must be tested and audited using an intersectional lens to ensure they do not reinforce or exacerbate existing inequities.

8) Culturally Respectful Data Collection

The collection of sign language data must involve native signers of national and regional sign languages, respecting linguistic variation, facial grammar, and cultural context. Special care must be taken to include and fairly represent regional, minority, and underrepresented variants to avoid algorithmic bias and cultural erasure.

9) Informed and Voluntary Consent

Signers must provide informed and voluntary consent prior to data collection. Clear and transparent information must be given regarding the purpose, use, and potential reuse of the

data. Any use beyond the original intent requires renewed consent.

10) Respect for Original Expression

AI developers must not modify or alter sign language recordings in a way that distorts or misrepresents their original meaning or cultural expression. Authenticity must be maintained throughout the development lifecycle.

11) Safeguarding Cultural and Linguistic Integrity

Sign language data must not be used to train AI systems unless robust safeguards are in place to preserve its cultural and linguistic integrity. Misuse or misrepresentation risks cultural appropriation and harms the legitimacy of AI outputs.

12) Protection of Personal and Cultural Identity

Signers' names, images, voices, facial expressions, and signing styles constitute integral parts of their professional and cultural identities. These must not be reproduced, simulated, or cloned through avatars or AI-generated content without the signer's explicit, prior, and separate written authorisation.

13) Fair Compensation for Data Use

Signers must be fairly remunerated for their contributions, with compensation proportionate to the duration, scale, and nature of the data's use in AI systems. Transparent agreements must outline terms of use and duration.

14) Accountability and Responsibility

AI developers, providers, and operators bear ethical responsibility not only for the technical performance of their systems but also for ensuring cultural and linguistic appropriateness. They must be held accountable for any harm resulting from misuse or misrepresentation of sign language data.

DECLARATION OF ETHICAL PRINCIPLES FOR THE USE OF ARTIFICIAL INTELLIGENCE IN SIGN LANGUAGES AND DEAF COMMUNITIES

Preamble

Within the fast-changing environment of artificial intelligence (AI), in which technology defines almost all that is current and contemporary in our lives, the implications for excluded communities, and particularly for deaf communities, need to be addressed with extreme caution and forethought. With AI systems now entering more deeply into the sphere of communication, specifically through sign language interpretation, there needs to be critical examination of the possible advantages as well as of the dangers such new developments hold.

This Declaration is envisaged on the premise that AI, if applied to sign language and language rights of deaf people, must not only keep pace with technological advancement but also maintain the human dignity, cultural identity, and language rights of deaf people.

Observing the unprecedented growth and influence of AI, it is evident that such technologies are deployed under the premise of efficiency, accessibility, and inclusivity.

Considering the specific linguistic and cultural aspects of sign languages, it is important that we acknowledge the boundaries and dangers of AI systems being introduced into this field without due consideration of these aspects. Sign languages such as National Sign Languages (NSLs) are not communication instruments but languages themselves with intricate visual-spatial grammars, firmly entrenched in the daily lives, histories, and identities of deaf communities. They are cultural symbols that symbolize the manner in which deaf people perceive and engage with the world.

Recognizing this, we must ensure that AI technologies introduced into this environment are engineered to support, rather than destroy, these fundamental linguistic and cultural bases.

Documenting the growing reliance on AI-based systems as a solution for sign language interpretation, we are confronted with the reality that these systems are often offered as low-cost, large-scale replacements for human interpreters as solutions to facilitate legal requirements and regulatory demands of accessibility.

Although the convenience and cost-effectiveness of such technology may appear appealing, in light of the practical implications in the real world, *it is evident* that the pervasive use of AI-enabled translation poses a risk to the quality, depth, and cultural sensitivity provided by human interpreters.

It is therefore important to highlight that AI must never be regarded as a replacement for human experts but rather as an added tool, one that should act to complement, not replace, the access and expertise to which deaf people are entitled both in digital and offline spaces.

Taking into account the technical limitations beneath AI, particularly in the area of low-resource languages such as sign languages, the use of such technologies raises grave concerns about their effectiveness. AI technologies, even more so those that are machine learning-based, are highly dependent on huge volumes of accurate data. But with sign languages, data sets are sparse, and regional varieties, dialects, and visual-spatial syntax are difficult for AI systems to capture.

Considering these challenges, it is clear that AI-powered sign language translation cannot be relied upon as a one-size-fits-all solution.

Noting the risks of misrepresentation, exclusion of certain varieties of sign languages, and propagation of translation errors, it is imperative that we demand the creation of AI systems with rigorous mechanisms to prevent such impacts.

Acknowledging the specific privacy concerns associated with the use of AI in sign language technologies, in particular the use of biometric and visual data, is important.

Taking into consideration the potential for such data to be exploited or inappropriately used, it is necessary that the collection of sign language data for AI systems is carried out transparently, with full knowledge and agreement of deaf people who use these languages, and with proper respect for their privacy and autonomy.

Considering the ethical application of AI must be based on the values of linguistic diversity, accessibility, reasonable accommodation, and universal design, as encapsulated in international and regional human rights law. Such values ensure technologies are not just technologically viable but socially aware and inclusively designed – capable of learning across a diversity of users, sign languages, contexts, and communicative intent.

In light of these observations, considerations, and challenges, *it is imperative* that this Declaration reaffirms the language rights of deaf people to self-determination in communication and ensures that AI technologies are developed and applied in

manners that respond to their linguistic, cultural, and personal interests.

In crafting these principles, we imagine a future in which deaf people are not passive recipients of technological solutions, but co-authors of technology. The use of AI in sign language contexts must be faithful to the everyday lives of deaf people, responsive to their rightful demands for accessibility, autonomy, and participation. By placing the deaf communities' voices and experiences at the forefront of AI system design, development, and deployment, we reaffirm our collective dedication to a future in which technology enhances, rather than hinders, human connection, understanding, and engagement.

This Declaration comes from the conviction that AI must be for the advancement of deaf communities – not the other way around. It recognizes that ethical AI involves not only compliance with technical or legal requirements, but with enhancing justice, equity, and flourishing of human diversity. It is a call to responsibility, co-creation, and mutual care in the conception, development, and use of technologies.

By setting out an unambiguous platform of ethical standards, this Declaration seeks to guide all stakeholders – governments, developers, institutions, researchers, companies, and civil society – towards one shared vision where AI systems contribute to linguistic inclusion, social participation, and the full realization of the rights of deaf people around the world.

1. Respect for Human Dignity and Linguistic Identity

AI must uphold and respect the dignity, autonomy, and linguistic identity of deaf people and sign language users. NSLs

are equal to spoken languages, rich, and legitimate languages with complexity and linguistic variations. AI systems should therefore enhance – not diminish – their public visibility, cultural standing, and legal recognition.

2. Freedom of Choice

Deaf people have the right to make independent choices about communication modalities and technologies that best suit their requirements and preferences. Freedom of choice can only be achieved if several and high-quality options – both digital and non-digital – are offered and made possible. AI must not be imposed as a substitute for human professional NSL interpretation, particularly in high-stakes settings such as education, justice, health, political life, and employment. Access to AI tools must be subsequent to and in support of informed, independent decision-making made by deaf people.

3. Inclusive and Participatory Development

The development, piloting, and rollout of AI systems both for sign languages and deaf technologies benefitting deaf people must directly be led by deaf professionals in relevant fields such as developers, engineers, scientists and linguists. This participatory involvement ensures cultural sensitivity, linguistic accuracy, and ownership of technological developments by deaf communities.

4. Deaf Technologies, Cultural Appropriateness and Linguistic Accuracy

AI must strive for the promotion and encouragement of technologies enhancing the cultural, linguistic and identity development of deaf communities, also referred as “Deaf

Technologies". Furthermore, AI must strive for high accuracy and contextual sensitivity in translating and interpreting sign languages. This includes the faithful rendition of non-manual signals, facial expressions, and spatial grammar that are essential to meaning. Translation must also be faithful to content and context of communication.

5. Transparency and Explainability

AI systems must operate transparently. Sign language users must be informed clearly if they are dealing with AI-generated content and from what resources the content is generated. The operations, limitations, and range of AI interpretations must be explainable and, where necessary, subject to human review and correction, especially in high-risk applications, following AI-related regulations and legislations such as the EU AI Act.

6. Right to Human Professional National Sign Language Interpretation and Translation

The use of AI must not erode and substitute the right to human professional NSLs interpreters and translators but rather complement whenever appropriate. In complex, emotional, or high-stakes situations – such as legal proceedings, medical appointments, educational instruction, or emergency services – human interpretation remains vital to deliver nuance, clarity, and full understanding.

7. Data Protection and Visual-Biometric Privacy

The collection and processing of NSLs data for training AI must be in strict compliance with the relevant data protection legislation and ethical research standards. In addition, the collection and use of data for training AI systems in NSLs must

be in accordance with strict standards of cultural and linguistic integrity. It is required that the data used be not only accurate and contextually appropriate, but also from valid sources within the deaf communities themselves. The visual aspects of language (e.g. facial expression) are biometric, consent must be informed, freely given, and fully revocable.

Data must be collected through the recording of deaf people being native signers and not, in any case, use data from NSLs Interpreters (i.e. interpreted events, news broadcastings, among others) to feed Sign Language AI systems.

The collected data must be securely stored, encrypted where appropriate and not shared with third parties without additional written permission. The data should be deleted or anonymised upon request, wherever technically feasible.

8. Prevention of Harm, Bias, and Misuse

AI systems must be rigorously tested by deaf persons representing the diversity in the deaf communities to prevent misinterpretation, cultural erasure, or discriminatory outcomes. Potential risks of harm, bias and misuse must be identified and risk mitigation measures must be implemented, including mechanisms for identifying and correcting bias, and processes for addressing any harms that may arise from the use of AI in public or private domains.

9. Equity in Access and Sustainability

All deaf people must have equitable access to AI systems irrespective of their intersectional identities and experiences comprising of their racial or ethnic origin, religion, languages, gender identity, disabilities, socio-economic status, sexual

orientation, age and any other layers of identities. Additionally, the systems must be designed for long-term sustainability with ongoing updates incorporating language evolution, accessible user feedback, and empirical performance evaluations with the deaf communities.

10. Accountability and Redress Mechanisms

There must be discernible accountability processes for all parties involved in the co-creation and implementation of AI systems. This must involve access to usable channels of complaint, remedy, and human intervention where AI systems result in harm, exclusion, or miscommunication. These remedies must be available and accessible in the NSLs.

11. Encouragement of Linguistic and Cultural Diversity

AI development must go beyond just respecting and promoting the richness of national and regional sign languages to encompass innovative solutions deaf people can bring to AI systems. Deafhood as well as linguistics entail that all life-experiences and sign language varieties are valued, represented, and incorporated in AI systems to contribute to diverse, multilingual and multicultural digital spaces.

SIGN LANGUAGE IN THE ERA OF ARTIFICIAL INTELLIGENCE: EXPLORATORY REPORT

EXECUTIVE SUMMARY

This report critically explores the impact of Artificial Intelligence (AI) on the digital rights of deaf communities, paying particular focus on the use of AI in the automatic translation of sign languages. It starts with the observation that, although legal requirements for accessibility are increasing, businesses and institutions increasingly turn to AI systems as quick and inexpensive solutions, instead of to the quality, cultural appropriateness and engagement of the concerned communities themselves.

Structured into three parts – conceptual, legal and multidisciplinary – the report develops the concept of Deaf Technology and makes a case for establishing the new discipline of Deaf Digital Law, which addresses digital accessibility and algorithmic ethics. Based on international documents such as the CRPD, the UNESCO Recommendation on the Ethics of AI and the upcoming Council of Europe treaty on AI and Human Rights, the report warns against the risks of replacing human interpreters with low-reliability automatic systems and promotes a vision of technological co-governance, centred on the knowledge and human rights of deaf people.

The document concludes with a set of practical recommendations which aims to guide public policies, technological practices and regulatory forms that are sensitive to social justice, linguistic sovereignty and the active participation of deaf communities in the digital age.

1. INTRODUCTION

Technological Development and the Impact of AI

The inflexion point of modern ideas of accessibility into the lives of deaf communities is designated by the incorporation of AI in the field of sign language interpretation and, not only that, but also, in any technological context, accessible technological solutions for deaf people in various areas of daily life.[1] Increasingly, AI technologies created and implemented offer solutions to automate sign language interpretation yet are presented and marketed as "innovative" solutions to the rapidly expanding legal requirements and demands for inclusion, most notably within the digital space. From websites and mobile apps to automated customer service platforms and online educational platforms, AI-powered sign language technologies are being marketed as more affordable alternatives to human interpreters.

(In)Accessible Solutions

But beneath the veneer of technological innovation are pressing ethical, social, and practical concerns. Beneath this controversy lies a troubling trend: the promotion of AI as a cost-cutting "quick fix" by governments, corporations, and

[1] For example, OZARKAR, S.; CHETWANI, R.; DEVARE, S.; HARYANI S. & Giri, N. (2020) "AI for Accessibility: Virtual Assistant for Hearing Impaired," *2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT)*, Kharagpur, India, 2020, pp. 1-7, doi: 10.1109/ICCCNT49239.2020.9225392.
ALKAHTANI, B.N. (2024). The Impact of Artificial Intelligence on Quality of Life for Deaf and Hard of Hearing Students. *American Annals of the Deaf 169*(4), 329-347. https://dx.doi.org/10.1353/aad.2024.a946587.
KAFLE, S., GLASSER, A., AL-KHAZRAJI, S., BERKE, L., SEITA, M., & HUENERFAUTH, M. (2019). Artificial intelligence fairness in the context of accessibility research on intelligent systems for people who are deaf or hard of hearing. *ACM SIGACCESS Accessibility and Computing*, 1 - 1.

institutions looking to meet regulatory requirements with minimum investment. This tendency not only diminishes accessibility to a question of procedural compliance alone, but risks undermining the more fundamental commitments to linguistic justice and human dignity upon which inclusive societies are based.

AI Concerns and Risks

Though such technologies are already ubiquitous in online spaces, their application is now set to move into high-stakes offline domains — like healthcare[2], education[3], judicial proceedings[4], and public administration[5] - where communication demands a high level of accuracy, contextual understanding, and cultural sensitivity. Replacement of professional interpreters with imperfect AI systems in these fields carries the risk of severe implications: miscommunication, misdiagnosis, denial of rights, and further marginalization of deaf people.

AI and Linguistic Diversity: Dilemmas

[2] Council of Europe. Report on the Impact of Artificial Intelligence on the Doctor-Patient Relationship - INF(2022)5, 7 June 2022, CDBIO

[3] Council of Europe. Recommendation on developing and promoting digital citizenship education - CM/Rec(2019)10; UNESCO. Artificial intelligence in education. https://www.unesco.org/en/digital-education/artificial-intelligence?hub=32618

[4] Council of Europe. Assessment Tool for the operationalisation of the European Ethical Charter on the use of artificial intelligence in judicial Systems and their environment – CEPEJ(2023)16Final; Guidelines on videoconferencing in judicial proceedings (including the use of AI) – CEPEJ(2021)4; European Ethical Charter on the use of artificial intelligence (AI) in judicial systems and their environment - CEPEJ(2018)14

[5] Council of Europe. Feasibility study on the establishment of a certification mechanism for artificial intelligence tools and services (in the sphere of justice and judiciary) - CEPEJ, 8 December 2020

Additionally, current AI systems, when turned to sign languages, remain connected with considerable technical constraints: though all sign languages are “low-resource” languages, not just due to the fact that their extensive, annotated corpora in regional or dialectical varieties have been limited so far, but also because most AI models do not possess the equivalent linguistic strength to encapsulate all the visual-spatial grammar, embodied characteristics - of facial expressions, body posture and movement - that construct the sign language's meaning[6]. This limitation perpetuates a digital divide where only deaf people who have high literacy in the written majority languages are in a good position to communicate with AI systems, thereby promoting structural inequalities and excluding those who use predominantly sign language.

In addition, the embodied nature of sign languages poses pressing questions of privacy and data ethics. Unlike spoken or written language, sign language is made by and through the body – gestures, facial expressions, handshapes – and as such is much more identifiable and far less amenable to anonymisation. The use of this type of biometric and visual data for training AI models heralds complex problems of informed consent, data ownership, representation, and the commodification of bodily expression.

The Need for Answers to Legitimate Questions

These intersecting issues highlight the necessity of an ethical, rights-based model of AI design, development, and deployment in sign language spheres – one that foregrounds quality,

[6] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.3 pp. 167-187 of the same volume)

autonomy, and the active participation of deaf communities. Technological advancement must not come at the expense of disrespected human dignity, compromised cultural integrity, or sacrificed linguistic equity.

It is here that the concept of Deaf Tech (Deaf Technology) emerges.[7] Deaf Tech envisions technology as a socio-political and epistemological endeavour instead of an apolitical tool.[8] In this regard, it asserts that technologies must be created with, not for, the deaf communities, based on their language rights, cultural identities, and collective aspirations. Deaf Tech disrupts technocentric paradigms by insisting on co-creation[9], respect for sign language ecologies, and resistance to "ableist norms"[10] in digital infrastructures.

Objectives, Structure, and Content of the Report

The purpose of this report is to provide a holistic ethical, legal, and sociotechnical framework for the responsible and fair use

[7] For example, Deaf Accessibility Technology: What Devices do Deaf People Use? https://www.handtalk.me/en/blog/deaf-accessibility-technology/

[8] ANGELINI, Robin; SPIEL, Katta & DE MEULDER, Maartje (2024). *Experiencing Deaf Tech: A Deep Dive into the Concept of DeafWatch*. In Proceedings of the 26th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '24). Association for Computing Machinery, New York, NY, USA, Article 83, 1–4. https://doi.org/10.1145/3663548.3688483; ANGELINI, Robin (2024): *Deaf tech worth wanting: A participatory speculative investigation*. DOI: 10.34726/hss.2024.117205

[9] DE MEULDER, M.; VAN LANDUYT, D., & OMARDEEN, R. (2024). *Lessons in co-creation: the inconvenient truths of inclusive sign language technology development*. https://arxiv.org/abs/2408.13171

[10] PHUTANE, Mahika; SEELAM, Ananya & VASHISTHA, Aditya (2025). "*Cold, Calculated, and Condescending": How AI Identifies and Explains Ableism Compared to Disabled People*. In Proceedings of the 2025 ACM Conference on Fairness, Accountability, and Transparency (FAccT '25). Association for Computing Machinery, New York, NY, USA, 1927–1941. https://doi.org/10.1145/3715275.3732128

MANKOFF, Jennifer; KASNITZ, Devva; JEAN CAMP, L.; LAZAR, Jonathan & HOCHHEISER, Harry (2024). *AI Must Be Anti-Ableist and Accessible*. Commun. ACM 67, 12 (December 2024), 40–42. https://doi.org/10.1145/3662731

of AI in applications involving sign languages and deaf people. The foundational premise of this endeavour is to recognise that sign languages are not auxiliary communication systems but, instead, are complete natural languages and a constituent part of the cultural, political, and epistemic existence of deaf communities. Any technological intervention with these languages, then, must be governed by justice, dignity, and participatory accountability.

The report is organized into three related segments:

(i) ***Conceptual Foundations*****:** The first part explores the theoretical underpinnings of Deaf Tech and situates it within wider debates on digital rights. Here, Deaf Tech is not presented as a collection of assistive technologies, but as an enfranchising, inclusive, and community-driven model of innovation. This section also introduces the concept of Deaf Digital Law: a proposed legal regime that legislates the digital rights of deaf people, protects the integrity of sign languages,

and regulates algorithmic harms[11], data sovereignty[12], and digital accessibility governance[13].

(ii) ***Multidisciplinary Perspectives*****:** The second part draws on interdisciplinary perspectives to explore how AI is reshaping the communicative environments of deaf people. Special focus is given to the embodied nature of sign language communication and its consequences for the use of AI.

(iii) ***Legal and Ethic Frameworks*****:** Part three examines the legal and ethical framework for AI, based on prominent international frameworks including the OECD's Updated Definition of an AI System[14], UNESCO's Recommendation on the Ethics of Artificial

[11] Council of Europe. Recommendation of the Committee of Ministers to member States on the human rights impacts of algorithmic systems - CM/Rec(2020)1; Declaration of the Committee of Ministers on the manipulative capabilities of algorithmic processes - Decl(13/02/2019)1; Recommendation of the Parliamentary Assembly of the Council of Europe about Technological convergence, artificial intelligence and human rights; Recommendation 2102(2017) Human rights by design: Future-proofing human rights protection in the era of AI, Follow-up Recommendation by the Commissioner for Human Rights, May 2023

[12] ROBERTS, H. (2024) Digital sovereignty and artificial intelligence: a normative approach. *Ethics Inf Technol* 26, 70 (2024). https://doi.org/10.1007/s10676-024-09810-5

SRIVASTAVA, Swati & BULLOCK, Justin. (2024) *AI, Global Governance, and Digital Sovereignty*. Available at SSRN: https://ssrn.com/abstract=4996387 or http://dx.doi.org/10.2139/ssrn.4996387

[13] For example, LAZAR, Jonathan; GOLDSTEIN, Daniel F. & TAYLOR, Anne (2015). *Ensuring Digital Accessibility through Process and Policy* (1st. ed.). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

[14] OECD. Artificial Intelligence. https://www.oecd.org/en/topics/artificial-intelligence.html

Intelligence[15], and the Council of Europe's Framework Convention on AI, Human Rights, Democracy and the Rule of Law and CRPD. Particular attention is given to the trend of embracing AI-powered sign language systems as cost-effective alternatives to human interpreters in high-stakes areas.[16]

The report concludes with a set of actionable suggestions to policymakers, developers, public institutions, and civil society actors. The report aims to contribute to and guide the strategic actions of the EUD, which can defend and respond to issues that accompany the rapid development of AI.

[15] UNESCO. Ethics of Artificial Intelligence. https://www.unesco.org/en/artificial-intelligence/recommendation-ethics?hub=32618

[16] For more information, Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§1, pp. 143-149 of the same volume); Italian Association of the Deaf (Ente Nazionale Sordi) (2025). *Notes on the Ethical and Policy Framework Concerning the Use of Artificial Intelligence (AI) in Sign Languages (AISL) and Related Deaf Technologies*. (pp. 139-142 of the same volume); ŠKRIP, Daniel; ŠIMON, Vladimír (ADH Czechia (SNN v ČR) (2025) Call for Contributions: Ethical and Legal Framework for AI in Sign Languages (pp. 150–166 of the same volume)

CHAPTER I: DEAF TECH AND THE FOUNDATIONS FOR A DEAF DIGITAL LAW IN THE AGE OF ARTIFICIAL INTELLIGENCE

1. Term "Artificial Intelligence"

The unprecedented evolution of Artificial Intelligence (AI) is re-shaping our digital spaces, not only influencing the manner in which knowledge is produced and exchanged, but also the manner in which human communication is mediated and interpreted. [17] Deaf communities and sign language users find themselves at a strategic crossroads within this new paradigm: *they are among the first to experience the benefits and challenges of AI-mediated accessibility*.[18] The use of AI for sign language interpretation and translation is gaining prominence, driven primarily by the increasing pressures on institutions, particularly in the public and digital spaces, to achieve legal accessibility obligations in cost-effective and scalable ways.

According to the Organisation for Economic Co-operation and Development (OECD), AI is "*a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or*

[17] OECD (2025), "Steering AI's future: Strategies for anticipatory governance", *OECD Artificial Intelligence Papers*, No. 32, OECD Publishing, Paris, https://doi.org/10.1787/5480ff0a-en.

[18] ABASCAL, J.; BARBOSA, S. D.; NICOLLE, C. & ZAPHIRIS, P. (2015). Rethinking universal accessibility: a broader approach considering the digital gap. *Univ. Acc. Inform. Soc.* 15, 179–182. doi: 10.1007/S10209-015-0416-1

virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment." [19]

[19] OECD (2024), "Explanatory memorandum on the updated OECD definition of an AI system", *OECD Artificial Intelligence Papers*, No. 8, OECD Publishing, Paris, https://doi.org/10.1787/623da898-en. "(…) TOPICS TYPICALLY ENCOMPASSED BY THE TERM "AI" Topics typically encompassed by the term "AI" and in the definition of an AI system include categories of techniques such as machine learning and knowledge-based approaches, and application areas such as computer vision, natural language processing, speech recognition, intelligent decision support systems, intelligent robotic systems, as well as the novel application of these tools to various domains. AI technologies are developing at a rapid pace and additional techniques and applications will likely emerge in the future. The OECD definition aims to be flexible by reflecting a broad understanding of AI, and actors using this definition are encouraged to exercise judgement on its relevant scope, depending on the context it is being used in. ROLE OF HUMANS, AUTONOMY AND ADAPTIVENESS Regarding the role of humans, an AI system's objective setting and development can always be traced back to a human who originates the AI system development process, even when the objectives are implicit. However, some types of AI systems can develop implicit sub-objectives and sometimes set objectives for other systems. Human agency, autonomy, and oversight vis-à-vis AI systems are critical values in the OECD AI Principles that depend on the context of AI use. The OECD definition of an AI system intentionally does not address the issue of liability and responsibility for AI systems and their potentially harmful effects, which ultimately rests with humans and does not in any way pre-determine or pre-empt regulatory choices made by individual jurisdictions in that regard. AI system autonomy (contained in both the original and the revised definition of an AI system) means the degree to which a system can learn or act without human involvement following the delegation of autonomy and process automation by humans. Human supervision can occur at any stage of the AI system lifecycle, such as during AI system design, data collection and processing, development, verification, validation, deployment, or operation and monitoring. Some AI systems can generate outputs without these outputs being explicitly described in the AI system's objective and without specific instructions from a human. Adaptiveness (contained in the revised definition of an AI system) is usually related to AI systems based on machine learning that can continue to evolve after initial development. The system modifies its behaviour through direct interaction with input and data before or after deployment. Examples include a speech recognition system that adapts to an individual's voice or a personalised music recommender system. AI systems can be trained once, periodically, or continually and operate by inferring patterns and relationships in data. Through such training, some AI systems may develop the ability to perform new forms of inference not initially envisioned by their programmers."

The UNESCO[20] also underscores that AI is not just a technological innovation, but a sociotechnical phenomenon which must be guided by ethical values, human rights, inclusivity, and sustainability. At the same time, the Council of Europe's Convention on Artificial Intelligence, Human Rights, Democracy and the Rule of Law (AI Convention)[21] underlines that AI systems must be transparent, fair, accountable, and developed in full respect of human dignity and diversity.

Concept and general scope

But the term AI embraces a wide range of technologies, and its extension to deaf people and sign languages requires inherent conceptual clarification. For the sake of this report, AI is understood not as a single "monolithic" system, but as a constellation of computational models and tools that are able to perform tasks typically requiring human intelligence –such as recognition, translation, generation, and interaction – when applied to language and visual communication.

OECD (2025), "Towards a common reporting framework for AI incidents", *OECD Artificial Intelligence Papers*, No. 34, OECD Publishing, Paris, https://doi.org/10.1787/f326d4ac-en.

CALVINO, F. *et al.* (2024), "A sectoral taxonomy of AI intensity", *OECD Artificial Intelligence Papers*, No. 30, OECD Publishing, Paris, https://doi.org/10.1787/1f6377b5-en.

[20] Global AI Ethics and Governance Observatory. https://www.unesco.org/ethics-ai/en

[21] The Framework Convention on Artificial Intelligence. https://www.coe.int/en/web/artificial-intelligence/the-framework-convention-on-artificial-intelligence

Specifically, the report is grounded in an analysis of three broad categories of AI technologies:[22]

(i) AI-powered Translation Systems[23], which include computer vision-based systems capable of recognizing and displaying signs in real time and are increasingly studied as substitutes for human sign language interpreters in digital and in-person settings;

(ii) Generative AI, like large multimodal models that can create synthetic content, like sign language avatar animation[24], textual summarizations[25], or visual output created from written description or gesture inputs[26];

[22] OECD (2022), "OECD Framework for the Classification of AI systems", *OECD Digital Economy Papers*, No. 323, OECD Publishing, Paris, https://doi.org/10.1787/cb6d9eca-en.

[23] ZAKI, M. Z., & AHMED, U. (2024). Bridging Linguistic Divides: The Impact of AI-powered Translation Systems on Communication Equity and Inclusion . *Journal of Translation and Language Studies*, *5*(2), 20–30. https://doi.org/10.48185/jtls.v5i2.1065

[24] KIPP, Michael; NGUYEN, Quan; Heloir, Alexis & Matthes, Silke. (2011). Assessing the deaf user perspective on sign language avatars. In The proceedings of the 13th international ACM SIGACCESS conference on Computers and accessibility (Dundee Scotland, UK). ACM, 107–114. https://doi.org/10.1145/2049536.2049557

[25] AKHMETOV, Iskander; NURLYBAYEVA, Sabina; UALIYEVA, Irina; PAK, Alexandr, & GELBUKH, Alexander. (2023). A Comprehensive Review on Automatic Text Summarization. *Computación y Sistemas*, *27*(4), 1203-1240. Epub 17 de mayo de 2024.https://doi.org/10.13053/cys-27-4-4792; KAUSHAL, A., LIN, C.-C., CHAUHAN, R., & KUMAR, R. (2024). Charting the Growth of Text Summarisation: A Data-Driven Exploration of Research Trends and Technological Advancements. *Applied Sciences*, *14*(23), 11462. https://doi.org/10.3390/app142311462

[26] LINARDAKIS, Manousos; VARLAMIS, Iraklis & TH. PAPADOPOULOS, Georgios (2025). Survey on Hand Gesture Recognition from Visual Input. https://arxiv.org/abs/2501.11992

(iii) Language Models (LLMs)[27], like transformer-based models (like GPT) that function and provide output in written language but are being used for multimodal applications that take sign language input and generate sign language output in the form of gesture recognition[28], video creation[29], or avatar animation[30].

Accessible technological solutions as an object of legal treatment

In acknowledging this diversity, the report adopts a functional perspective on AI: it doesn't just examine the technology itself, but rather its concrete applications in deaf people's lives – namely, how AI is being designed, marketed, and put into practice in the name of accessibility and inclusion. While some innovations hold out the promise to enhance digital equity, they also raise profound ethical and social concerns if implemented without sufficient oversight, cultural awareness, or participatory governance. These concerns include undermining the right to

[27] OECD (2023), "AI language models: Technological, socio-economic and policy considerations", *OECD Digital Economy Papers*, No. 352, OECD Publishing, Paris, https://doi.org/10.1787/13d38f92-en.

[28] ZHANG, Yanqiong; HAN, Yu; ZHU, Zhaosong; JIANG, Xianwei & ZHANG, Yudong (2024). *Artificial intelligence in sign language recognition: A comprehensive bibliometric and visual analysis*. Comput. Electr. Eng. 120, PC (Dec 2024). https://doi.org/10.1016/j.compeleceng.2024.109854; PANOPOULOS, I., TOPALIS, E., PETRELLIS, N., & HADELLIS, L. (2025). Greek Sign Language Detection with Artificial Intelligence. *Electronics*, *14*(16), 3241. https://doi.org/10.3390/electronics14163241

[29] DIGNAN, C.; PEREZ, E.; AHMAD, I.; HUBER, M.; & CLARK, A. (2022). An AI-based approach for improved sign language recognition using multiple videos. *Multimed. Tools Appl.*, pp. 1–22. doi: 10.1007./S11042-021-11830-Y/TABLES/11

[30] KIPP, M., HELOIR, A., NGUYEN, Q. (2011). Sign Language Avatars: Animation and Comprehensibility. In: Vilhjálmsson, H.H., Kopp, S., Marsella, S., Thórisson, K.R. (eds) Intelligent Virtual Agents. IVA 2011. Lecture Notes in Computer Science, vol 6895. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-23974-8_13

professional human interpretation, linguistic misrepresentation, sidelining “low-resource” languages or invasion of privacy.[31]

It is therefore essential to examine how AI systems are being marketed as “cheap” substitutes for human-based services, particularly in high-stakes settings – such as healthcare, education, government, and justice. This path, which is economically attractive to institutions, raises essential questions regarding digital quality, individual autonomy, and linguistic justice. AI must not be deployed as a “cheap solution” for accessibility, replacing human expertise with automated substitutes lacking the cultural sensitivity, emotional sensitivity, and contextual intelligence required for high-risk communication in sign languages.

Digital access as a matter of legal recognition and not as a privilege

By doing so, the report establishes that deaf people are not passive users of technological systems, but epistemic agents who must be recognized as co-designers of the digital future. AI must not be built around deaf people without deaf people. It is only through a commitment to co-governance, accessibility, and language rights that the application of AI can become an instrument of linguistic justice rather than a mechanism of exclusion.

[31] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§5 and 6, pp. 143-149 of the same volume); Italian Association of the Deaf (Ente Nazionale Sordi) (2025). *Notes on the Ethical and Policy Framework Concerning the Use of Artificial Intelligence (AI) in Sign Languages (AISL) and Related Deaf Technologies*. (pp. 139-142 of the same volume); ŠKRIP, Daniel; ŠIMON, Vladimír (ADH Czechia (SNN v ČR) (2025) Call for Contributions: Ethical and Legal Framework for AI in Sign Languages (pp. 150–166 of the same volume)

Here, technology access is not a privilege – it is an equal opportunity.[32] Deaf people must be guaranteed the right to employ technologies designed to meet their communicative preferences, culturally and linguistically appropriate, and produced in close collaboration with deaf communities. Furthermore, freedom of choice must not be compromised by the use of AI, in the sense that deaf people need to employ AI tools alone where a human interpreter or other accommodation is more appropriate to the context.

Thus, the ethics of AI in deaf spaces must enshrine the core human rights values of accessibility, equality, participation, and reasonable accommodation. The AI may be a true facilitator of inclusion and empowerment, rather than a source of new exclusions or unintended harm, only on such a rights and community-oriented foundation.

This report therefore builds on the normative foundation established by the OECD[33], UNESCO, and the Council of Europe, and strives to apply these principles to the situation of deaf people in a digital society. It provides ethical guidelines and risk analyses for AI system development, deployment, and regulation of AI systems designed for or impacting sign language communication, ensuring that such systems reflect the real-world needs and expectations of the people for whom they are to serve.

[32] HAMMERSCHMIDT, T., STOLZ, K., & POSEGGA, O. (2025). Bridging the gap: inequalities that divide those who can and cannot create sustainable outcomes with AI. *Behaviour & Information Technology*, 1–30. https://doi.org/10.1080/0144929X.2025.2500451

[33] OECD AI Principles overview. https://oecd.ai/en/ai-principles

2. Deaf Tech: A Transformative Framework for Deaf-Centred Technological Innovation

Essential concept

The concept of Deaf Tech represents a paradigm shift away from traditional models of "assistive technology,"[34] which have tended to approach deafness as a disability to be mitigated or cured. In contrast, Deaf Tech is based on a deaf-centred, rights-based model that affirms Deafhood[35] as a linguistic, cultural, and social identity - not a disability to be "fixed," but a difference to be appreciated and celebrated.

From this perspective, Deaf Tech refers to technologies created by, with, or/and for deaf people, based on their lived experiences, communicative practices, and cultural values. It foregrounds sign languages, visual and tactile modalities of engagement, and the value of communicative autonomy. In doing so, it presents a critical reaction to "monological technological fixes" – like voice-only recognition systems or automated avatars – by proposing instead a deaf digital ecosystem based on self-determination, informed consent, technological diversity, and cultural recognition.

[34] ABDALLAH, E. E. & FAYYOUMI, E. (2016). "Assistive technology for deaf people based on android platform," in *Procedia Computer Science*. Elsevier, B.V., pp. 295–301. doi: 10.1016/j.procs.08044; BOTELHO, F. H. F. (2021). Accessibility to digital technology: Virtual barriers, real opportunities. *Assis. Technol.* 33, 27–34. doi: 10.1080/10400435.2021.1945705

[35] LADD, P. Deafhood: A concept stressing possibilities, not deficits. *Scandinavian Journal of Public Health*. 2005;33(66_suppl):12-17. doi:10.1080/14034950510033318

Examples of Deaf Tech include: AI-driven sign language recognition[36], interpretation, and translation systems; Visual and vibrotactile alert systems for alerts and alarms[37]; Accessible video communication platforms that are sign

[36] PAPASTRATIS I, CHATZIKONSTANTINOU C, KONSTANTINIDIS D, DIMITROPOULOS K, DARAS P. (2021). Artificial Intelligence Technologies for Sign Language. Sensors (Basel). 2021 Aug 30;21(17):5843. doi: 10.3390/s21175843. PMID: 34502733; PMCID: PMC8434597.

[37] POOKKUTTATH, S., ABDULKADER, R. E., ELARA, M. R., & VEERAJAGADHESWAR, P. (2023). AI-Enabled Vibrotactile Feedback-Based Condition Monitoring Framework for Outdoor Mobile Robots. *Mathematics*, *11*(18), 3804. https://doi.org/10.3390/math11183804 ; G. A. d. Souza *et al*. (2018). "Evaluation of Visual, Auditory and Vibro-Tactile Alerts in Supervised Interfaces," *2018 20th Symposium on Virtual and Augmented Reality (SVR)*, Foz do Iguacu, Brazil, 2018, pp. 163-169, doi: 10.1109/SVR.2018.00033.

language-friendly; Sign language avatars[38], gesture-recognition interfaces[39], and haptic feedback technologies[40].

Above all, Deaf Tech must be understood not as an extension of "assistive paradigms", but as a transformational model – one that reframes accessibility as intrinsic to technological design, rather than an auxiliary add-on. It envisions inclusion on deaf terms, foregrounding empowerment, individual autonomy, and cultural affirmation.

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[38] DE MARTINO, J. M.; SILVA, I. R.; BOLOGNINI, C. Z.; COSTA, P. D. P.; KUMADA, K. M. O.; CORADINE, L. C., *et al.* (2017). Signing avatars: making education more inclusive. *Univ. Access Inform. Soc.* 16, 793–808. doi: 10.1007/S10209-016-0504-X/TABLES/3

ANGELINI, Robin & SPIEL, Katta & DE MEULDER, Maartje. (2024). Bridging the Gap: Understanding the Intersection of Deaf and Technical Perspectives on Signing Avatars. 10.1007/978-3-031-47362-3-12.

ANGELINI, Robin (2023). Contrasting Technologists' and Activists' Positions on Signing Avatars. In Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23). Association for Computing Machinery, New York, NY, USA, Article 566, 1–6. https://doi.org/10.1145/3544549.3583946

KRAUSNECKER, Verena & Schügerl, Sandra. (2021). Best Practice Protocol on the Use of Sign Language Avatars. https://avatar-bestpractice.univie.ac.at/en/english/

QUANDT, Lorna C; WILLIS, Athena; SCHWENK, Melody; WEEKS, Kaitlyn & FERSTER, Ruthie. (2022). Attitudes Toward Signing Avatars Vary Depending on Hearing Status, Age of Signed Language Acquisition, and Avatar Type. Frontiers in psychology 13 (2022), 730917. https://doi.org/10.3389/fpsyg.2022.730917~

WOLFE, Rosalee. (2021). Sign language translation and avatar technology. Machine Translation 35, 3 (2021), 301–304.

WOLFE, Rosalee; MCDONALD, John C; HANKE, Thomas; EBLING, Sarah; LANDUYT, Davy Van ; PICRON, Frankie; KRAUSNEKER, Verena; EFTHIMIOU, Eleni; FOTINEA, Evita & Braffort, Annelies. (2022). Sign Language Avatars: A Question of Representation. Information 13, 4 (2022), 206.

[39] Lu, W., Fang, P., Zhu, M., Zhu, Y., Fan, X., Zhu, T., Zhou, X., Wang, F., Chen, T. and Sun, L. (2023), Artificial Intelligence–Enabled Gesture-Language-Recognition Feedback System Using Strain-Sensor-Arrays-Based Smart Glove. Adv. Intell. Syst., 5: 2200453. https://doi.org/10.1002/aisy.202200453

[40] Shi Y, Shen G. (2024). Haptic Sensing and Feedback Techniques toward Virtual Reality. Research (Wash D C). 2024 Mar 23;7:0333. doi: 10.34133/research.0333. PMID: 38533183; PMCID: PMC10964227.

Deaf-centred co-creation and governance

The creation of AI solutions for Deaf communities must be based on co-creation and co-governance, understood through democratic practices of solution-making in common. Accessibility cannot in this context be reduced to a once-off adaptation mechanism but must be understood as a structural and transversal right, a *sine qua non* for full participation in all social, cultural, and political dimensions.

To this purpose, it is paramount that AI design, development, and regulation entail the active, informed, and transparent participation of Deaf people in all their linguistic and cultural diversity. This includes encompassing, from its outset, Deaf experts, representative organisations, and diverse communities — Including deaf seniors, LGBTQIA+ people, BIPOC people, and other intersectional identities.[41]

AI policy must actively recognize that there is not a single deaf experience but a number of social and cultural realities. Co-design[42] with the deaf community through deaf experts and deaf-led organisations during the entire AI lifecycle (planning, development, implementation, monitoring and evaluation) should be not just an ethical requirement, but a legal and political one as well.[43]

[41] Council of Europe. Recommendation of the Committee of Ministers to member States on protecting the rights of migrant, refugee and asylum-seeking women and girls - CM/Rec(2022)17

[42] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§3.5, pp. 167-187 of the same volume)

[43] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (pp.

Essential legal framework: regulation and complementarity of AI

Deaf Digital Law can be as a specific and complementary legal field, aiming to make sure that advances in AI. The design of Deaf Digital Law should be based on tools that have already been created at an international level – such as the CRPD, the Council of Europe Convention on Artificial Intelligence, and European Union law – that set minimum normative standards for the realization of equality and accessibility.

AI, for such ends, can neither be imagined as an end in itself, but as an *instrumental right*: a means to strengthen and supplement the effectiveness of the deaf people's inherent rights and freedoms. Instrumentality in this context refers to that any technological solution that is on offer must be responsive to the deaf community's wishes, interests, and genuine choice, or it will reinforce disparities rather than mitigate them.

AI must therefore be seen as a complement to human intervention, not a substitute. Where there are sensitive fields – health, justice, education, public services – in SL, not just human interpretation[44], knowing that it is not merely a "technical service" but also a linguistic and cultural right.[45]

167-187 of the same volume); Italian Association of the Deaf (Ente Nazionale Sordi) (2025). *Notes on the Ethical and Policy Framework Concerning the Use of Artificial Intelligence (AI) in Sign Languages (AISL) and Related Deaf Technologies*. (pp. 139-142 of the same volume)

[44] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.1, pp. 167-187 of the same volume);

[45] See, about depersonalization, RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (pp. 167-187 of the same volume)

Deaf people and digital rights

Deaf people must be viewed not as passive recipients or consumers of technology, but as active participants, co-designers, and rights-holders in digital system development and deployment.[46] AI no doubt has tremendous potential, yet it must not substitute for human professionalism where nuance, emotional intelligence, or sensitivity to ethics matter most, such as in legal, educational, or healthcare settings. Nor should AI promote one-size-fits-all models of accessibility that fail to respect the cultural and linguistic diversity of deaf communities.

Instead, AI should function as an enabling technology, expanding the variety of communication modalities available to deaf users and allowing them to select the modalities best suited to their identities, preferences, and contextual demands.

For AI technologies to support the rights and dignity of deaf people, the following underlying principles should guide their design and utilization:

(i) ***Freedom of Choice***: Deaf people should have the right to choose any form of communication, both in direct human interactions in different modalities and, if possible, through technological devices (e.g., captions, haptic feedback), and they also have the right to have human interpretation services that best adapt to their

[46] Italian Association of the Deaf (Ente Nazionale Sordi) (2025). *Notes on the Ethical and Policy Framework Concerning the Use of Artificial Intelligence (AI) in Sign Languages (AISL) and Related Deaf Technologies*. (pp. 139-142 of the same volume): "This reflects a broader societal narrative in which Deaf individuals are viewed as passive recipients of information rather than as active agents shaping their communicative environments. Access is prioritized over participation"

needs and desires.[47]

(ii) ***Reasonable Expectations of Inclusion***: AI must be designed with a heightened sensitivity to the cultural, linguistic, and social contexts of deaf users. Technologies must not impose reductive or homogenising frameworks of accessibility but instead reflect the richness and diversity of deaf experiences.

(iii) ***Human Rights-Based Innovation***: Deaf space AI innovation must be led by ethical structures that put digital accessibility, equal access, and deaf people as full members in the digital existence.

Deaf Tech, as thought of here, strives to marry honest AI creation to deaf people's existing experience, esteem, and rights. It envisions an open future in which technologies do not merely replicate hearing-oriented norms but instead empower deaf people through culturally and linguistically affirming design. By putting deaf agency at the forefront of AI and other digital systems' design and governance, Deaf Tech affirms the requirement that inclusion must be participatory, intersectional, and grounded first and foremost in human rights.

3. Deaf Digital Law: Ensuring Language Rights in the Digital World

Multilevel scope of rights

[47] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§4 in education and §5 in structured interactions (in public services) (pp. 167-187 of the same volume)

Language rights of the deaf people have been fought for worldwide in public and private spaces throughout history. Public space pertains to official recognition of sign languages in education, public administration, healthcare, and other public services. Private space entails the use of sign language in family, workplace, and communities' spaces.[48] With the advent of digital technologies, though, there has emerged a new and distinct arena: the digital world, one that needs its own particular legal safeguards. [49]

Digital Law is the set of principles and rules that regulate the use of technology in society. Critical elements of this body of law are the right to privacy, data protection, and accessibility in the digital world. In this domain, Digital Law seeks to protect the legitimate interests of all users, having their rights equally respected in public, private, and now digital spaces. It ensures that virtual communities will play a positive role in fostering a respectful, inclusive, and linguistically diverse society.

From Deaf Tech, we can move towards the broader concept of Deaf Digital Law – a branch of law aimed at regulating and safeguarding the ethical and equitable application of digital technologies by and for the deaf people.[50] This emerging

[48] SOUSA, Filipe Venade de. (2025). SHAPING SIGN LANGUAGE POLICY: STATUS PLANNING TOWARDS MULTILINGUALISM. *Caderno De Letras*, (49), 289-311. https://doi.org/10.15210/cdl.vi49.27436

[49] European declaration on digital rights and principles. https://www.consilium.europa.eu/en/policies/european-declaration-on-digital-rights/

SMUHA, Nathalie A. (2025). The Cambridge Handbook of the Law, Ethics and Policy of Artificial Intelligence. Cambridge University Press.

SOURDIN, Tania; DIMATTEO, Larry A.; PONCIBÒ, Cristina; CANNARSA, Michel (eds) (2023). Cambridge Handbook of Artificial Intelligence: Global Perspectives on Law and Ethics. *Prometheus.* 2023.

[50] ROBERTS, T. (2025). *Understanding Digital Rights: Definitions, Conceptions, and Myths*, Brighton: Institute of Development Studies, DOI: 10.19088/IDS.2025.014

concept encompasses Deaf Digital Rights, which define the distinctive rights of the deaf people in relation to digital technologies, AI, and digital accessibility. Deaf Digital Law is thus key to achieving the full digital citizenship of the deaf people.

Safeguarding, advocating, and adequately embedding sign languages in the digital space through targeted legal provisions needs to be guaranteed. These provisions shall ensure that technologies become drivers of inclusion rather than widening exclusion. Public policy and law must therefore transform according to this new standard, building a digital future that is genuinely accessible and inclusive.

The Deaf Digital Law idea introduces a different legal framework for the full integration of deaf people into cyberspace. It broadens the common understanding of digital accessibility to cover, for instance, the implementation of sign languages in digital interfaces, virtual assistants[51], sign language inclusion into social networking sites, streaming services, and customer service platforms.

AI technologies, and any future digital systems, must be designed and deployed in a way that openly benefits the sign language user. The systems must foster linguistic diversity by ensuring sign language users with whatever structures and supports they require to thrive in the digital age. Additionally, they must be designed to avoid imposing disproportionate

[51] TRAN, Nina; DEVRIES, Paige S; SEITA, Matthew; KUSHALNAGAR, Raja; GLASSER, Abraham; VOGLER, Christian. (2024). Assessment of Sign Language-Based versus Touch-Based Input for Deaf Users Interacting with Intelligent Personal Assistants. In Proceedings of the CHI Conference on Human Factors in Computing Systems (Honolulu, HI, USA) (CHI '24). Association for Computing Machinery, New York, NY, USA, Article 53, 15 pages. https://doi.org/10.1145/3613904.3642094

financial or social burdens on deaf communities, particularly in accessing goods, services, and digital infrastructure.

Digital Law demands that AI technologies and systems have high standards of accessibility so that sign languages are properly represented and not devalued or marginalized. Deaf users should be facilitated to make independent choices of digital services freely, without being interfered with, biased, or restricted, particularly in cases where they may prefer AI-mediated services over human interpreters. By this reasoning, AI must be an empowerment technology for human beings, such that human beings' interests and rights take precedence.

Transparency is also an important principle. AI systems must make it known to users when they are interacting with artificial agents, and the systems must be trained on representative and inclusive datasets to prevent algorithmic discrimination[52]. Most importantly, human oversight mechanisms[53] must be put in place to fix outputs that could infringe the rights of sign language users.

In the field of Digital Law, it would be morally wrong for AI to ever be used to unequally decide the choices of the deaf people – most importantly, in vital areas like health, education, employment, and other areas relevant to deaf people. Freedom

[52] Council of Europe. Study on Discrimination, artificial intelligence, and algorithmic decision-making - ECRI, November 2018; Study on the impact of artificial intelligence systems, their potential for promoting equality, including gender equality, and the risks they may cause in relation to non-discrimination - GEC/CDADI, August 2023

[53] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.3.1: EU AI Act Article 14 (Oversight) – Encouraging human oversight in AI-mediated communication) (pp. 167-187 of the same volume); Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (pp. 143-149 of the same volume): "Human oversight by native signers"

of choice must always be preserved through access to simple, trusted, and well-navigable information.

The privacy rights and data protection are also necessary. Deaf people must exercise control over their personal information and its use. Apart from these, digital rights comprise the right to create, share, use, and access digital content in sign language. For these rights to be fully exercised, deaf users must access the required technologies, devices, and telecommunication infrastructures equally, respecting the cultural and linguistic diversity of the sign languages.

Lastly, digital rights of the sign language users should be recognized as part of the broader human rights context of universal human rights in the digital age. Legal protections should ensure that all persons, depending on the language spoken, are accorded the dignity and respect automatically due to them.

CHAPTER II: MULTIDISCIPLINARY CONTRIBUTIONS FROM THE USE OF AI

1. Technological and digital evolution of sign languages

This report recognizes that the digital revolution has significantly accelerated the progress of high-tech machinery and AI capabilities, which continue to dominate scientific research, inventions, and business activities. [54] Indeed, AI has emerged as a vehicle for automating sign language

[54] European Parliament resolution of 3 May 2022 on artificial intelligence in a digital age (2020/2266(INI))
European Parliament resolution of 20 October 2020 with recommendations to the Commission on a framework of ethical aspects of artificial intelligence, robotics and related technologies (2020/2012(INL))

interpretation as an attractive, “low-cost” option for business firms and governments under pressure to meet burgeoning accessibility demands, especially in digital settings. AI translation, which initially targeted the digital space, is now being gradually extended to even more fields, and its potential expansion to offline environments such as government institutions, hospitals, and other service, where the need for simultaneous translation can lead organisations to turn to AI alternatives rather than human interpreters in order to cut costs, is raising essential issues about deaf communities linguistic integrity and social inclusion.

Today, AI is unwell positioned in numerous senses to properly capture sign language's sheer linguistic richness and cultural significance.[55] The initial threat is to human interpreters who add a degree of empathy, context, and understanding that will be replaced by oversimplifications or even distortion of sign languages using AI equipment which jeopardizes quality and accessibility to communication. This risk of poor-quality, machine translation in sensitive areas like healthcare and public services that have an essential human dimension is a real threat to the very language rights of sign language users, possibly making them marginalized.

It is clear that AI will transform many aspects of life, including the experiences of deaf communities and sign language users, as well as sign language professionals. Given this world, the effects of AI on sign language cannot be ignored or treated as

[55] Han Zhang, Rotem Shalev-Arkushin, Vasileios Baltatzis, Connor Gillis, Gierad Laput, Raja Kushalnagar, Lorna C Quandt, Leah Findlater, Abdelkareem Bedri, and Colin Lea. (2025). Towards AI-driven Sign Language Generation with Non-manual Markers. In Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25). Association for Computing Machinery, New York, NY, USA, Article 278, 1–26. https://doi.org/10.1145/3706598.3713855

secondary uncertainty. Alternatively, they should be the cornerstone of the debate on digital literacy, linguistic freedom and advanced development.

Sign languages are “low-resource” languages, which further complicates the integration of AI technologies. AI language models struggle with languages that have limited digital coverage or data, and sign languages, which are not typically well-covered in written format, are especially vulnerable. This deficit might put sign language users in the backseat during the ongoing AI revolution, with only the recourse of using written language to interact with AI, a solution which may not be optimally suited to their communication requirements.

Moreover, AI-generated images or depictions of sign language pose additional problems, since sign language is inherently a bodily, physical means of communication. Compared with text-based language models, where written input can be anonymized, sign languages are recognizable, identifiable bodily movements, and therefore privacy and consent concerns are raised when these movements are created or used by AI systems.

Against such a background, it is clear that the incorporation of AI in sign language research and application has both opportunities and dangers. On the positive side, AI can be leveraged to enhance the visibility and access to sign language in virtual spaces. On the negative side, AI threatens to commodity and desecrate the “linguistic homogeneity” of sign language. Thus, it is necessary that deaf people and their advocate organisations take proactive measures to promote such AI developments so that they suit their social and linguistic requirements. Rather than awaiting machine learning-led developments to occur, they must take an active role in shaping

automated reasoning rules and innovations so that AI turns out to be an agent that fosters, rather than weakens, the vitality of sign language.

For instance, poorly designed AI systems can lead to disastrous errors in sign language translation[56], affecting both accuracy and understanding. To prevent such a scenario, AI technologies for sign language must be developed strictly so that they respect the language rights and intrinsic nature of the language. Additionally, AI must always be employed as an aid for sign language users, not as a replacement for their natural mode of communication.

In an effort to achieve trust with AI technology among sign language users, the platforms should be executed under tight supervisory systems that ensure preservation of the linguistic and cultural identity of the sign language users. The sign language should never be reduced to a digitized language aimed at data communications, but should have systems designed that will serve specific purposes for the sign language users without diluting the integrity of the language.

Furthermore, an assessment system of risks should be established in order to evaluate the impact of AI innovations on sign language users. The system should examine potential risks in light of their potential severity and likelihood, ensuring that AI-driven innovations achieve high standards of language safety, factuality, traceability, human oversight, and customer protection.

[56] Parton BS. (2006) Sign language recognition and translation: a multidisciplined approach from the field of artificial intelligence. J Deaf Stud Deaf Educ. 2006 Winter;11(1):94-101. doi: 10.1093/deafed/enj003. Epub 2005 Sep 28. PMID: 16192405.

Lastly, successful AI integration into the sign language framework will depend on synergy between public policies, technological innovation, and the active involvement of deaf communities. Through building collaboration between decision-makers, technology developers, and deaf organisations, one can ensure that AI will be utilized to support the preservation and growth of sign language, rather than undermining its viability in the digital age.

2. Ethical safeguards in AI for sign languages

A central issue at the intersection of AI and sign language is the potential misappropriation or dilution of sign languages in the digital domain.[57] Large-scale implementation of automation through AI could unintentionally disempower human sign language interpreters and compromise the quality of human-to-human interaction in sign language. As AI technologies are in the process of developing, it is feared that the nuances, cultural richness, and human value of sign language will be reduced to a mere digital code, distorting its very nature in the interests of efficiency and technological progress.

For AI systems to attain the deserving trust of sign language users, they must be developed within a firmly established ethical and legal framework that respects and preserves the linguistic and cultural integrity of sign languages. Sign languages are not just a communication tool but are strongly connected with the identity, heritage, and social life of deaf

[57] DE MEULDER, Maartje. (2021). Is "good enough" good enough? Ethical and responsible development of sign language technologies. In Proceedings of the 1st International Workshop on Automatic Translation for Signed and Spoken Languages (AT4SSL). Association for Machine Translation in the Americas, Virtual, 12–22. https://aclanthology.org/2021.mtsummit-at4ssl.2

people. AI should not be a tool that compromises this integrity, and it should not be allowed to reduce sign languages into computational data points for research or commerce. The commodification and digitization of sign languages should be tightly controlled so as not to strip them of their intrinsic nature or distance them from their lived reality.[58]

In this regard, it is important to establish firm legal limits that rein in the excesses of technological innovation into the linguistic rights of sign language users. Sign languages ought not to be forcibly compressed or distorted by AI tools in ways that subvert their internal structures and meanings. AI should not be viewed as a means of substitution or redefinition of sign languages based on technological constraints, but rather as a way to provide greater accessibility without interfering with the essential characteristics of the languages themselves. Rather than as a replacement for human communication, AI needs to function as a facilitator, allowing for greater inclusivity without interfering with the integrity of sign language.

Therefore, there should be regulatory legal and ethical frameworks outlining the use of AI in sign language. The frameworks should establish clear boundaries so that the pace of technological advancement does not tip the scale against the linguistic rights and cultural stakes of sign language users. The objective should be to balance the potential of innovation with the preservation of linguistic diversity so that AI technologies

[58] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§1, pp. 143-149 of the same volume): "Deaf cultures and sign languages must be protected and not commodified or standardised by AISL technologies"

augment human communication and the preservation of cultures rather than undermining it.[59]

To make sure that AI is being ethically and responsibly used in the field of sign language, a number of significant mechanisms must be put in place to guarantee transparency, accountability, and public trust. These are not just a precaution but are necessary to make sure that the users of sign language are empowered and not excluded by technology. Among the steps, the following are essential:

(i) ***Risk Classification Models***: These models would identify and analyse potential risks to sign language users, considering both risk severity and likelihood. These models would function to anticipate challenges and minimize the negative impacts of AI implementation in this sector, helping to create systems that respect the language rights of deaf people.[60]

(ii) ***High-Quality Data Standards:*** AI models are only as good as the data they are trained on. There is a necessity to have strict data standards to ensure that AI models are trained on trustworthy, representative,

[59] Council of Europe. E-relevance: The Role of Arts and culture in the Age of Artificial Intelligence - CM/Rec (2022)1; Recommendation of the Committee of Ministers to member States on the role of culture, cultural heritage and landscape in helping to address global challenges - CM/Rec (2022)15

[60] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§3, pp. 143-149 of the same volume): "A similar but nuanced approach could be applied to specifically to AI and sign languages i.e. what is considered limited or minimal risk in other AI systems may indeed be considered unacceptable or high risk in the case of, for example, using AI text/voice-to-sign in medical, legal or educational settings." See. RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§4–5; 6.6) (pp. 167-187 of the same volume)

and ethically sourced sign language datasets. Data should be varied, reflecting a diversity of sign language dialects, and be gathered in a way that respects the privacy and consent of the communities. This way we can ensure governance by deaf communities on the datasets

(iii) ***Exhaustive Documentation and Traceability:*** AI-generated sign language content must be traceable with comprehensive documentation of how these systems function. This enables professionals and sign language users to audit and verify AI-generated outputs, giving insight into the processes behind them and facilitating human oversight. Documentation should include explanations of algorithms, ethical access to data sources[61], and potential limitations of the technology.

(iv) ***Human-Centred AI Design:*** AI systems cannot be designed in isolation by technical experts alone. Sign language users must be actively involved in developing, testing, and calibrating AI systems. Through collaboration with the deaf communities at every stage of AI design, these systems can be better designed to meet their needs while respecting the unique features of their languages. This collaboration is critical to ensuring that AI technologies accurately

[61] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§4, pp. 143-149 of the same volume)

reflect the lived experiences and values of sign language users.[62]

(v) ***Transparent Accountability Mechanisms:*** Transparent accountability mechanisms are needed to determine who is responsible when errors or biases happen in AI-generated sign language content.[63] These mechanisms must offer sign language users recourse for addressing grievances and holding developers responsible for mistakes. There must also be mechanisms for quickly detecting and fixing any errors or harm caused by AI systems, especially in high-stakes areas such as healthcare, education, or public services.

Achieving these protections requires coherence between public policy, research agendas, and technological investment. Policymakers, researchers, and scientists must work together to ensure AI systems are not advancing at the expense of language rights and cultural integrity. AI must be envisioned as a tool that supports and enhances the goals of the deaf communities, not one that diminishes their linguistic heritage. In this context, public policies must give precedence to the creation and conservation of sign languages, in a way that these languages are not commodified or appropriated in a way that diminished their value and meaning.

[62] Italian Association of the Deaf (Ente Nazionale Sordi) (2025). *Notes on the Ethical and Policy Framework Concerning the Use of Artificial Intelligence (AI) in Sign Languages (AISL) and Related Deaf Technologies*. (pp. 139-142 of the same volume)

[63] DESAI, Aashaka; DE MEULDER, Maartje; HOCHGESANG, Julie A.; KOCAB, Annemarie & LU. Alex X. (2024). Systemic Biases in Sign Language AI Research: A Deaf-Led Call to Reevaluate Research Agendas. https://doi.org/10.48550/arXiv.2403.02563 arxiv:2403.02563 [cs]

Importantly, AI systems must be created in close collaboration with deaf communities, in a way that technological innovation contributes positively towards the future of sign languages. By involving such communities in the development and implementation of AI, we can ensure that these sorts of technologies are created to resolve their real-world problems and needs, respecting their linguistic and cultural rights. It is not so that we should let AI replace human contact but use it as a tool for empowering sign language users towards greater accessibility, inclusion, and communication in every sphere of life.

Last but not least, the ethical deployment of AI in sign language environments requires a delicate balance between technological innovation and cultural heritage preservation.[64] Through the creation and adherence to clear ethical guidelines and legal safeguards, we can ensure that AI technologies are a force for good, supporting the health and sustainability of sign languages in an increasingly digital world.

3. Multidisciplinary and inclusive approaches to AI in sign language

The ethical evolution of AI for the context of sign languages requires a broad, multidisciplinary process encompassing learnings from different domains, including linguistics, law, ethics, and technology, among other disciplinary areas.[65] In as much as AI becomes progressively the determining force in

[64] Council of Europe. Recommendation of the Committee of Ministers to member States on the role of culture, cultural heritage and landscape in helping to address global challenges - CM/Rec (2022)15

[65] See. RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§2, 4, 5, 6) (pp. 167-187 of the same volume)

shaping the future of communication technologies, its application in sign languages should be examined with caution, with a multidisciplinary approach, to give due consideration to these languages being respected, preserved, and enhanced through technological development. The development of AI technology for sign language should not be solely driven by commercial or technical interests but should seek to address the real needs and interests of deaf communities.[66]

A key principle of this inclusive approach is the participation of sign language experts, deaf professionals, and deaf communities' representatives in the development process. It is critical that the users of sign language to convey information are not recipients of technology but key players in the creation of AI. Their experiences, insights, and perceptions should shape the creation of AI systems to ensure the tools reflect the nuances and cultural significance of sign languages. This approach not only adds more trust in AI technology but also ensures that the solutions developed are suitably matched to the requirements of sign language users.

There are no general standards or ethics directives on how to handle AI in sign language environments, particularly in virtual worlds and virtual spaces, currently.[67] The absence of such guidelines creates a huge gap in ensuring that AI tools are aligned with the linguistic rights and cultural heritage of deaf communities.[68] It is important that AI developers, researchers,

[66] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§1, pp. 143-149 of the same volume)

[67] For example, Interpreting SAFE AI Task Force Guidance on AI and Interpreting Services. https://safeaitf.org/guidance/

[68] For example, Ethics guidelines for trustworthy AI. https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

and policymakers collaborate to develop ethical standards and legal protections that guarantee the integrity of sign languages is upheld in digital platforms.[69]This alliance must go beyond technological innovation and step into the realm of policymaking, such that sign languages become not merely part of the AI revolution but are integrated in a way respectful of their uniqueness.

There are several areas requiring imperative attention in order to assure AI's ethical use in sign language technologies on both the technology and culture sides:

(i) Data Governance and Ethics

One of the largest challenges in developing AI for sign languages is regulation of data. AI require massive inputs of data in order to learn, but the collection and use of sign language data should be handled with absolute caution. Ethical guidelines must control the collection, use, and dissemination of data in a way that prevents encroachment of the cultural identity, and linguistic and cultural rights of deaf people. The automation of the sign languages in terms of AI should not reduce them to the level of mere data points or commodify them in a manner that belittles their cultural significance. In addition,

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AI Ethics Guidelines: A Practical Guide. https://codoid.com/ai/ai-ethics-guidelines-a-practical-guide/

Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators. https://op.europa.eu/en/publication-detail/-/publication/d81a0d54-5348-11ed-92ed-01aa75ed71a1/language-en

AI Ethics Statement. https://www.sil.org/ai-ethics-statement

HORVÁTH, I. (2022). AI in interpreting: Ethical considerations. *Across Languages and Cultures*, *23*(1), 1-13. https://doi.org/10.1556/084.2022.00108

[69] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.6.) (pp. 167-187 of the same volume)

there is the possibility of sign language corpora data being distorted or manipulated in ways that misrepresent deaf culture or reinforce biases. As one method to guard against these risks, data governance mechanisms[70] must be established to ensure that the information that gets used to create AI systems is ethically produced, culturally acceptable, and annotatively correct enough to preserve intact the sign language communication.

(ii) AI Transparency and Explainability

One of the biggest problems with AI is its "black box" approach, where models' decision-making is opaque and difficult to interpret even for experts. This becomes particularly dangerous when AI is being used in languages like sign language, where the stakes of accurate interpretation are high. To instil trust in AI systems, there must be an effort at the collective level to make AI transparent and easier to understand to users and developers. Although it is true that AI systems, and deep learning models specifically, are inherently complex, there is value in investing in making these technologies interpretable and accountable. That can mean developing tools that allow users, in this instance, sign language communities, to see how the AI is making its decision or producing its translation. More significant than technical transparency, though, might be developing digital and AI literacy in deaf communities. By providing sign language users with the cognitive foundation of how AI operates and what its application implies, they will be better equipped to work with, question, and ultimately develop the technology that impacts their lives. Literacy in AI must be at

[70] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§2.) (pp. 167-187 of the same volume): "with special focus on the decentralized data governance and open access"

the forefront of educational systems among the deaf so that deaf people can empower themselves to shape their own digital future.

(iii) Regulation by Human Agency

One of the most pressing problems is the possibility of AI replacing human sign language interpreters and translators, particularly in contexts such as government services, healthcare, or education. AI technologies need to be regulated appropriately so that they do not diminish the role of human professionals in critical communication contexts. To protect the dignity and value of the human interpreters' profession, regulatory systems must be put in place that clearly state when and how AI technology can be used in conjunction with human translation and not in place of it. The regulations must prioritize the accuracy, empathy, and social appropriateness that are the defining features of human interpreters so that AI technology does not compromise the quality of communication and experience of deaf people in issues of significant concern.

(iv) Education and Awareness Among Publics

Other than internal regulation and transparency, strong demand for public education and consciousness of the importance of sign languages and their challenges in the age of digital technologies is essential. Policymakers, designers, and the broader public must be educated about the specific character of sign languages and the potential dangers of modifying them using AI technologies without fully appreciating their cultural and linguistic depth. This broader societal awareness is central to the creation of political and social will required to make sure that AI technologies for sign language are developed in ways that benefit the deaf communities. It is

also necessary for policymakers to be informed of the potential negative effects of poorly designed AI systems, such as loss of linguistic diversity, deaf communities' marginalization, and risk of cultural appropriation[71].

Data availability, in the current context, sign language corpora, is a critical part of AI development. AI technologies rely on massive quantities of data to function, and sign language is no exception. Nevertheless, extensive access to sign language data must be regulated to prevent linguistic biases or misinterpretation[72]. For instance, not-so-representative sign languages or lesser-represented dialects within AI systems would sustain mistakes or even eliminate cultural and linguistic variation among the deaf people.[73]

Also, sign language data sharing and use can sometimes lead to unintended linguistic prejudices or even cultural appropriation[74]. If the AI systems are trained on misrepresentative data for sign language or lacking in its cultural elements, the generated translation can expose the

[71] S. Tiribelli, S. Pansoni, E. Frontoni and B. Giovanola. (2024). "Ethics of Artificial Intelligence for Cultural Heritage: Opportunities and Challenges," in *IEEE Transactions on Technology and Society*, vol. 5, no. 3, pp. 293-305, Sept. 2024, doi: 10.1109/TTS.2024.3432407.

[72] Kang O, Hirschi K. (2025). Bias and stereotyping: Human and artificial intelligence (AI). *Annual Review of Applied Linguistics*. Published online 2025:1-16. doi:10.1017/S026719052500008X; Hanna MG, Pantanowitz L, Jackson B, Palmer O, Visweswaran S, Pantanowitz J, Deebajah M, Rashidi HH. (2024). Ethical and Bias Considerations in Artificial Intelligence/Machine Learning. Mod Pathol. 2025 Mar;38(3):100686. doi: 10.1016/j.modpat.2024.100686. Epub 2024 Dec 16. PMID: 39694331.

[73] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§5, pp. 143-149 of the same volume)

[74]Karakaidou, Sofia (2019). Authorship and Appropriation in Artificial Intelligence generated Artworks. https://repositorio.ucp.pt/entities/publication/f722526c-0d23-48bf-bb33-8ade43e5a721

authenticity of sign language communication in the virtual space. It is therefore important that the gathering, exchange, and use of sign language information is controlled so that it is treated with respect, is accurate, and is attuned to the diverse requirements of sign language users.

4. Collaborative strategies and ethical imperatives for AI in sign language

Effective integration of AI into sign language communication requires strong partnerships among key stakeholders, including technological, political, and social actors.[75] There needs to be collaboration between developers of AI, deaf communities, linguists, and policymakers to ensure that AI-based solutions are compatible with the real needs of sign language users[76] and not a technology-driven solution that does not consider linguistic and cultural specifics.[77]

This would be achieved by establishing a platform that is dialogical and cooperative, having enabled structured

[75] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.2.) (pp. 167-187 of the same volume)

[76] ŠKRIP, Daniel; ŠIMON, Vladimír (ADH Czechia (SNN v ČR) (2025) Call for Contributions: Ethical and Legal Framework for AI in Sign Languages (pp. 150–166 of the same volume): "AI systems for sign language should be developed through open, interdisciplinary cooperation involving Deaf community representatives, linguists, legal experts, and technologists"

[77] See. RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.6 iv)) (pp. 167-187 of the same volume): "creation of a platform that provides a complementary and up-to-date list of legal documents, toolkits, guidelines, procedures, and other products (...) under a new subpoint."

interaction, knowledge sharing, and the ethical regulation of AI systems. This platform will:

(i) Ensure participative R&D (research and development) that ensures sign language users are active participants in the structuring of AI-created innovation.

(ii) Ensure rational resource management in the funding of AI-led R&D for sign language, and ensure these are applied responsibly and sustainably.

(iii) Establish reliable AI tools that encourage sign language without compromising its authenticity, offering linguistic accuracy, cultural awareness, and usability.

With technological advancement, ethical considerations must always come first. AI-driven sign language apps must augment human abilities rather than replace them to ensure deaf people have full access to human interpreters and can remain linguistically independent. AI can be designed as an auxiliary tool that can provide accessibility without compromising the inherent rights of sign language users.

CHAPTER III: AN ANALYSIS OF THE LEGAL AND POLICY FRAMEWORK INHERENT TO THE USE OF AI

1. United Nations (UN)

Throughout the United Nations system,[78] AI has been mostly identified as the world's biggest challenge, at its centre, transforming human relationships and social systems.

In 2022, the United Nations adopted the Principles for the Ethical Use of Artificial Intelligence in the UN System,[79] which closely mirror the Recommendation on the Ethics of Artificial Intelligence adopted by UNESCO in 2021.[80] The ten ethics and human rights-based principles are a roadmap to the ethical use of AI throughout all stages of its lifecycle in the UN entities. They must be read together with applicable policies and International Law, especially in the field of human rights. *The principles are: do no harm; defined purpose, necessity, and proportionality; safety; fairness and non-discrimination; sustainability; right to privacy, data protection, and data governance; human autonomy and oversight; transparency*

[78] UNRIC Library Backgrounder: Artificial Intelligence – Selected Online Resources.https://unric.org/en/unric-library-backgrounder-artificial-intelligence/; Governance of artificial intelligence. https://unsceb.org/topics/artificial-intelligence

[79] In September 2022, the United Nations System Chief Executives Board for Coordination endorsed the Principles for the Ethical Use of Artificial Intelligence in the United Nations System, developed through the High-level Committee on Programmes (HLCP) which approved the principles at an intersessional meeting in July 2022. https://unsceb.org/principles-ethical-use-artificial-intelligence-united-nations-system

[80] UNESCO. Recommendation on the Ethics of Artificial Intelligence. https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence

and explainability; responsibility and ac-countability; and inclusion and participation.

The UN Special Rapporteur on the Rights of Persons with Disabilities recently submitted a report to the Human Rights Council,[81] urging prompt regulation of AI to prevent systemic and often clandestine discrimination. The rapid progress in AI development brings both pioneering opportunities and terrible threats, in particular to people with disabilities. [82]

The Special Rapporteur points out that the CRPD contains explicit obligations of States regarding the regulation of AI, namely protection from discrimination. The obligations extend to private actors like technology companies and industry players beyond the public sphere. The report also highlights that States must ensure AI technologies are developed and designed in an inclusive way, incorporating the rights of persons with disabilities from their initial conceptualization. This preventive action requires not only robust regulatory steps, but also enabling inclusive innovation among the private sector to prevent the entrenchment of systemic barriers.

At the same time, AI can be a great force for advancing inclusion, most prominently through the development of assistive technologies that enhance autonomy and accessibility. AI-based innovations have the capacity to improve personal mobility, for example, by identifying accessible routes, and to aid communication through eye-

[81] UN. A/HRC/49/52: Artificial intelligence and the rights of persons with disabilities - Report of the Special Rapporteur on the rights of persons with disabilities. https://www.ohchr.org/en/documents/thematic-reports/ahrc4952-artificial-intelligence-and-rights-persons-disabilities-report

[82] Artificial intelligence and the rights of persons with disabilities. https://srdisability.org/thematic-reports/artificial-intelligence-and-the-rights-of-persons-with-disabilities/

tracking technology and speech-to-text software, enabling greater access to education and information. In addition, AI-based systems can tailor accommodations to meet specific needs, affirming the right to accessibility and reasonable accommodation. By expanding access to education, employment, and information, AI can transform lives and create a more inclusive globe.[83]

Yet, AI development also comes with severe and far-reaching risks. AI systems are operated on pre-specified datasets, which by definition limits their capacity to reflect human diversity. When used by the State, AI can redefine the State's engagement with people with disabilities, and with far-reaching consequences. In most professional and social domains, discriminatory data sets and prejudiced algorithms have the potential to exclude people with disabilities from work, social rights, and other basic entitlements, thus extending poverty and exclusion in systematic, widespread, and difficult-to-trace manners.

In his report, the Special Rapporteur presents both the advantages and the risks of the application of AI in assistive technologies, noting its ability to promote independent living for individuals with disabilities but also revealing the risks of its unregulated use. To reduce these risks, the report discusses the main legal obligations that need to regulate the development and use of AI.

Governments naturally have a role to incorporate anti-discrimination rules and human rights protections within their national systems of regulation relating to AI. In addition, the

[83] Building an accessible future for all: AI and the inclusion of Persons with Disabilities. https://unric.org/en/building-an-accessible-future-for-all-ai-and-the-inclusion-of-persons-with-disabilities/

private sector must adopt principles of transparency, evaluate the impact of AI systems on persons with disabilities, and implement remedial actions to eliminate discriminatory practices.

The Special Rapporteur identified examples relating to sign language. The report also identifies the critical aspects of AI compliance with the CRPD, particularly in AI use in sign languages. [84] The rights in the CRPD are the fundamental standard by which the threats and opportunities provided by AI are assessed. Some of the relevant *erga omnes* rights and obligations include privacy, autonomy, independent living, work, education, health, and, above all, the general principle of equality and non-discrimination.[85]

1.1. The CRPD and AI: Legal Considerations

Minimum regulatory framework

The CRPD provides a specific legal framework for the protection of the rights of sign language users in the digital

[84] UN. A/HRC/49/52: Artificial intelligence and the rights of persons with disabilities - Report of the Special Rapporteur on the rights of persons with disabilities, p. 29: "Adaptive learning platforms can provide the kind of personalized learning experiences that addresses the specific needs of students with disabilities. Speech-to-text software is being used to meet the chronic lack of sign language interpreters and enable people with speech impairments to interact more easily with others. Signing avatars now assist persons who are deaf and those who are hard of hearing. Artificial intelligence-enabled systems can contribute to better outcomes for persons with disabilities if used to diagnose illnesses and recommend treatments, uses that are helpful to everyone and could usefully be extended to applications in rehabilitation contexts as well. Artificial intelligence is also beginning to be used in the mental health field, including, inter alia, to structure peer support and otherwise provide mental health services."

[85] UN. A/HRC/49/52: Artificial intelligence and the rights of persons with disabilities - Report of the Special Rapporteur on the rights of persons with disabilities, p. 37.

age.[86] The rapid rate of development and deployment of AI poses opportunities as well as risks to sign language users, necessitating that AI be assessed through the principles enshrined in the CRPD.[87]

While the CRPD does not strictly regulate AI, it is a significant legal benchmark for reconciling technological development with human rights protections. Perhaps most significantly, Article 4(1)(e), which enunciates protection from discrimination, and Article 9(2)(h), which promotes the development of accessible technology, serve as the foundation for a regulatory framework for AI.

AI technologies have the potential to enhance access, autonomy, and participation in society among sign language users. Yet without appropriate regulation guarantees, AI may even reinforce discrimination and undermine language rights. CRPD provisions are thus a foundation that promotes AI adherence to human rights, specifically in regard to non-discrimination, accessibility, personal autonomy, and cultural identity.

State obligations

The Convention imposes clear obligations upon States and, indirectly, private entities that develop technological activities, for example. States must undertake informed and transparent consultation with sign language users and their representative

[86] VALLE ESCOLANO, R. (2023). Artificial intelligence and rights of people with disabilities: The power of algorithms. *Revista Española de Discapacidad, 11*(1), 29-49; JOSE BARIFFI, Francisco (2021). Artificial Intelligence, Human Rights and Disability. Pensar, Fortaleza, v. 26, n. 2, p. 1-14, abr./jun. 2021.

[87] *e.g.* CERMI (2020). *Inteligencia artificial y personas con discapacidad desde una visión exigente de derechos humanos*. http://semanal.cermi.es/noticia/Inteligencia-Artificial-Personas-Discapacidad-vision-exigente-derechos-humanos.aspx

organisations under Article 4. This obligation must be applied to all AI-based systems and policies so that sign language users are involved in the design, development, and implementation of the systems and policies. Furthermore, active steps should be taken to diversify the groups that are engaged in the development of AI technologies, including data collection, processing, research, regulation, and deployment. [88]

Guiding principles

The CRPD also elaborates on the principle of universal design, which applies generally to AI technologies. It is the principle that AI systems owe a duty of being accessible and responsive to the diverse needs of persons with disabilities. Equitable use requires AI to be inclusive in design, and segregation or stigmatization should be eschewed. Universal design, nonetheless, as explicated in Article 2, does not negate States' obligation for reasonable accommodations where necessary.

I. Legal Obligations for AI and Accessibility

The obligations in Article 4(1)(f)(g)(h) are to be interpreted along with substantive articles of the Convention, such as Article 9(g)(h). The obligation to undertake research and development in universal design is part of the overall duty to fulfil the rights of persons with disabilities. The obligation to promote the endeavours further requires education and awareness-raising, without any leeway for discretion on the part of States in their implementation.

As it is, States are required to implement particular policies that:

[88] UN. A/HRC/49/52: Artificial intelligence and the rights of persons with disabilities - Report of the Special Rapporteur on the rights of persons with disabilities, p. 58-59.

(i) Provide accessible information on AI-driven technologies and related support.

(ii) Monitor the private sector's compliance with accessibility standards.

Under Article 4(1)(e), States are also responsible for preventing discrimination in AI applications in the private sector. The article provides for taking legislative, regulatory, and administrative measures to make AI treat persons with disabilities with dignity for their rights.

Besides, Article 9(2)(h) requires States to promote and facilitate the development of technologies that enhance accessibility. It reinforces the fact that digital accessibility, as well as access to the internet and digital communication, is imperative for social inclusion. AI-powered technologies are therefore bound by the accessibility stipulations of the CRPD to prevent exclusion and marginalization of persons with disabilities.

II. AI and Discriminatory Risks

Digital discrimination[89] in the context of disability refers to the ways in which digital technologies and AI systems — whether intentionally or inadvertently — exclude or marginalize persons with disabilities, perpetuating pre-existing inequalities.[90] This form of discrimination manifests in two primary ways:

[89] KRUPIY, Tetyana (Tanya); SCHEININ, Martin. (2023). Disability Discrimination in the Digital Realm: How the ICRPD Applies to Artificial Intelligence Decision-Making Processes and Helps in Determining the State of International Human Rights Law, *Human Rights Law Review*, Volume 23, Issue 3, September 2023, ngad019, https://doi.org/10.1093/hrlr/ngad019

[90] UN. A/HRC/49/52: Artificial intelligence and the rights of persons with disabilities - Report of the Special Rapporteur on the rights of persons with disabilities

(i) ***Equal access to technology*** – The ability to fully utilize AI-driven tools depends on factors such as internet connectivity, accessible interfaces, and digital literacy.

(ii) ***Algorithmic bias*** – AI systems must be designed to be inclusive, accessible, and usable by all individuals, including persons with disabilities, to prevent discriminatory outcomes.

Certain AI uses have the potential to discriminate against persons with disabilities. For instance:

(i) Facial recognition software can mis-identify deaf people or mistake their facial expressions due to AI model bias, leading to misclassification or exclusion.[91]

(ii) Emotion detection technology can be particularly problematic as it is grounded in normative facial expression and body movement assumptions that cannot necessarily be in alignment with deaf culture and sign language communication. This would contribute to misreading of trustworthiness, intention, or emotional state, which perpetuate discriminatory biases.

III. Privacy and AI

The privacy right is explicitly protected under Article 22 of the CRPD that guarantees the privacy of personal and health-related data of persons with disabilities. Protection is especially imperative in the scenario of AI because systems tend to

[91] Council of Europe. Guidelines on Facial Recognition - T-PD(2020)03

handle sensitive personal information. Every AI application involving biometric inspection, behavioural inspection, or mechanical decision-making is required to apply strict privacy mechanisms to ensure persons with disabilities enjoy dignity and independence.

1.2. Legal Implications of AI in the context of Sign Languages

The use of AI with respect to sign languages must be strictly adhered to the provisions and standards of the CRPD.[92] The applications of AI must not exceed the following legal boundaries:[93]

I. AI as a means of communication, not a language (Article 2 CRPD)

The CRPD distinguishes between “language” and “communication”. AI could fall under the general notion in the last paragraph of Article 2 of the Convention relating to the idea of "language". It should be interpreted as follows: AI could be a type of non-verbal communication in the sense that the term “communication” is wide and versatile and could include the use of AI with respect to sign language.

While AI-based technologies may assist communication by offering automated or digitized sign language services, they

[92] *e.g.* BANTEKAS, Ilias; STEIN, Michael Ashley & ANASTASIOU, Dimitris (eds) (2018). *The UN Convention on the Rights of Persons with Disabilities: A Commentary*, Oxford Commentaries on International Law; DELLA FINA, Valentina; CERA, Rachele; PALMISANO, Giuseppe (ed.) (2017). *The United Nations Convention on the Rights of Persons with Disabilities A Commentary*. Springer.

[93] See. RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§2.1, 4.1.1, 5.1, 6.4.1, 7.1) (pp. 167-187 of the same volume)

cannot replace sign language itself. Sign language is recognized as a linguistic and cultural basis of the deaf communities and a critical means of expression and identity.

II. Legal Protection of Sign Languages (Article 2 CRPD)

In Article 2 of the CRPD, sign languages are explicitly recognized as full languages, enjoying parity with spoken languages. The recognition establishes legal obligations on states to ensure the protection, promotion, and development of sign languages, even in the context of AI-based technologies.

The interface between AI and sign languages must be viewed within the context of three fundamental rights outlined in the CRPD:

(i) Non-Discrimination and Accessibility (Articles 5 and 9): AI must not create communication barriers or amplify algorithmic biases that discriminate against sign language users.

(ii) Language Rights (Article 21): Deaf people have the right to receive and share information in their own language, including through accessible technological means.

(iii) Cultural Identity (Article 30): The deaf communities have the right to preserve, promote, and develop their linguistic heritage. AI must not distort or push to the fringe the natural evolution of sign languages.

AI systems must not distort, undermine, or re-define the linguistic properties that are intrinsic to sign languages. In particular, AI must not:

(i) Render sign languages into incomprehensible algorithm-based codes that lack their linguistic integrity.

(ii) Reduce sign language utterances to over-simplified or inaccurate translations, as machine translation inevitably involves a loss of meaning.

(iii) Disregard cultural utterances and contextual nuances, which are essential components of sign language communication.

III. Equality and Non-Discrimination (Articles 2 and 5 CRPD)

AI systems have to uphold the principles of non-discrimination and universal accessibility. In particular, AI applications have to:

(i) Adapt to the specific needs of sign language users.

(ii) Provide that automated sign language equipment complies with reasonable accommodation standards to prevent exclusion or marginalization.

IV. Individual Autonomy and Decision-Making (Articles 3, 12, and 23 CRPD)

AI should not undermine the agency of sign language users, who are rights holders and not objects of technological intervention. AI systems should not:

(i) Override informed consent in decision-making.

(ii) Engage in profiling or automated decision-making meant to influence sign language users without their awareness or control.

V. Privacy and Data Protection (Articles 22 and 31 CRPD)

Its gathering, processing, and utilization of information regarding sign language users must be in line with strict protection of privacy. AI systems ought to:

(i) Ensure the protection of content produced by sign language users, and data inferred by algorithms.

(ii) Empower users to control, supervise, and delete their own information.

(iii) Guarantee data processing transparency in order to prevent misuse or exploitation.

VI. Access to Information and Freedom of Expression (Article 21 CRPD)

AI must ensure linguistic freedom for sign language users through:

(i) Facilitation of information in accessible formats.

(ii) AI-based technologies facilitating precise and dependable sign language interpretation.

VII. Linguistic Accessibility in Education (Article 24 CRPD)

AI must facilitate inclusive and accessible education for deaf students through:

(i) Facilitation of sign language accessibility within digital learning platforms.

(ii) Use of reasonable accommodations for ensuring linguistic diversity.

VIII. Sign Language as Cultural and Linguistic Heritage (Article 30 CRPD)

Sign language is a cultural identity of the deaf people as a tool for: Transmission of history and tradition and constitution of identity and preservation of cultural expression. While AI may help preserve sign languages, it also risks stripping them of authenticity.

IX. Intellectual Property and AI (Article 30 CRPD)

AI technologies are also increasingly being applied to influence creative and artistic content in sign language. In this regard:

(i) The AI technologies shall not deny or distort the perception and protection of linguistic identity.

(ii) Intellectual property rights of sign language users, as well as their artworks, shall be safeguarded.

(iii) AI-created materials in sign language shall be made transparent and accountable to protect the cultural integrity of the deaf communities.

X. Legal Obligations of States and Private Actors

States Parties to the CRPD are required to regulate AI in a way that protects the language rights of sign language users. This requirement covers the public and private sectors and entails:

(i) ***Legislative and Regulatory Measures (Article 4):*** Governments need to implement laws and policies that avoid AI-based discrimination against sign language users and provide accessibility in AI-based technologies.

(ii) ***Inclusive AI Development (Article 9):*** AI systems shall be developed according to the principles of universal accessibility in order to facilitate the linguistic needs of sign language users.

(iii) ***Consultation with the deaf communities (Article 4(3)):*** Representative groups and deaf people must be actively involved in creating, planning, and implementing AI technology that has a bearing on sign language access.

2. Council of Europe

2.1. Framework Convention on Artificial Intelligence and Human Rights, Democracy, and the Rule of Law

In 2024, for the first time ever in the Council of Europe,[94] various States will adopt the Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy, and the Rule of Law.[95] The Framework Convention is a milestone in AI global governance, since it lays down vital guidelines to States concerning the use and development of these technologies.[96]

This Framework Convention is open to non-European States, and also to the signature States of the Convention of the Council of Europe. It sets out a legal framework for the entire lifecycle of AI systems, weighing potential risks against stimulating innovative responsibility. Moreover, the Convention adopts a risk-led approach to the design, development, usage, and decommissioning of AI systems, based on the situation assessed.

This Framework Convention's preambular provision, considering a number of alternative legal standards,

[94] Council of Europe (2019). Unboxing artificial intelligence: 10 steps to protect human rights.https://rm.coe.int/unboxing-artificial-intelligence-10-steps-to-protect-human-rights-reco/1680946e64.

[95] Framework Convention on Artificial Intelligence and Human Rights, Democracy, and the Rule of Law. https://www.coe.int/en/web/artificial-intelligence/the-framework-convention-on-artificial-intelligence

[96] Council of Europe. Possible elements of a legal framework on artificial intelligence, based on the Council of Europe's standards on human rights, democracy and the rule of law - CAHAI, 17 December 2021; Feasibility study on a legal framework on AI design, development and application based on CoE standards - CAHAI, 17 December 2020 Towards regulation of AI systems - CAHAI, 17 December 2020; Responsibility and AI: Study on the implications of advanced digital technologies (including AI systems) for the concept of responsibility within a human rights framework - DGI(2019)05

acknowledges concerns about the challenges to discrimination in computerized settings and their potential to create or to exacerbate inequalities.

The Framework Convention establishes the definition of AI in Article 2. It establishes a common understanding and aligns with the general definition of AI systems as outlined in the OECD Recommendation on Artificial Intelligence (2019),[97] which identifies several important features of AI systems.

Article 1 of the Framework Convention aims to make all activities related to AI fully compatible with human rights. Thus, government bodies have to implement all the required measures — legislative, policy-based, or administrative — so that they can fulfil their obligations under the Convention. Those measures should be graduated and differentiated as required based on the category and gravity of the risks to human rights represented by AI systems. Adherence to the protection for the handling of AI-related risks that interfere with human rights is ensured under Article 3 of the Framework Convention, and Article 4 provides that the measures must be in line with obligations under International Human Rights Law.[98]

The Framework Convention spells out underlying principles pertaining to the digital realm and use of AI in Articles 6 and 7. Article 16 includes the categorization and management of risks and consequences stemming from use of AI, concerning existing and possible impact on human rights. Such actions ought to be aligned as need may be, against background and

[97] Recommendation of the Council on Artificial Intelligence. https://legalinstruments.oecd.org/en/instruments/oecd-legal-0449

[98] Explanatory Report to the Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law. https://www.coe.int/en/web/artificial-intelligence/the-framework-convention-on-artificial-intelligence

envisaged use of AI systems, that is to threats posed by such AI to human rights.

Article 18 of the Framework Convention is especially significant to the rights of deaf people, in that it reaffirms respect for the rights of people with disabilities as established in national law and International Human Rights Law, and in particular the CRPD. This is without prejudice to the automatic effect of the obligations enunciated in the CRPD, as set out in Article 21 of the Framework Convention.

Countries have a duty to ensure that their national legislation aligns with their international law obligations. It is for this purpose that the rights of deaf people should be accorded due respect, taking into consideration their specific access requirements and lived experiences. Similarly, Article 19 of the Framework Convention mandates that government representatives should actively involve civil society on matters pertaining to AI through public debate and multi-stakeholder consultation, considering social, economic, legal, ethical, environmental, and other relevant implications.

2.1.1. General Principles of the Framework Convention Applied to Sign Languages

The Framework Convention reinforces and builds on prior treaty commitments such as the CRPD to advance non-discrimination, accessibility, and personal autonomy. Going further, it addresses protection against new challenges in the digital era so that AI is not a tool of exclusion but of social, linguistic, and cultural inclusion.[99]

[99] See. RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§2.1, 6.5) (pp. 167-187 of the same volume)

The Framework Convention includes explicit State obligations that must be interpreted in light of the rights of deaf people and the promotion of sign languages. In relation to sign languages, the Framework Convention mentions several pertinent dimensions. [100]

(a) Human Dignity and Individual Autonomy (Article 7)

Article 7 of the Framework Convention highlights the importance of human dignity and personal autonomy. The dignity of the human person is the foundation of human rights. Therefore, deaf people who use sign languages must be guaranteed full legal assurances of their dignity and autonomy in all AI processes. AI systems must not "dehumanize" deaf people by replacing their decision-making processes in a way that could limit their freedom and autonomy.

Within the context of Article 7, the idiosyncrasies of the deaf people must be respected, recognizing their specific identity, life experience, values, and emotions. Respect for the inherent dignity of deaf people entails recognition of their inherent worth, regardless of their origin or individual characteristics.

In AI and sign languages, this means that:

(i) The sign language users must be respected as rights bearers, and not just consumers or passive recipients of technology.

(ii) AI cannot replace the personal autonomy of deaf people, and must be used as a tool for empowerment and not control.

[100] Explanatory Report to the Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law. https://www.coe.int/en/web/artificial-intelligence/the-framework-convention-on-artificial-intelligence

(b) Non-Discrimination and Equality (Article 17)

The Framework Convention's general principle of prohibition of discrimination has a direct nexus to Article 5 of the CRPD, which provides for equal opportunity and the combat against structural barriers. For sign languages, this implies that States have an obligation to:

(i) Enforce that all AI-based technology respects linguistic and cultural diversity in deaf communities.

(ii) Prevent AI systems from scaling up bias or excluding sign language users from essential services such as education, health and justice.

(iii) Set control and audit mechanisms in place to track the ongoing impact of AI on deaf people.

(c) Active Consultation and Participation of deaf communities (Article 19)

The Framework Convention requires that policies regarding AI be formulated with the participation of civil society. For sign languages, this would imply that:

(i) Representative organisations of deaf people and sign languages users must be involved at all stages of designing AI technologies.

(ii) Governments and business entities should implement a representative and diverse staff comprising deaf people and specialized members for conducting research, developing, and deployment of AI.

(iii) All AI systems employed in public settings or essential services should be subject to accessibility requirements regulated by governments.

(d) AI and the Right to Access to Information and Linguistic Expression (CRPD Article 21)

The Framework Convention reaffirms the CRPD's commitment to providing equal access to information and communication by deaf people. This means that AI should be employed to expand, not limit, deaf people's right to sign language information.

(i) AI can facilitate access to audio-visual content and government information in sign languages.

(ii) AI systems should be developed with transparency and explainability so that users can understand how algorithmic decisions affect their communication and access to information.

2.2. The European Charter for Regional or Minority Languages (ECRML) and Artificial Intelligence

The ECRML,[101] adopted by the Council of Europe in 1992 and which came into force in 1998, is the main international treaty for the protection and promotion of regional and minority languages in Europe. Its aim is to keep these languages alive in use in a number of areas of society, protecting them from extinction and preserving linguistic and cultural diversity.

[101] European Charter for Regional or Minority Languages. https://www.coe.int/en/web/european-charter-regional-or-minority-languages

Although ECRML was originally conceived for spoken languages, there is potential to use it for sign languages because they meet the requirement of being minority languages.[102] The CRPD specifically recognizes sign languages as such, and several European States have already accorded NSLs legal recognition. This means that in the majority of states, sign languages could be encouraged in the essence of ECRML, specifically regarding the following principles:

(i) Recognizing sign languages as an important part of the cultural identity of deaf communities (Article 7(1)(a))

(ii) Promoting the public and private use of sign languages (Article 7(1)(d))

(iii) Promoting teaching and the intergenerational transmission of sign languages (Article 7(1)(f))

Through the emergence of AI, new opportunities and challenges also arise for the preservation and promotion of regional and minority languages, as well as sign languages. In the report "*Facilitating the implementation of the European Charter for Regional or Minority Languages through artificial intelligence*" (2022),[103] it is explained how AI can be leveraged

[102] EUD (2025). REPORT: *Sign languages in the European Charter of Regional or Minority Languages* (ECRML). https://eud.eu/preliminary-report-sign-languages-in-the-european-charter-of-regional-or-minority-languages-ecrml/

[103] Facilitating the implementation of the European Charter for Regional or Minority Languages through artificial intelligence. https://edoc.coe.int/en/minority-languages/11416-facilitating-the-implementation-of-the-european-charter-for-regional-or-minority-languages-through-artificial-intelligence.html

to support the objectives of the Charter, citing both the benefits and risks of this technology.

Automatic language translation is perhaps the most significant application of AI in this regard.[104] Machine translation programs can potentially make minority languages more visible on the internet by translating them to and from such languages, and thus make them more prevalent in online environments. For sign languages, sign recognition and synthesis systems will make sign-to-spoken language and spoken-to-sign language translation possible, improving deaf people accessibility and enabling inclusion in every area of society.

Moreover, AI can aid learning and education in such languages.[105] Machine learning-based platforms can offer courses in minority languages[106], and enable language learning to be more accessible and tailored to the requirements of users. Interactive tools enable practice and intergenerational transmission of these languages, ensuring new generations have access to resources to learn and use their mother tongue.

Another essential field is the application of AI in linguistic records conservation. With technology, content in minority languages can be digitized, stored, and examined to guarantee that these records are saved for future generations. This is

[104] ESSELINK, Lyke; ROELOFSEN, Floris; DOTLACIL, Jacub; MENDE-GILLINGS, Shani; DE MEULDER, Maartje; SIJM, Nienke & SMEIJERS, Anika. (2023). Exploring automatic text-to-sign translation in a healthcare setting. Universal Access in the Information Society.

[105] Artificial intelligence as an asset to language learning in Europe. https://school-education.ec.europa.eu/en/discover/news/artificial-intelligence-asset-language-learning-europe

[106] NAJIB, F.M. (2025). Sign language interpretation using machine learning and artificial intelligence. *Neural Comput & Applic* 37, 841–857 (2025). https://doi.org/10.1007/s00521-024-10395-9

crucial in the fight against language extinction and enabling research on their structure and utilization.

Finally, AI can serve as a helpful tool for supporting minority language users' communication. AI that recognizes speech and text can help improve digital services' accessibility to make both public and private services available in these languages. In the case of sign languages, AI can be used to automatically translate signs in public places and online platforms, making information more accessible for deaf people and fostering linguistic inclusion in different contexts.

Therefore, AI can be used to promote and protect regional, minority, and sign languages so that they can be recognized and maintained as well as become lively and accessible in today's society.

In the face of the challenges and potential of AI, signatory States to CRPD (and ECRML) are obligated to proceed in the application of the technology proactively and responsibly. These are:

(i) Facilitating funding for the development of inclusive technologies that promote linguistic diversity and accommodate minority languages.

(ii) Developing clear guidelines on AI and language rights consistent with the CRPD and the Council of Europe Convention on AI.

(iii) Encouraging research and development of accessible AI, engaging active minority and sign language communities.

(iv) Implementing supervision and assessment processes to ensure that AI technologies are not employed to evade the protection and development of ECRML-covered languages.

Consequently, sign languages are dynamic and constantly changing. Therefore, AI applied to teaching and learning must be continuously updated, reflecting both natural linguistic changes and feedback provided by deaf users themselves.

In this context, the following are recommended:

(i) Aligning sign language learning materials with the criteria of the Common European Framework of Reference for Languages (CEFR)[107], to offer international standards for teaching, testing, and certification;

(ii) Pedagogic diversification, combining multimodal and collaborative modalities, rather than hard standardizations;

(iii) Critically validating AI-based assessments in educational and research contexts, preventing algorithms from opaquely determining language proficiency levels.

Therefore, AI should support an adaptive pedagogy that recognizes the variation, creativity, and historicity of sign languages, rather than reducing them to rigid and uniform schemes. For example,

[107] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§4.4) (pp. 167-187 of the same volume)

(i) Corpus design for linguistics and the development of pedagogic and didactic materials for teaching and learning sign languages have the potential to benefit from resources provided by AI, if they respect legal and ethical boundaries written into international treaties.[108]

(ii) Linguistic research using AI should be subject to strict ethical principles in the gathering, analysis, and processing of data, such that the integrity of sign language is maintained.[109]

(iii) AI-driven learning content must be aligned with the objectives of the CEFR and provide excellence levels in learning, teaching, and testing equivalent to those mediated by human interaction.[110]

In addition, the development of AI systems and future-generation avatars must be conceived with multimodality in sign languages. This includes conceptualizing not only in terms of manual parameters, but also non-manual ones — facial expressions, prosody, body posture, gestural space use — to ensure linguistic fidelity and communicative quality.[111]

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[108] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§2.2) (pp. 167-187 of the same volume)

[109] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.5) (pp. 167-187 of the same volume)

[110] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§4.4) (pp. 167-187 of the same volume)

[111] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.3) (pp. 167-187 of the same volume)

3. European Union

3.1. European Parliament Resolution of 11 September 2018 on Language Equality in the Digital Age

The European Parliament Resolution of 11 September 2018[112] on language equality in the digital age poses the question of how linguistic diversity can be considered a fundamental value of the European Union, especially concerning new technologies. Language technology is a broad field that includes computational linguistics, AI, and computer science, among others, as per the resolution. But the particular focus of this resolution is on the acknowledgement of sign languages as a crucial component of the linguistic diversity of Europe.

European Parliament is aware that "language technologies can facilitate communication" for the deaf people. Language technology is a general term that encompasses domains like computational linguistics, AI, and computer science, among numerous others. Language technologies encompass spoken language and sign languages as well. The resolution identifies that sign languages are "*an essential part of Europe's linguistic diversity*." It further identifies that sign languages are recognized at the state level in the CRPD and, therefore, "*whereas multilingualism presents one of the greatest assets of cultural diversity in Europe and, at the same time, one of the most significant challenges for the creation of a truly integrated EU*"[113]

[112] European Parliament Resolution of 11 September 2018 on Language Equality in the Digital Age. (2018/2028(INI)) (2019/C 433/08) https://www.europarl.europa.eu/doceo/document/TA-8-2018-0332_EN.html

[113] Para. D). European Parliament Resolution of 11 September 2018 on Language Equality in the Digital Age. (2018/2028(INI)) (2019/C 433/08) https://www.europarl.europa.eu/doceo/document/TA-8-2018-0332_EN.html

Technological progress is tending to become language-based, and its social implications are profound. Thus, technological research, education, and the necessity of supportive policies for languages are more crucial. For instance, the availability of technology tools such as learning apps in common languages decides the advancement in language skills.

Language forms a vast percentage of the new functions of enormous data. The abundance of information stored in human languages makes it possible for a variety of language technology products and services to operate in different environments. The European Parliament alerts us to the fact that, due to the lack of appropriate policies in Europe, there is increasingly a technological divide between resource-rich languages and resource-poor languages. Institutions need to take responsibility for consolidating, promoting, and safeguarding linguistic diversity in Europe. Smaller languages are at a disadvantage due to the absence of tools, resources, and research funding. As a result, small languages are unable to realize the full potential of language technologies, and digital inclusion is compromised in the face of new technological advances.

To address this inequality, these languages must be given special consideration. Besides, there must be comprehensive language policies made, granting needed provisions and employing the proper instruments to enhance and facilitate linguistic diversity and multilingualism in the digital realm.

The value of sign languages should not be underestimated. Sign languages are evolving languages with linguistic structures, vocabulary, and signs that constitute the cultural identity and communication for the deaf communities. Encountering sign languages as a pillar of language diversity in

Europe entails adopting policies that guarantee visibility, accessibility, and preservation for sign languages online.

For EU policy to existentially enable linguistic equality, it must be flexible and adaptable, sensitive to the specific needs of sign languages users, which are susceptible to suffer from specific resource difficulties as well as representational issues. The European Union, therefore, has an obligation to ensure that its digital agenda is linguistically sensitive to diversity in every aspect, spanning from platform architecture to translation tool development.

Furthermore, there needs to be global cooperation among member states to ensure that sign languages are recognized and developed in a sustainable and equitable way. That is, cooperation among universities, research centres, and deaf communities should be prioritized in creating technological solutions that are appropriate for the use of sign languages.

3.2. EU Artificial Intelligence Act

The Artificial Intelligence Act of the European Union (EU AI Act)[114] aims to establish a specific regulatory framework for AI usage, emphasizing safety, transparency and accountability. The Act classifies AI systems into different risk levels (low, medium and high) and enforces certain requirements on high-risk systems that can significantly affect people's lives,

[114] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act). https://artificialintelligenceact.eu/ai-act-explorer/

including those who use sign languages.[115] This legislation is needed to ensure that AI, as a technology, is equitably and ethically implemented, without discriminating, invading privacy and having other negative impacts, especially on vulnerable communities, such as people who are deaf.

EU AI Act may have different consequences for sign languages that require specific legal safeguards.[116]In line with the EU Regulation, it is worth noting certain relevant standards that may be of interest in the context of sign languages:[117]

(a) **The term AI System is generally used for activities conducted by AI and other technologies linked to it**. We can observe that in the case of sign languages, the definition must be framed according to the legal frameworks. AI systems that execute activities that are either directly or indirectly linked with sign languages ought to be adequately classified under European Union law meaning, and at the same time, the meaning needs to be multifaceted so that it can adjust to technological innovation in this context. The theoretical premises of the AI system under European Union law are, at least,

(i) The particularity inherent in the essential construction of the AI system;

[115] AI Act https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

[116] In addition, RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§3, 4–5) (pp. 167-187 of the same volume)

[117] In addition, Informe describe el impacto en los derechos de las personas con discapacidad del nuevo Reglamento Europeo de Inteligencia Artificial. https://diario.cermi.es/entry/un-amplio-informe-describe-el-impacto-en-los-derechos-de-las-personas-con-discapacidad-del-nuevo-reglamento-europeo-de-inteligencia-artificial

(ii) Autonomy (or differentiation) of the AI system in relation to "conventional" programming or software, or computing systems;

(iii) Autonomy and empowerment of the AI system to execute its autonomous operations and have some autonomy over human involvement or intervention, being machine-based only.

(b) **Sub-article 3 of Article 3 should interpret "biometric data" and "biometric identification" applicable to sign languages** to refer to the fact that governmental authorities need to take account of the specifics of sign languages, that is, users of such sign languages – in normal use, they are employed by deaf people – should be protected for safeguarding information regarding authentication, identification, or classification of deaf people as well as for the identification of emotions that involve variable facial expressions as an essential characteristic of use of sign languages, pursuant to linguistic principles. AI systems should not get sign language rules governing facial and bodily expressions mixed up with biometric identification that (apparently) verifies individual characteristics of deaf people for specific purposes, such as availing themselves of a service or accessing a device. The label "emotion recognition system" is to be specifically defined in the interest of avoiding confusion between facial and bodily expressions inherent in the use of sign language and those expressions which stand independent of the singularity of the sign languages.

(c) **Article 5(1)(a)(c)(d)(f)(g) (Prohibited practices):** The use of AI that exploits a disability, interferes with a decision, or uses subliminal techniques, such as biometric recognition, is prohibited. We can misuse and identify banned practices

related to sign language use, particularly based on vulnerabilities relating to the linguistic nature utilized by sign language users, and boundaries for biometric sign language user identification need to be defined. For the case of sign languages, this idea of manipulative techniques being facilitated through AI also pertains and should be clarified, such that it doesn't become confounded with manipulative or other unfavourable uses, resulting in incorrect productions of sign languages not adhering to sign language linguistic rules.

(d) **Articles 6 to 10 (Risk and Classification of AI Systems).** The Act distinguishes between low-risk and high-risk AI systems, with the latter being subject to more stringent regulation. In sign languages, AI systems used in sign recognition, sign language translation or communication with digital assistants using sign languages can be classified as high-risk systems, due to their direct application in sensitive domains such as education, healthcare and public services. AI systems that need automatic translation or interpretation of sign languages must be strictly monitored, as errors in translation could result in digital exclusion or misunderstandings that will negatively affect deaf people communication. In addition, AI systems that need facial recognition or biometrics to identify deaf people or detect facial expressions that relate to sign language must be strictly scrutinized to ensure non-discrimination or privacy invasion.[118]

[118] See. RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (arts. 6-7 EU AI Act at these parts: §3.1.1 and 4.1.1 and 7.1) (pp. 167-187 of the same volume)

(e) **Article 10 (Data quality):** High-risk AI systems must not be based on data characteristic of discriminatory and harmful treatment based on disability and indirectly based on the language signed by sign language users.

(f) **Articles 16 and 50 (Accessibility):** Sign language users in any given context must be able to access AI systems. The accessibility provisions and impact assessment are key to ensuring that AI systems are inclusive for sign language users. Digital accessibility must ensure deaf people have equal access to information and services, particularly given the increasing digitalisation of public services, education and healthcare. The AI impact assessment must consider not only the risks of discrimination, but also how digital inclusion for deaf people will be influenced. This includes the utilization of AI for automatic translation and communication in sign languages in digital interfaces. These systems must be created to avoid exclusions or breakdowns in translation that can hinder communication for deaf people. Apart from that, universal access to technology must be ensured for those who communicate using sign languages. AI systems must enable accessibility features, such as accurate automatic captions, real-time translation, and recognition of signs and facial expressions consistent with the linguistic conventions of sign languages.

(g) **Article 27 (Impact assessment):** The assessment of the risks of discrimination on the grounds of disability and, indirectly, language use by sign language users must be made in consideration of possible and actual risks.

(h) **Article 60 (Protection during testing):** Rights of sign language users must be safeguarded during testing of AI, with informed consent and adequate supervision.

(i) **Article 77 (Supervision and transparency**): Transparency is one of the AI Act's founding principles, specifically relating to the functionality of AI algorithms. For sign language interpretation, it matters that AI systems can provide satisfactory explanations about how the translations or transcriptions were conducted. This is especially relevant where the translated content has sensitive or critical information. The powers that be shall oversee whether or not AI systems discriminate against sign language users, and the providers shall ensure transparency in usage. The government regulators must monitor the use of AI in sign language translation systems and make sure that these systems are not used in a way that is harmful to sign language users, either due to technological failures, design failures, or manipulation of translations.

(j) **Article 95 (Codes of conduct):** Representative organisations of deaf people and sign language user service providers should also establish and define the code of conduct of AI regarding the usage of sign languages. It is important to have codes of conduct for both developers and users in the field of sign languages to ensure that technologies are used ethically and responsibly. This includes developing best practices for automatic sign translation, the use of facial recognition with ethics, and promoting linguistic diversity.

3.2.1. Fundamental Principles of Artificial Intelligence Regulation in the European Union

A series of resolutions by the European Parliament set out minimum principles that apply to the regulation of AI.[119]

The first such principle is one of ***human primacy***, the view that AI must be human-centered and designed by humans. This principle, rooted in sound international human rights law, is to apply across all AI-based technologies. Thus, the development, deployment, and use of AI, robotics, and other related technologies must strictly adhere to the legal standards established by international human rights law and other frameworks safeguarding fundamental rights and freedoms. This will ensure the removal of discrimination, such as disability or language, employed on a daily basis by deaf people. AI must actively promote fairness, inclusion, and transparency while eliminating biases and discrimination. The human primacy principle ensures that technology serves the benefit of humanity, not to substitute for or make decisions on behalf of humans, with the ultimate aim of enhancing human well-being. It insists that AI, robotics, and other technologies must be tailored to human needs, ensuring that their development, use,

[119] European Parliament resolution of 3 May 2022 on artificial intelligence in a digital age (2020/2266(INI)); European Parliament resolution of 20 October 2020 with recommendations to the Commission on a civil liability regime for artificial intelligence (2020/2014(INL)); European Parliament resolution of 20 October 2020 with recommendations to the Commission on a framework of ethical aspects of artificial intelligence, robotics and related technologies (2020/2012(INL)); European Parliament resolution of 20 October 2020 on intellectual property rights for the development of artificial intelligence technologies (2020/2015(INI)); European Parliament resolution of 11 September 2018 on language equality in the digital age (2018/2028(INI)) (2019/C 433/08); European Parliament resolution of 19 May 2021 on artificial intelligence in education, culture and the audiovisual sector (2020/2017(INI))

and deployment are always for the benefit of people and never otherwise, thus enhancing well-being and human freedom.

The second is the ***legitimate trust principle*** in AI and related technologies, emphasizing that they need to be trusted in order to develop and deploy effectively. AI systems, particularly opaque algorithm-based and biased dataset-based ones, can be inherently risky. Therefore, public trust in AI must be established with a robust legal framework founded on ethical grounds. This principle ensures that all used AI systems honour international human rights law and legal instruments protecting essential freedoms and rights.

The third is the ***precautionary principle***, which guides the legal framework on the regulation of AI. AI, robotics, and associated technologies shall therefore be guided by the principles of proportionality and necessity. This approach allows technological actors to introduce innovations and create market opportunities, while ensuring that fundamental rights are not undermined. AI systems must incorporate ethical aspects from the development stage, such that their development, deployment, and operation remain under human control. Furthermore, AI systems must allow for human intervention and restoration of control when necessary, implementing adequate safeguards to prevent harm.

The fourth is the ***risk assessment principle***, whereby AI regulation must be differentiated, prospective, and risk-based. A systematic classification of the risks of AI in different contexts must be made based on clearly defined criteria, particularly when AI development, use, and deployment risks severe damage or violation of fundamental rights.

The fifth is the ***transparency and accountability principle***. All individuals have the right to information on AI activities, as

offered under existing legal regimes. Transparency in engagements with AI is essential, such as automation processes, operational mechanisms, capabilities, and limitations – like how the information is sifted and delivered, its reliability, and potential boundaries. Individuals ought to be notified when interacting with an AI system, particularly when such systems personalize products or services. Second, users need to be able to switch off or limit this personalization. For the sake of ensuring reliability, AI, robots, and related technologies need to be technically responsible, stable and accurate.[120]

The sixth is the ***non-discrimination principle***. AI and related technologies must not create or sustain prejudice, nor facilitate automated discrimination, especially against people with disabilities, deaf people and other sign language users. AI needs to be configured to honour, serve, and defend human rights and liberties and respond to the specific needs of the persons relying on AI technologies.

The seventh principle is the ***social responsibility principle***. Robotics, AI, and related technologies must be developed and used in a socially responsible manner, being actively involved in solutions that promote and safeguard fundamental rights and freedoms. The technologies can reduce social inequalities and assist in the development of a more equitable and inclusive society.

The eighth principle is the ***data protection and privacy principle***. The processing, collection, and use of all data — either biometric or personal — obtained from the development,

[120] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§5, 6.5–6.6, 7) (pp. 167-187 of the same volume)

deployment, and operation of AI, robotics, and connected technologies must provide data protection and privacy. The right to object to profiling, to control the use of one's own data, and to get explanations for decisions made through automated processing, should be provided to deaf people. In addition, AI systems must also comply with privacy-by-design principles, and the overall principles of proportionality, necessity, and purpose limitation, in order that data is processed only for well-defined purposes and in accordance with the European Union's legal framework on the protection of personal data.

CHAPTER IV: THE ETHICAL FRAMEWORK INHERENT TO THE USE OF AI

1. Introduction to Ethical Principles for Use of AI in Sign Languages

Ethical definition of AI in the context of sign languages is strategically significant because it guides the ethical use of AI in various areas of sign language users' daily lives. Principles evolved by various legal and regulatory standards – directly or indirectly affecting sign language issues – become a required foundation to ensure AI development and use in alignment with the ethical values of sign language users.

As such, determining ethical principles for AI in this context involves a verifiable, evolutionary, and multidisciplinary approach. The process must be capable of keeping up with technological advancements while being attuned to present socio-political and sociocultural factors. Significantly, the principles must maintain the set boundaries that ensure the integrity of sign language use as well as the rights of deaf communities.

It is difficult to establish an objective, broadly accepted ethical framework for AI applications pertaining to sign languages. This is a task involving a strict examination of already existing legal norms to discover normative rules that may serve as ethical guardians in the given field. At the same time, it is important to consider whether the deaf communities themselves can define and assert what they perceive are the ethical expectations required for preserving sign languages in order to conduct themselves in keeping with their community values and practical experience.

Active involvement of the deaf people, as well as more particularly professionals with a background in sign language, is vital. It is vital that their input feeds into the co-construction of an ethical practice that not just aligns with their values but is sensitive to the distinct needs of concerned communities. In this participative and collaborative mechanism, there occurs a more powerful, contextually responsive ethical framework that highly considers lived experience as well as languages rights.

This chapter seeks to identify key ethical contributions that will inform a principled response to the application of AI to sign languages. Most current contributions available today are vague and general, providing loose suggestions. The aim here is to begin the shift toward a more detailed, context-dependent image of ethical principles, reflecting the complexity of AI interaction with sign languages.

With the heterogeneity of interpretation and lack of solutions generalizable to all, we find that there is a necessity for a multi-level approach to ethics. This kind of approach would have to consider the multi-faceted contexts under which sign languages are used in daily life and arrive at specific normative directives corresponding to broad ethical objectives and shared values. In doing so, the ethical framework can best direct and inform the application of AI responsibly that maintains the linguistic integrity, the cultural identity, and the communicative autonomy of sign language users.

As clear from our detailed analysis of the existing legal and ethical frameworks, it is evident that the establishment of ethical principles is not an “academic” exercise but, rather, the starting point to a responsive and adaptive ethical framework. Such a system should be able to direct the assessment and application of AI in various contexts that include sign languages. In fact, several principles can be blended,

depending on the area of application, acknowledging that various contexts can require different regulatory and ethical strategies. In the context of AI, this may also mean that decisions about ethical oversight and adaptability must be made at the level at which they can be best addressed in a timely and fitting way.

2. Implementing fundamental ethical principles of AI for sign languages

AI ethical principles based on the legal framework of European Union law and UNESCO regulatory instruments[121] are especially pertinent when extended to sign languages and the rights of deaf people. AI and related technologies should be developed and implemented in a way that respects, accommodates and protects linguistic diversity, such as sign languages, which are recognised as languages of their own by international legal instruments such as the CRPD. These principles need to work effectively to promote equal access for sign language users in the digital space.

(a) Human Dignity

Human dignity is the fundamental basis of all human rights. It states the inherent worth of every human being, irrespective of their linguistic or cultural characteristics. For deaf people who use sign languages as their primary form of communication, dignity is deeply connected with the recognition and acceptance of their linguistic identity, cultural heritage, and communicative autonomy.

In AI, the ethical requirement to uphold human dignity is that systems designed to interact with or enable sign language

[121] UNESCO. Ethics of Artificial Intelligence. https://www.unesco.org/en/artificial-intelligence/recommendation-ethics?hub=32618

interactions do so in ways that support, and not erase, the deaf personhood. These include:

(i) ***Linguistic integrity:*** Sign languages are not gestural representations of the oral word, but full, natural languages with syntax, grammar, and cultural expression. AI systems must be developed with linguistic respect, avoiding "reductionist" models of signed communication.[122]

(ii) ***Digital mediation transparency:*** Deaf people need to be transparently informed when they are interacting with an AI-powered interface, such as a signing avatar or a machine translation, instead of a human interlocutor. Indistinguishability between AI and human agents, especially in sensitive communication contexts, has the potential to undermine the user's dignity and erode trust.

(iii) ***Informed and voluntary choice:*** Deaf people must not be deprived of the right to choose between human interpreters and AI-driven sign language systems, especially in critical domains such as healthcare[123], judicial processes, and education. Technological convenience must never take precedence over the right to culturally and linguistically appropriate human

[122] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.3 and 6.5) (pp. 167-187 of the same volume)

[123] ALMYRANTI, M. *et al.* (2024), "Artificial Intelligence and the health workforce: Perspectives from medical associations on AI in health", *OECD Artificial Intelligence Papers*, No. 28, OECD Publishing, Paris, https://doi.org/10.1787/9a31d8af-en.

contact.[124]

(iv) ***Communicative autonomy respect:*** AI should augment the communicative capacities of deaf people, not direct, take over, or observe their communications. Employing AI in sign language environments must facilitate, not impair, users' agency.

(v) ***Machine delegation constraints:*** Certain tasks – such as those that involve empathetic interaction, nuanced contextual understanding, or moral discernment – must remain in the domain of human professionals. The use of AI must not result in the mechanization of intrinsically human communication activities central to deaf people's lived experience.

Thus, the ethical control of AI within the context of sign languages must be founded on human dignity. It must ensure that technological advancement is respectful of the full humanity of the creatures whose identities are created through visual-spatial language and ensure that deaf people are not simply reduced to objects of prediction, manipulation, or exclusion in cyberspace.

(b) Personal Autonomy and Human Supervision

The principle of human primacy mandates the use of AI for the welfare of human beings and not against them. Individual Autonomy for deaf people and sign language users is closely connected to the right to communicate through a natural language, to receive information without a language barrier, and to participate fully in social, cultural, and institutional life.

[124] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§5) (pp. 167-187 of the same volume)

When extended to sign languages, it means that AI must complement, rather than substitute, human-mediated sign language interpretation. Sign language recognition and translation programs need to be developed to assist and not replace professional interpreters so that deaf people can be independent and self-determining in communication. In addition, AI-based sign language technology must respect the cultural and linguistic identity of the users of sign languages and promote the principle that AI is there to empower and not control human interaction.

Several key considerations should guide the ethical implementation of such technologies:

(i) ***Linguistic agency respect*:** Deaf people must not be deprived of the ability to choose how, when, and by what means they communicate with digital systems that mediate sign language. Whether selecting AI-generated avatars or human interpreters, this should be up to the user, not determined by technological possibility or institutional convenience.

(ii) ***Human-in-the-loop monitoring:*** Essential communication scenarios, such as court proceedings, mental health counselling sessions, or education evaluations, require human monitoring to ensure sign language is interpreted with cultural awareness and contextual understanding. AI can assist but not replace human professionals in cases where misinterpretation could compromise human rights, well-being, or linguistic justice.

(iii) ***Transparency and informed consent:*** Deaf people must be made clearly aware of how AI systems operate, the extent of their capabilities and limitations,

and what data is being collected, particularly visual, biometric, or gestural data. Clear communication is required for autonomy and enabling truly informed decision-making.[125]

(iv) ***Dependency avoidance*:** While AI may increase access and autonomy, there is a risk that over-reliance on automated systems could create new forms of dependency, especially if there are no human alternatives. Accurate individual autonomy is not only the availability of technology, but the freedom to choose not to use it.

(v) ***Empowerment through design*:** AI needs to be developed in partnership with deaf communities, incorporating user-led design approaches that amplify the voices of sign language users. Collaborative design ensures that systems are not only accessible but empowering, responding to real needs rather than anticipated ones.

Upholding personal autonomy in the Deaf digital rights case is about respecting individual sign languages as tools of self-expression, identity, and choice. AI systems must operate under the primacy of human values, and there must be controls to ensure that autonomy is never seconded to algorithmic efficiency or cost-cutting rationalities.

(c) Non-discrimination, Equality and Fairness

The non-discrimination principle is central to the development of AI technologies in a manner that does not disadvantage or leave out sign language users. Traditionally, deaf communities

[125] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§2, 6.5) (pp. 167-187 of the same volume)

have been left behind as digital and technological advancements have continued to unfold, with AI-voice recognition technology being created almost exclusively for use in spoken languages. AI now must be utilized proactively in order to advance accessibility, wherein sign language recognition, generation, and translation technology prioritizes the language rights of deaf users. In addition, sign language apps powered by AI should shun the provision of solutions that are all-in-one sizes, rather embracing linguistic variety and personal communication styles.

In the scope of AI and sign languages, several risks of discrimination may arise:

(i) ***Exclusion and data representation*****:** The majority of AI systems are trained on spoken and written language data, and this discriminates against sign languages on the basis of their visual-spatial modality. The exclusion is systemic and propagates a digital divide in which sign language users are underserved or misrepresented, thus violating the ideals of equal access and linguistic justice.

(ii) ***Algorithmic interpretation bias*****:** AI systems attempting to interpret or generate sign languages can codify and perpetuate biases – linguistic or cultural. Such bias not only distorts meaning but also excludes portions of the deaf communities from equitable AI interaction.[126]

[126] MILANEZ, A.; LEMMENS, A. & RUGGIU, C. (2025). "Algorithmic management in the workplace: New evidence from an OECD employer survey", *OECD Artificial Intelligence Papers*, No. 31, OECD Publishing, Paris, https://doi.org/10.1787/287c13c4-en.

(iii) ***Invisibility in design and policy*****:** Systemic disregard stems from the historic exclusion of deaf voices within technological governance. Non-discrimination also implies going beyond merely avoiding prejudicial outcomes and actively engaging deaf communities at every level of AI system design and policymaking.

(iv) ***Digital marginalisation*****:** As AI-driven services become ubiquitous in public and private life. From education and the workplace to healthcare, sign language users can be systematically excluded if these systems are not developed to address their communication needs. This can entrench existing inequalities and contravene obligations under international human rights treaties, including the CRPD.

(v) ***Intersectional justice*****:** Deaf people are likely to experience more than one form of discrimination, e.g., on grounds of disability and language. AI systems must be tested and audited using an intersectional lens so that intersecting vulnerabilities do not result in compounding forms of injustice or exclusion.

In this respect, AI systems must integrate fairness by design: linguistic plurality guarantee, inclusive user testing, and accessibility standards that cater to the fact of sign language communication. Additionally, equality cannot be reduced to the provision of equal services; it requires to be differentiated and adaptive actions responding to the diverse realities of deaf communities in various sociocultural contexts.

It is only through this adherence to principles that AI can be rendered a tool that dismantles, rather than reinforces, structural inequalities, and forges an inclusively digital society.

(d) Prevention of Harm

The duty not to harm is a cornerstone of human rights discourses and a foundation principle of governing AI. Where AI systems engage with sign languages, the principle of harm prevention has to be sensitive to the deaf people's and communities' linguistic, cultural, and communicative specificity.

Harm in this case can not only be physical or psychological, but also epistemic injustice, linguistic marginalization, and destruction of deaf identity. In order to uphold this principle, several critical dimensions must be considered:

(i) ***Linguistic faithfulness and cultural authenticity***: AI technologies employed in sign language recognition, translation, or generation should not simplify or distort the sophisticated grammatical structures and cultural nuances of signed languages. [127] Distortion can lead to misinformation, misunderstanding, or even discrimination, particularly in health care, education, or legal contexts.

(ii) ***Avoiding algorithmic bias:*** AI models trained on narrow or unrepresentative sign language corpora stand a risk of mimicking and amplifying existing biases. For example, giving priority to mainstream forms of sign languages and excluding regional, generational, or cultural ones runs the risk of marginalizing deaf communities. Avoiding harm requires inclusive data practice and representative

[127] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§§6.3, 6.5; Conclusion) (pp. 167-187 of the same volume)

training corpora.[128]

(iii) ***Respecting mental and emotional well-being:*** Interacting with AI should not cause confusion, isolation, or emotional pain. For the majority of deaf people, sign language communication is very much connected to identity and dignity. AI that ineffectively mimics signing, or replaces human communication in intimate situations, can harm users through depersonalizing or devaluing their primary means of expression.

(iv) ***Prevention of deskilling and overreliance***: Unnecessary overdependence on AI in interpreting or communication can result in the degradation of human skills such as professional interpreting skills and signed peer-to-peer interaction. Danger can't just come from its misuse, but from the general breakdown of human networks and capacities.

(v) ***Surveillance and data abuse protection:*** Visual and biometric information employed for training or operating AI sign language systems raise serious privacy and surveillance issues. Without robust protections, these technologies can be used to monitor, track, or profile deaf people, thus causing harm through loss of autonomy, dignity, and trust.

Lastly, harm mitigation in AI-mediated sign language technology involves an anticipatory and proactive approach grounded in the lived experiences of deaf communities.

[128] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§5-6, pp. 143-149 of the same volume)

Solutions that are co-designed, thoroughly tested, and continually monitored for ethics must be instituted in order to safeguard against technological progress at the cost of safety, inclusion, or human rights.

(e) Transparency

Transparency is a cornerstone of rights-based and ethical governance of AI systems. They are especially crucial in the protection of the interests and agency of sign language users, who are systematically underrepresented in digital infrastructures.

In the context of sign language users, transparency needs to be understood not only as technical openness but also as linguistically and culturally available clarity on how AI systems are trained, how they interpret gestural data, and how decisions are made or mediated through these systems.
Key considerations are:

(i) ***Explainability of AI systems:*** A great deal of AI use tries to talk across between spoken or written language and sign language. However, given the natural richness of visual-spatial syntax and facial expression, and local sign variation, internal system logic needs to be explainable not just to programmers, but to deaf users themselves. This involves making system constraints, potential mistakes, and interpretative assumptions transparent in sign language, not written language only.

(ii) ***Knowledge of AI facilitation:*** Deaf users must be consciously informed when they are interacting with an AI-facilitated sign language interface – be it an avatar,

a translation module, or a conversational assistant[129]. The possibility of misinterpretation between human and artificial interpreters can make trust complicated and distort informed consent, especially in areas such as legal proceedings, health care, or education.

(iii) ***Right of contest:*** AI systems must provide users with accessible processes to challenge incorrect translations, misrepresentations, or discriminatory outputs, particularly where these have tangible impacts on access to service or rights. Such processes of contestability must be provided in sign language formats and include channels for human consideration and review.

(iv) ***Participatory auditability:*** Transparency mandates that deaf stakeholders be involved in auditing and authenticating AI systems that affect their linguistic rights. Technical opacity without participatory control can result in the silent reproduction of injustices concealed behind innovation or neutrality claims.

(v) ***Cultural transparency:*** Sign languages are not codes to be deciphered. They are carriers of cultural meaning, group identity, and affective signification. For this reason, transparency would also have to entail acknowledging and showing how AI systems engage with, diminish, or even potentially flatten the cultural richness of signing practice.

[129] GLASSER, Abraham; MANDE, Vaishnavi & HUENERFAUTH, Matt. (2020). Accessibility for deaf and hard of hearing users: Sign language conversational user interfaces. In Proceedings of the 2nd Conference on Conversational User Interfaces. 1–3.

Briefly, the ethics of transparency in AI need to be greater than algorithmic transparency, but also communicative transparency, linguistic transparency, and procedural justice. This reaffirms the initial principle that human agency – and not technical efficacy – is the guiding value in digital politics.

(f) Safety, Security and Resilience

The principles of safety, security, and resilience take special directions when applied to AI technology that communicates with sign language and deaf people. The technologies must be so designed and governed that they not only protect people from physical or technological harm, but also their linguistic integrity, cultural rights, and personal autonomy.
Safety in this regard also involves ensuring that AI systems used to translate or generate sign language are accurate, context-sensitive, and do not generate outputs that might mislead, misinform, or be dangerous, particularly in high-stakes domains such as legal communication, emergency response, or healthcare consultations. A misaligned or defective AI translation might have life-altering effects, particularly for sign language users.

Security refers to the defence of biometric data specific to sign language and communication. Sign languages are corporal: they are based on facial affect, hand form, body orientation, and movement patterns that are uniquely identifiable. These renders sign language especially vulnerable to biometric surveillance, identity theft, or state or commercial misuse of motion-capture information. Robust data protection mechanisms must particularly deal with such risks, ensuring that gestural datasets are harvested, stored, and used in human rights compliance and with competent, accessible consent.

Resilience is the capacity of AI systems to withstand and adapt to unforeseen challenges or failures. In the context of Deaf digital rights, resilience entails:

(i) The ability of sign language AI to handle linguistic variation and dialectical differences without reducing expression to a narrow norm.

(ii) The human ability when AI fails, such as the seamless integration of trained human interpreters.

(iii) Systemic robustness against cultural bias, exclusionary training sets, and underrepresentation of deaf voices during development.

Additionally, resilience must be institutional and social, rather than technical. Importantly, it entails the sustained involvement of deaf communities in co-design, testing, and governance regimes so that security and safety do not lag behind technological progress and cultural evolution.

In short, it is not only a matter of technical concern to ensure safety, security and resilience in sign language AI systems, it is an ethical, human rights, and linguistic imperative. It requires the recognition that communication rights in the digital age include the right to be respected, secure, and safe in one's language, especially where that language is gestural, visual, and historically marginalized

(g) Accountability and Responsibility

The ethical principle of responsibility and accountability is most significant in the conception and deployment of AI systems

handling, interpreting[130], or generating sign languages. Because sign languages have been marginalized historically in legal, educational, and technological spheres, and deaf communities are linguistically at risk, it is essential that all the stakeholders involved in the AI lifecycle are defined clearly, held accountable, and reached by rights-based and inclusive approaches.

Accountability in this context means that developers, providers, and operators of AI technology are responsible not only for the technical functioning of their systems, but also for the cultural and language appropriateness of their systems. If AI enables sign language communication, e.g., by avatars or gesture recognition, any breakdown, misinterpretation, or misrepresentation can cause catastrophic harm: infringement of human rights, medical errors, or breakdowns in essential interpersonal communication. Such harms must be traceable and remediable at law.

(i) Clear documentation must be supplied on how data are gathered, annotated, and processed, and what is known about dialectal and cultural variation.

(ii) Deaf user accessible redress and complaint procedures in case of wrong AI results, supported by sign language assistance throughout the process.

(iii) Ethical governance models incorporating deaf experts, linguists, and representative organisations in both ethical governance and technical evaluation of AI systems.

[130] DE MEULDER, Maartje & HAUALAND, Hilde (2021). Sign language interpreting services: A quick fix for inclusion?16, 1 (2021-05-31), 19–40. https://doi.org/10.1075/tis.18008.dem

Responsibility, nonetheless, necessitates an active effort towards co-designing AI tools with deaf communities. This includes not only the technical teams, but public institutions and private entities that deploy AI in spaces where sign language use is necessitated or compulsory. Accountability translates to recognizing that language is not a passive data set: it is an evolving expression of autonomy, culture, and identity. Thus, the deployment of AI in sign language spaces without real deaf investment is an ethical shortcoming, even if technical requirements are met.

Additionally, duty involves foresight: looking ahead to how prejudice in training materials, being omitted from development practices, or legal unregulation could consolidate structural disparities and boil down the expressive diversity of sign languages to merely command signs or simplistic transcriptions.

Overall, accountability and responsibility in sign language AI systems must go beyond conventional performance measures. They must include legal safeguards, cultural sensitivity, and participatory ethics at every stage of development and deployment, so that deaf people and sign language users are not only protected, but empowered as co-creators and equal participants in the digital sphere.

(h) Democratic accountability and social empowerment

Democratic accountability and social empowerment are critical values in the situation of incorporating AI systems that affect sign language use and deaf communities' communication rights. In light of the specific social, linguistic, and cultural needs of sign language users, AI systems must not just be designed to meet technical requirements but must also be kept under constant democratic oversight to ensure that their application protects equality, accessibility, and cultural integrity.

Democratic control means that decision-making powers, such as governments, regulatory agencies, and independent advisory committees, actively involve deaf representatives in all stages of AI regulation and policy development. The historical exclusion of deaf people from these processes results in systems that fail to capture the full extent of sign language's linguistic diversity and cultural depth. Therefore, control has to ensure:

(i) Sign language users are a key determinant in setting AI standards, guidelines, and regulation in a way that their oversight and review are involved in the development of digital tools.[131]

(ii) Public consultations are inclusive in such a manner that deaf people and their representative organisations have the ability to input concerns and ideas, with specific measures put in place to ensure accessibility in sign language on all levels of discourse.

(iii) There are public accountability mechanisms to regularly review the social impact of AI systems on deaf communities with a view to preventing discrimination, misrepresentation, or marginalisation.

Social empowerment, on the other hand, calls for AI technologies to facilitate empowerment through guaranteeing participation and full access to deaf people across various dimensions of public and private domains of living. AI technologies can be leveraged to support and promote deaf people's linguistic rights such that they engage freely in

[131] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§7, pp. 143-149 of the same volume): "ethical review boards with deaf experts for all AISL projects and human oversight by native signers"

cyberspace, access education, healthcare, and government services, and engage with democratic practices uninhibited. This can be achieved through:

(i) Creating accessible AI interfaces that allow deaf people to communicate with technology in their own sign language.

(ii) Enabling the creation of technologies of sign language that allow for instant, precise translation and communication assistance, facilitating sign language users in social, professional, and public life.

(iii) Building education schemes that increase digital literacy rates among deaf communities, allowing them to participate actively in the evolving digital world.

Besides, civic empowerment and democratic regulation need to guarantee openness regarding the development, deployment, and evaluation of AI systems affecting sign language users. This also means an open and understandable explanation of the interpretation or creation of sign language by AI-based tools in such a way that deaf users can audit and contest AI results when necessary. The developers' and deployers' moral and legal obligations toward such systems must be publicly outlined and implemented by effective accountability frameworks.

In summary, democratic governance[132] and social empowerment in the context of sign language AI mean that deaf people and communities must not only be regarded as

[132] Council of Europe. Recommendation of the Committee of Ministers to member States on the principles of good democratic governance, with its explanatory memorandum (principles 6 – Openness and transparency, and 12 - Openness to change and innovation) - CM/Rec(2023)5

passive consumers of technology, but as co-designers with rights to design, control, and criticize AI systems directly affecting their lives. Through the practices of being open and transparent, only then is AI in a position to serve the linguistic and cultural rights of sign language users and secure real equality for all in the digital age.

(i) Protection of data and the right to privacy

The privacy and data protection principles rely on ensuring respect for the autonomy of individuals and safeguarding against the abusive exploitation of sensitive information.[133] In AI applications, particularly in the case of sign languages and deaf communities, the same principles must be applied cautiously to derive solutions that account for the specific needs of utilizing AI systems for sign language interpretation, translation, and communication. Let us observe how the principles enumerated in this passage can be applied in this context. In deaf communities, privacy and data protection are a particularly salient concern. Sign language data, in the form of video, gesture recognition, or other forms of AI-mediated translation and interpretation, is a very intimate and sensitive type of information. Processing such data raises concerns of autonomy, identity, and misrepresentation or exploitation of the language being used by deaf people.[134]

(i) ***Right to Privacy during Use of Sign Language:*** Even as human beings have a right to privacy, in the same way, there is a corresponding right for the deaf

[133] Council of Europe. Guidelines on Artificial Intelligence and Data Protection - T-PD(2019)01

[134] Irish Deaf Society (2025). *Ethical and Legal Framework for AI in Sign Languages*. (§6., pp. 143-149 of the same volume): "There is a risk of commercial exploitation of ISL by companies using AI avatars built from data gathered without consent from or compensation for Deaf people"

people too to control the way their sign language data will be recorded, processed, and used. AI sign language processing systems must ensure that the deaf people data are treated with the best possible privacy measures so that the personal and family life is respected.

(ii) ***Consent and Control Over Data:*** The principle of consent is still key. Deaf people should be able to provide or deny consent for their sign language data to be processed, especially in AI-driven systems that interpret or translate what they communicate. The consent must be informed, specific, freely given, and unambiguous so that deaf users clearly understand how their data will be used, whether for real-time translation, AI model training, or another function.

(iii) ***Potential Data Processing Threats:*** AI systems operating on sign language data are able to infer personal information about individuals that is more than linguistically in nature. For instance, machine learning algorithms can make potential inferences regarding personal tastes, behaviours, or even sensitive health information from gesture or facial expression patterns utilized. Therefore, systems must be devised in a way that the deduced personal information will not violate the right to privacy of the deaf people or expose them to injurious profiling.

(iv) ***Informed Consent in a Multilingual Context:*** Since sign language is not universal around the globe and varies significantly based on the region, it is necessary that information and consent facilities are provided to the deaf users in their native sign language. Providing

consent in written format alone may not suffice for those with visual or gestural communication. Accessibility to consent procedures becomes important to the level where deaf people can make informed decisions about the use of their data.

(v) ***Data Minimization and Security:*** AI systems that work with sign language should adhere to the data minimization principle — only collecting data strictly necessary for the task, with data retention policies to avoid excessive or unauthorized storage. Moreover, the system should employ strong encryption and security protocols to protect sensitive information from unauthorized access, misuse, or breaches.

(j) Principle of Risk Assessment in AI for Sign Language Technologies

Risk assessment principle requires thorough evaluation of AI deployments for sign language processing. AI systems that misinterpret or mistranslate sign languages pose a serious threat to the rights of deaf people. For instance, misleading AI-translated interpretations in legal hearings, medical consultations, or emergency calls can lead to catastrophic consequences, including violating fundamental rights. Therefore, AI systems must endure context-specific risk assessments to guarantee that high-risk applications have rigorous human verification processes in place.

It is essential to implement a structural risk model that would ascertain, categorize, and examine the potential impact of AI on the fundamental rights of deaf people. This model must:

(i) Be proportionate and suitable for the technology purposes, reducing risks and vulnerabilities as much

as possible;

(ii) Categorise the risks in terms of their likelihood and severity, and assign specific focus to high-risk sectors like healthcare, justice, education, and public services;

(iii) Consider the specific effect of employing AI on sign languages, in terms of national, regional, and local linguistic diversity and the attendant cultural contexts.

In addition to assessment, systematic documentation of risks and vulnerabilities is also essential for ensuring traceability and enabling the implementation of effective counter-measures. The government and private organisations are obliged to adopt the responsibility of documentation, publication, and up-dating reports on evaluated risks, based on legal and ethical standards.

(k) Social Responsibility and Developing Sign Language Technology

The social responsibility principle emphasizes the role of AI in mitigating linguistic disparities and enhancing sign language accessibility. AI-based technologies have the capacity to provide increased access to education, work, and government services through real-time interpretation and sign language translation. AI-facilitated accessibility services must nevertheless be developed in close consultation with deaf communities to make sure they actually facilitate easier communication and don't add to broader social disparities. AI can also be a critical factor in safeguarding language diversity by documenting endangered sign languages and their possible revitalization.

(l) Legitimate Trust and Ethical AI for Sign Languages

The principle of legitimate trust is critical in the use of AI solutions for sign language users. Deaf people should be assured that AI-based interpretation and recognition tools operate transparently, predictably, and unbiasedly. All AI technology used in sign language interaction must be built on ethical frameworks that emphasize inclusion, accuracy, and cultural sensitivity. Additionally, developers must engage sign language communities in the design and testing of AI systems so that they reflect the linguistic and expressive richness of sign languages and do not risk algorithmically misrepresenting or standardizing them in a way that could distort natural communication.

(m) Respect for Linguistic Diversity

AI must facilitate, not undermine, the linguistic richness of sign languages. This richness includes not only states officially recognized languages, but also those without legal status, although they are *de facto*, living languages validated by use within communities.[135]

Linguistic homogenization fostered by standardized technology solutions is a definite danger. AI should not be used as a tool for standardization, but rather as a tool to celebrate and preserve linguistic diversity, including national, regional, and local sign languages.

In this case, the protection of sign languages – in accordance with their respective national, regional and local realities – is not limited to preserving a form of communication, but also the identity and dignity of deaf communities. Linguistic material design and analysis for AI needs to be attuned to diversity and

[135] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§6.4) (pp. 167-187 of the same volume)

representation standards that encapsulate deaf people's diversity of contexts, identities, and experiences. Corpus building needs to incorporate different variants of language, with extensive coverage and maintaining no position that would push minority groups of deaf people out.

It requires to make open, transparent, and well-informed access to how data are collected, processed, and used available, making the free and informed consent of the affected parties a prerequisite.

(n) Equity, Inclusion, and Intersectionality

The development of AI must be guided by the ethos of inclusive equity so that all groups of the deaf communities enjoy equal benefits from technological progress.[136] This entails:

(i) Participatory testing and audits with diverse profiles of deaf users, i.e., age, cultural, and socioeconomic diversity;

(ii) Special attention to marginalized groups, such as older deaf adults and other deaf individuals with other intersectional identities;

(iii) Striving to ensure that the use of AI does not expand existing inequities, continue to fuel gaps between those who have access to accessible technologies and those who do not.

[136] RATHMANN, Christian & ROMANEK, Peter (2025). *AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks* (§4–6) (pp. 167-187 of the same volume)

Equity involves the recognition of the intersectionality of deaf experience, the fact that gender, race, social class, territory, and various and plural identities intersect to create vulnerabilities of complexity. AI must, then, be designed not for the teleological, abstract mean deaf subject, but for the multiplicity of the real deaf subjects in all their diversity.

CONCLUSIONS

This analysis reiterates the necessity of reframing the design and deployment of AI in sign language and deaf communities settings not as a simply technical or functional issue, but instead as a structural question of linguistic accessibility, human dignity and democratic participation. Deaf people are anything but passive recipients of innovation, and they must be placed at the forefront as co-creators of knowledge and policy of the engineering of the technological spaces that shape their communication, cultural and civic life.

The report has shown that growing application of AI technologies – especially machine translation systems and generative models – in areas of digital accessibility is being sold, in many cases, as a “quick and cheap” solution to meet legal requirements for inclusion. Efficiency-driven approaches that prioritise cost-saving over quality and rights has the consequence of devaluing the qualitative dimensions of communication in sign language, ignoring these languages' grammatical, visual-spatial and cultural wealth, as well as the grave dangers of misinformation, exclusion and rights violation that are created as human mediation is replaced by systems that are yet imperfect and non-transparent.

Furthermore, the report highlighted that all sign languages are “low-resource languages” in AI, which seriously compromises their inclusion in big linguistic models and technological development platforms. This technical exclusion cannot be divorced from historical and political asymmetries that have

always affected sign languages in the public arena, and it solidifies a digital divide that excludes, especially, deaf people who are not literate in the dominant written language.

The report further highlighted the ethical risks involved in the use of biometric and visual data to train AI models, including automatic recording and replaying of body cues without consent, potential algorithmic surveillance, and commodification of embodied linguistic practices that are harder to anonymize than spoken or written language. They require a robust ethical framework, founded on respect for bodily integrity, data sovereignty, and appropriate cultural representation. To this end, the concepts of Deaf Tech and Deaf Digital Law, developed here, offer an essential epistemological and normative basis to guide the future of inclusive AI. Deaf Tech challenges the idea of technology being a neutral tool and proposes a model of co-design, in which technologies are created based on the knowledge, needs, and rights of deaf communities. Deaf Digital Law, on its part, proposes the creation of specific legal norms that recognize the peculiarity of sign language in the digital environment, ensure the democratic governance of AI, and protect the integrity of sign languages as a linguistic heritage and human right.

Through a dialogue among legal, ethical, technical and sociocultural viewpoints, the report outlines a vision of accessibility that exceeds minimalist legal compliance and is premised upon an emancipatory view of digital inclusion. Such accessibility involves recognition of sign languages as full languages, rejection of poor-quality automated solutions for high-stakes environments, and investment in participatory and ethical methods of technological innovation.

Finally, it reaffirms that the path ahead cannot ignore building robust collaborations between deaf communities, researchers, lawyers, technologists, educators, public authorities and civil society. It is in intersectional dialogue and active listening to deaf experiences that the possibility of an equitable digital future can be envisioned. There, AI is not a threat to linguistic and cultural rights, but an opportunity to amplify, protect and reimagine them.

It is thus concluded that the innovation of AI in sign language contexts cannot be led by criteria of innovation or efficiency alone but must be guided by principles of equity, linguistic justice, social responsibility and co-governance. The future of Deaf people's technological accessibility must ensure that AI supports - and never replaces or marginalises - the linguistic and cultural integrity of deaf communities. With the right legal safeguards, inclusive innovation, and deaf-led governance, AI can become a powerful tool to amplify and protect the full realisation of their rights in the digital age.

RECOMMENDATIONS

Based on the analyses created, the following recommendations are proposed, to policymakers, AI developers, public authorities, scholars and civil society actors:

1. **Participatory Governance and Co-Design**

(i) Ensure deaf people, interpreters and sign language experts' meaningful participation at every phase of the AI life cycle (design, development, implementation, evaluation).

(ii) Promote co-design approaches with deaf communities, respecting their knowledge, languages and cultures.

2. Legal safeguards of Sign Languages in the Digital Environment

(i) Incorporate the legal safeguards of sign languages into digital accessibility and AI legal regimes.

(ii) Render the application of professional human interpretation compulsory in high-stakes environments (education, justice, health), even when automatic solutions are available.

3. Ethical and Technical Regulation of Machine Translation Systems

(i) Establish quality standards, transparency, and explainability for automatic sign language translation systems, especially in public settings.

(ii) Prohibit the exclusive application of AI in high-stakes domains where misinterpretation may compromise human rights.

4. Protection of Biometric and Body Data

(i) Implement specialized directives on ethical use of visual and biometric data used in training AI with sign languages.

(ii) Ensure free, informed and revocable consent to any collection or use of sign and body data.

5. Facilitation of Linguistic Equality and Fair Access

(i) Promote the development of technological resources in national and regional sign languages and less represented languages in technology markets.

(ii) Provide support for AI initiatives to linguistic diversity and digital inclusion of most vulnerable deaf communities.

6. Monitoring and Redress Mechanisms

(i) Set up public monitoring systems for the effect of AI technologies on deaf people's rights.

(ii) Establish clear procedures for reporting harm, correcting errors, and compensating individuals affected by algorithmic discrimination or exclusion.

7. Digital Literacy and Deaf Education

(i) Develop educational programs enabling digital literacy in sign languages.
(ii) Educate the technicians and the interpreters, which are specialized in AI ethics and in technology accessibility

ANNEX

Fundamental Principles of Deaf Digital Law in the Context of Artificial Intelligence

Principle	Description	Objective	Example
1. Technological Self-Determination	The right of deaf people to freely choose the technologies they use, without the imposition of automated solutions.	Ensure freedom of choice and prevent the imposition of ineffective or unwanted solutions.	A deaf people have the choice to use either AI-driven captions or professional sign language interpreters in a virtual meeting, based on their preferences and comfort.
2. Linguistic and Cultural Integrity	Protection of the diversity of sign languages and respect for their variation, avoiding homogenization through AI.	Safeguard linguistic authenticity and cultural rights of deaf communities.	AI systems must support various regional sign languages and adapt its translation models to each.
3. Participation and Co-design	Active involvement of deaf communities at all stages of technological development: design, testing, validation, and implementation.	Ensure that technological solutions meet the real and legitimate needs of their users.	In the development of a speech-to-text app, a group of deaf users, alongside sign language linguists, actively test and provide feedback on the app's functionality.
4. Primacy of Human Interpretation	Guarantee the right to professional human interpretation, especially in sensitive contexts (health, justice, education).	Avoid undue substitution of human interpretation, preserving communication quality and nuance.	In a courtroom, AI-generated captions may assist, but a human sign language interpreter is always available for complex legal discussions and to ensure accuracy.
5. Reasona	Technological adaptations tailored	Respond to the diversity of needs, in	A deaf user with low vision may require high-contrast

ble Accommodations	to the specific realities of each deaf people, such as format, usability, and usage environment.	line with Article 2 of the CRPD.	text or screen readers in a video conference app with AI captions, ensuring accessibility for their needs.
6. Transparency and Explainability	Clear communication about how AI works, its limitations, automated decisions, and accountability.	Strengthen trust, human control, and responsibility over the systems in use.	An AI platform for captioning explains how it processes audio data, what its accuracy levels are, and when human intervention is needed to ensure full context.
7. Protection of Visual-Biometric Data	Ethical and secure handling of sign language and expressive data, with informed consent and proper anonymization protocols.	Prevent abuses and protect sensitive data related to sign language communication.	An AI-powered avatar translating sign language must obtain explicit consent before recording or storing any visual data (e.g., handshapes, facial expressions).
8. Accountability and Redress	Clear legal mechanisms for complaints, review, accountability, and redress in cases of harm caused by AI.	Ensure justice in cases of failures, algorithmic discrimination, or denial of rights.	A deaf user is misrepresented by an AI translation system. The system should have a clear process for the user to file a complaint and have the error corrected promptly.
9. Continuous Improvement and Sustainability	Regular updates to AI systems based on community feedback, linguistic evolution, and technological development.	Ensure long-term effectiveness and adaptation to social and linguistic transformations.	An AI system that translates sign language evolves continuously based on community feedback, as new signs and cultural contexts emerge.

CONTRIBUTIONS

Referencing Note

This publication brings together diverse contributions from experts, organisations, and researchers across the European Union. Each author or organisation retains their preferred academic referencing style. EUD has chosen not to standardise these formats in order to respect the integrity and disciplinary diversity of each submission. All references are the responsibility of the respective contributors.

Italian Association of the Deaf (Ente Nazionale Sordi)

Notes on the Ethical and Policy Framework Concerning the Use of Artificial Intelligence (AI) in Sign Languages (AISL) and Related Deaf Technologies

Real-life examples of benefits or risks of AI systems in Italy

In Italy, we are witnessing the rise of a form of technological solutionism, often driven by external fascination with sign languages and the symbolic allure of signing avatars. Despite increasing evidence of the limitations and risks associated with these systems, research and development continue to advance with minimal attention to co- design processes or validation by the Deaf community.

In institutional settings, the Italian Association of the Deaf (ENS) has frequently encountered top-down proposals involving signing avatar systems, presented as ready-made accessibility solutions. However, these technologies remain underdeveloped and are not suitable for critical contexts such as emergency communication or healthcare. Despite this, they continue to be promoted with enthusiasm, often supported by substantial European funding, which drives AI implementation regardless of the community's readiness or acceptance.

Even the legal recognition of Italian Sign Language (Law 69/2021), while a landmark achievement, has not led to the creation of Deaf-led research centers or spaces dedicated to Deaf epistemologies, such as Deaf Studies programs. Instead, institutional efforts have focused primarily on expanding interpreter training programs, thereby reinforcing a translation-based model of accessibility. This reflects a broader societal narrative in which Deaf individuals are viewed as passive recipients of information rather than as active agents shaping

their communicative environments. Access is prioritized over participation.

Public service institutions, in collaboration with private companies, are developing projects in which sign language avatars are promoted as the solution to Deaf inclusion. This reinforces a top-down model of accessibility focused solely on "translation." Missing from these initiatives is genuine engagement with Deaf people's needs and expectations, as well as the exploration of alternative, creative applications of AI, such as Deaf-led apps, AI tools to support writing, learning, teaching, or workplace accessibility. Instead, the focus remains narrowly centered on sign language avatars.

The dynamics described by Deaf scholars such as Desai et al. (2024) and Angelini et al. (2025) are currently unfolding in Italy with near-identical patterns.

Views on how to ensure deaf agency, leadership, and co-creation in AI-related projects

Deaf skilled individuals and Deaf-led organizations must be involved from the earliest stages of project design, and ideally, the projects themselves should emerge from the needs and proposals of Deaf communities. This requires increased recognition and representation of Deaf voices at institutional levels.

We support the position statements issued by the World Federation of the Deaf (WFD) and the World Association of Sign Language Interpreters (WASLI), as well as the recent Coalition on Sign Language Equity in Technology (co-SET) Report.

Reflections on legal gaps and good practices in data protection and biometric privacy

In Italy, privacy issues already affect Deaf individuals in existing communication services. For example, Deaf users of video relay services often face rejection from company or public-sector call centers, which refuse to recognize the interpreter's mediation and demand direct spoken communication. Some even deny the use of interpreters, citing privacy concerns. This is a significant barrier to accessibility.

Other issues include the difficulty many Deaf users experience in reading disclaimers, privacy policies, or terms and conditions on apps and websites—putting them at risk of consenting to terms they do not fully understand.

Use cases: what should be permitted or prohibited, and under what conditions

While AI technologies may offer support in specific contexts, their use must be carefully regulated—especially in high-stakes environments such as healthcare, emergency response, or any context where accurate, real-time communication is essential. In such cases, AI cannot and must not replace qualified human interpreters.

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Irish Deaf Society Submission to the European Union of the Deaf

Ethical and Legal Framework for AI in Sign Languages

Submitted on 30th May 2025

Introduction

This document is a response to the invitation for submissions from the European Union of the Deaf on an Ethical and Legal Framework for AI in Sign Languages and is submitted by the Irish Deaf Society (IDS).

The IDS is the only national Deaf-led representative organisation of the Deaf, and it serves the interests and welfare of the Deaf community. It provides educational and advocacy services, and advice delivered through ISL to Deaf children, adults, and their families. ISL is the language of the Deaf community and was recognised as such via the ISL Act 2017. The Deaf community sees itself as a linguistic and cultural minority group.

The IDS is recognised as a Disabled Persons' Organisation (DPO) under the UN Convention on the Rights of Persons with Disabilities (CRPD). IDS are members of the World Federation of the Deaf (WFD) and the European Union of the Deaf (EUD) and have consulted with international Deaf representative bodies in relation to a number of societal issues that impact on Deaf people.

The IDS leads the ISL Act Cross Community Group, which is a group of National organisations and service providers working in the Deaf community. We consult with this group in relation to topics of interest to Deaf people including the ISL Act and the

topics discussed in this submission. This group includes the following members: Bridge Interpreting, Centre for Deaf Studies (CDS) TCD, Chime, Council of ISL Interpreters of Ireland (CISLI), Council of ISL Teachers (CISLT), Greenbow LGBTQ+, Irish Deaf Research Network (IDRN), Irish Deaf Youth Association (IDYA), National Deaf Women of Ireland (NDWI), Sign Language Interpreting Service (SLIS), Deaf Reach Services and Deaf Sports Ireland (DSI).

There are no accurate statistics on the size of the Deaf community in Ireland, but it is estimated that 5,000 people communicate in ISL as their primary language together with a community of an estimated 40,000 including family, friends and those working in the Deaf community. The most recent data from the central statistics office show there are over 233,000 people who are deaf and hard of hearing in Ireland. However, not all communicate in ISL as their primary language, or many may not consider themselves to be part of the Deaf community. The IDS use the term Deaf to cover all Deaf people, regardless of the degree of hearing they have.

Below, we will highlight some points to be considered by the European Union of the Deaf with respect to an Ethical and Legal Framework for AI in Sign Languages.

Points to be considered

1. General statement

The IDS strongly supports the development of an ethical and legal framework for AI in Sign Languages (AISL). We advocate for a rights-based, Deaf-led approach to the design and deployment of AISL technologies. IDS supports the EUD's overarching principles and affirm the following:

- Deaf cultures and sign languages must be protected and not commodified or standardised by AISL technologies.
- Deaf people must have agency and leadership in the design, development and evaluation of AISL technologies.
- Deaf professionals must retain full control over their Name, Image, and Likeness (NIL) in AI- generated representations.
- The framework must be grounded in international human rights standards, particularly the UNCRPD
- Signing avatars must never replace live, human sign language interpreters in contexts where human nuance and accuracy are critical. This is highlighted in the WFD-WASLI Joint Statement (2021).
- Informed consent, transparency and data protection must be fundamental in all AISL technologies.
- Revenue generated through the use of AI avatars or systems that use Deaf likeness or signing must benefit the original contributors and the broader Deaf community.
- AISL technologies must be accountable, trustworthy, culturally respectful and human-centred.

2. AI Applications and Potential Benefits

With strict regulations and standards, AI has the potential to enhance access and inclusion for Deaf people in Ireland, particularly for public information and announcements. Such contexts may include signing avatars for standard instructions/announcements in waiting rooms (e.g. hospitals) and transport systems, and emergency alerts. However, the

benefits depend on co-design with Deaf people and culturally competent development.

3. AI, Legal Protections, and Regulatory Frameworks

While there is no specific legal protection in Ireland for AI and sign languages, the EU AI Act may offer some ethical and legal guidance. The EU AI Act is the world's first legal framework regulating artificial intelligence. It aims to ensure AI systems are safe, ethical and respect fundamental rights within the EU. The Act categorises AI systems into four risk levels, each with specific obligations- unacceptable risk, high risk, limited risk and minimal risk. A similar but nuanced approach could be applied to specifically to AI and sign languages i.e. what is considered limited or minimal risk in other AI systems may indeed be considered unacceptable or high risk in the case of, for example, using AI text/voice-to-sign in medical, legal or educational settings.

4. Technological Challenges and Development Considerations

- Ethical access to ISL data sources for training machine learning systems
- There has been underinvestment in digital sign language documentation in Ireland
- Accounting for variation within ISL e.g. gender, region etc

5. AI and the Future of Sign Languages

- AI can support the preservation and promotion of ISL through digital corpora, but this must be community-led.

- Variation must be preserved and mitigate the risk of presenting “standard” ISL

- IDS supports multilingual sign language projects where Deaf communities control translation standards and ethics

- Guiding principles should include: informed consent, linguistic integrity, cultural respect, co- creation and transparency

6. Ethical Dilemmas and Societal Risks

We echo the WFD–WASLI Joint Statement on Signing Avatars (2021), which warns against inappropriate use of avatars:

- Avatars must not replace qualified human interpreters, especially in legal and medical settings. AI-generated signing lacks fluency, emotion and cultural nuance which can have detrimental communication implications. IDS would also include education in the contexts where qualified human interpreters are essential.

- There is a risk of commercial exploitation of ISL by companies using AI avatars built from data gathered without consent from or compensation for Deaf people.

- The representation of signing without community validation risks linguistic erasure and harm.

7. Use Cases and Guardrails

As mentioned above, the appropriate use of signing avatars are confined to limited public information such as instructions and announcements. ISL documentation projects are, when

community-led and ethically governed, beneficial for the preservation and promotion of ISL.

Prohibited Use Cases:

- Signing avatars used without consent or compensation of the original signer or community
- Signing avatars replacing qualified human interpreters especially legal, medical, education or emergency communication

Guardrails:

- Ethical review boards with Deaf experts for all AISL projects
- Human oversight by native signers
- Transparency about whether content is AI-generated
- Agreements recognising NIL and data rights of Deaf contributors
- Community-led dataset access and control

Conclusion

The area of AI in Sign Languages must develop in a way that is rights-based and rights-led and promotes linguistic diversity and cultural integrity. IDS urges the EUD to ensure that the resulting ethical and legal framework for AI in sign languages:

1. Is led by and co-created with Deaf people
2. Protects NIL, language data, and consent
3. Prevents standardisation or commodification of sign languages

4. Embeds enforceable ethical, legal and participatory standards in all AISL development

Supporting Documents

IDS Strategic Plan 2023-2026: https://irishdeafsoc.wpenginepowered.com/wp-content/uploads/2023/06/IDS-Strategy-2023-2026-Web-Download-1.pdf

For more information on any of the above, please contact ceo@irishdeafsociety.ie

Call for Contributions: Ethical and Legal Framework for AI in Sign Languages – Answer from ADH Czechia (SNN v ČR)

The use of Artificial Intelligence (AI) in relation to sign languages and the Deaf community must be handled with great care. While we recognize the potential of AI to improve accessibility, independence, and efficiency, we also see the risks of unethical application, poor quality, and exclusion. Through consultations with key institutions and organizations in the Czech Deaf ecosystem, we offer the following consolidated recommendations:

AI as a Supportive Tool – Not a Replacement

Maintain human-centered interpreting and translation in contexts requiring ethical judgment, emotional sensitivity, or legal precision.

Label AI-Generated Content Clearly

Especially in sign language contexts, where misrepresentation or deepfakes can seriously damage trust and identity.

Data Quality and Linguistic Representation

Ensure AI systems are trained on high-quality, culturally rich sign language data, developed and reviewed with input from native signers and linguistic experts.

Protect Vulnerable Groups

Prevent sudden job loss among interpreters or support workers, and ensure that older or digitally excluded Deaf individuals are not left behind.

Transparent Ethics and Legal Frameworks

Develop legislation that addresses biometric data privacy, interpreter accountability, and liability for AI-related errors.

Inclusive, Interdisciplinary Development

AI systems for sign language should be developed through open, interdisciplinary cooperation involving Deaf community representatives, linguists, legal experts, and technologists.

Education and Digital Literacy

Promote AI literacy among Deaf users, enabling them to understand and evaluate AI-generated content critically.

Artificial intelligence should not deepen inequality but be a tool of empowerment. Its development and application in the Deaf context must reflect not only technological advancement but also respect for language rights, human dignity, and cultural identity.

We hope this contribution from ADH Czechia can serve as a valuable voice in shaping a safe, just, and Deaf-aware European framework for AI in sign languages.

The next section presents the detailed background submission from ADH Czechia and five partner organisations. Their inputs are shown as received, with some variation in style, to ensure transparency and preserve their authentic voices. The consolidated recommendations above were drawn from these contributions.

Background submission from ADH Czechia (SNN v ČR)

Artificial Intelligence (AI) is a very important topic in almost all aspects of human life and in management of organizations for the Deaf. In the last few years, AI is evolving rapidly and we find it very crucial to set the framework for Full Member States of the EUD to participate in the discussion to set rules and boundaries for future usage of AI in the Deaf community, sign languages and management of the organizations to prevent future ethical, diplomatic and political problems in the future.

Big language models are used for the research of sign languages without regulations, there are projects trying to implement AI into sign language translations (e.g. Signapse.ai) and to enhance sign language interpreting services. We, ADH Czechia, see it as a revolution of peoples' approach to inclusion, technical support for the Deaf, and we believe that this technology is going to change where and how the Deaf people are going to work in the society. This opportunity sounds tempting for us, organizations of the Deaf, to join this big wave with no hesitations and to be part of this fast development and let IT professionals and AI developers to do the tough work for us. On May 22, 2025, the US House of Representatives passed a set of significant AI-related provisions in the budget reconciliation package, currently making its way through Congress. These provisions would bar US states and localities from enforcing laws or regulations on AI models for further 10 years, till 2035. This is a major concern for the whole future of AI in our society and we find it crucial to set a different approach to AI framework when it comes to sign languages and the Deaf community in Europe. There are ethical, environmental, cultural and social reasons to do so.

Other reason to set this EUD framework could be the EU AI Act, the first regulation on artificial intelligence from June 2024

that protects EU citizens from misuse of AI in the EU. We strongly support this Act that can prevent dangerous AI systems to harm European democracy and EU citizens, especially the Deaf who can be more vulnerable as a language and cultural minority. We strongly support the idea of labeling AI generated content as 'AI generated' when it comes to content in sign language on social media that can be in some cases hateful, can steal peoples' identity (so called deepfakes) or break the intellectual property laws.

Therefore, we recommend these factors to bear in mind while setting the AI framework:

- Proceed consciously and systematically in the implementation of AI to prevent sudden job losses in the Deaf community and uncontrolled production of non-human content.
- Protect vulnerable groups from job loss due to AI automation.
- Protect and educate against the risks of deepfake, false and AI-generated content in both spoken and sign languages.
- Emphasize labeling content that is created by AI.
- Prioritize sign language translations and interpreting from real people in serious situations that can affect future of the individual.
- Emphasize human control of AI decisions on ethical issues and in situations where it significantly affects peoples' lives.

We didn't want to do this statement for the Czech Deaf community and for the Czech Sign Language alone, so we

invited other major organizations and institutions for the Deaf to share their opinions along with ours. In the Czech Deaf community, AI is not used much yet, but we see it as a very important subject to discuss to be prepared for the fast and rapid shift of how things are done in the community. We asked almost all major organizations, but due to tight deadline we received five answers. We have anonymized involved organizations out of respect for their privacy. The organizations are:

- University Support Centre for Students with Special Needs
- University Institute of Deaf Studies
- Interpreting services for the Deaf
- Professional translating and accessibility services for the Deaf
- Community center for the Deaf

University Support Centre for Students with Special Needs

Positive:

Better Internet search for people with written language as the second language – AI generated short answers, customized content for different language levels for the Deaf individuals.

Negative:

Hard to find sources where AI gets information from, hard to compare, bias, no double-check.

AI as addition to current services:

Easily translated predictable content (e.g. public transport info), support for social and interpeting services in clear situations.

Deaf influence:

Poor quality of AI interpreting and translation services for the Deaf. Deepening the gaps for technically untalented, socially weak and some older, health-impaired citizens. Using AI for communication - translations/interpretation between Czech and Czech Sign Language will bring initial disillusionment and disappointment from misunderstandings. For example, literal translations that will not reflect the true meaning of the message, problems with phraseology, idioms, irony, etc., difficulties with a diverse and changing character stock, grammar. There will probably also be some technical difficulties and a lack of human willingness, similar to what happened with the introduction of online interpreting. We also see a risk in not reflecting culture and individual adaptation with regard to the possibilities of communicating individuals (intellectual abilities, health status). After years, when the quality improves, there will be less need for live interpreters/translators.

Sign Language risks:

In the case of Czech Sign Language, we see an increased risk that AI will use poor-quality data as input, so the output will also be poor-quality (translations/interpretation). Currently, we still do not have a sufficiently described grammar of CSL, a sufficient number of research and scientific papers, we do not have a corpus of language production of native CSL users on the basis of which CSL dictionaries would be created. On the contrary, we have a 'jungle' in the field of dictionaries and materials in CSL and Signed Czech. People have difficulty navigating it. We also see a risk that when processing Czech, the creators will focus on the manual part and will only marginally pay attention to the non-manual part, which is just as important. The results were visible in the first avatars, which did not have facial expressions, even though they are meaningful and grammatically necessary.

What to keep in mind:

Protection of the older generation, the disabled and the weaker, the health-disadvantaged. General education in critical thinking and information evaluation. Education in the use of AI for translations and interpreting in real situations - of all communicating parties.

Ethical and legal issues:

A live interpreter has a code of ethics, responsibility, and will not be abused for fraud. If this happens, it is resolved through ethics committees, fines, etc. It will be necessary to tighten the liability of the AI operator for errors caused by poor-quality translation/interpretation and address the consequences through legislation. Approach AI thoughtfully and responsibly.

University Institute of Deaf Studies

Artificial intelligence has a great impact on all areas of our lives, no one knows where it will go and it will definitely affect sign languages, the deaf community and the field of Deaf Studies.

I see huge potential in this if AI is able to learn sign languages at a similar level to how it can master spoken/written languages. It does not yet have sufficient data. It could have a great impact on sign language research, for example, annotations in corpora, which are currently done manually, could be faster in conjunction with artificial intelligence. If it could translate from/to sign languages, it would be a major breakthrough in the accessibility of deaf people to everything that is currently only in the majority language. Now everything is changing from day to day and I am not able to predict what the impacts will be. Colleagues from the Department of Cybernetics in Pilsen are working quite intensively in this field and according to them, it is a matter of the very near future. It's hard for me to comment on something that I don't know how it will look or function. The impacts will certainly be far-reaching and I believe they will be rather positive.

Interpreting services for the Deaf

Possible benefits:

- Czech proofreading.
- Czech stylistic editing.
- Inspiration for teaching CSL or for various ppts.
- Use to help with understanding text - plain language (easy-to-read).
- Searching for necessary information (private, work, etc.).

AI as addition to current services:

- In social services, employees can search for necessary information.
- Social service clients can use AI to meet some of their goals (text editing, letter explanation - plain language, etc.).
- Expected impacts on the field:
- How do you imagine the impact of AI on the professional field of interpreting, translation or education of the deaf?
- In interpreting, it will help with the preparation of interpreters
- In translation, it will help interpreters with stylistics and proofreading of Czech

Deaf influence:

- assistance with the preparation of teaching the Deaf.
- Collaboration between AI and humans:
- How do you imagine effective cooperation between AI and human experts? Where should the priority remain for human work and where can AI effectively help?
- preparation, information search, help with instructions and procedures, explanation of terminology
- but the expert must verify the information

Sign Language risks:

- Inaccurate translation, without a cultural perspective
- Risk of data leakage
- Does not take into account dialects and language differences
- Loss of meaning of the message if the non-verbal component is not involved
- Unable to adapt to children, to people with mental disabilities, etc.
- Does not recognize all oral components, lacks a corpus of sign language
- Interpreters will lose their jobs, human empathy will be missing

What to keep in mind and future wishes:

- Development of avatars
- Use of translation and interpreting in courts

- Ethics and human rights

Ethical and legal issues:

- Fear of giving sensitive information to AI in general, but also fear of reliable interpreting, for example, to maintain confidentiality
- Who is responsible for the accuracy of the translation?
- Where should a possible complaint be directed?

Do you see a need for changes to the legal framework (e.g. in the area of biometric data protection, privacy)?

Yes.

Recommendations and inspiration:

- Enter instructions for AI well
- Verify information
- Do not enter sensitive information
- Do not rely on sufficient understanding of the text
- Involve the deaf community in the development and testing of AI
- Create open and extensive sign language database so that the state continues to trust experts more than AI

Community center for the Deaf

Community center shared views with us on the use of artificial intelligence (AI) in the context of sign language and its potential benefits for the everyday lives of deaf individuals.

The Benefits of AI:

Easier Work with Text and Improved Comprehensibility

Community center emphasised that AI significantly helps deaf users when working with written text, which can often pose a barrier. With AI, there's no longer a need to seek help from an interpreter or another person to edit or clarify written communication. AI can simplify complex texts into clearer, more accessible sentences, which the organisation sees as an important step toward greater independence for deaf individuals.

AI and the Translation of Signed Language into Text

According to the community center, examples from abroad (particularly in the U.S.) show how AI is already being used to translate sign language such as American Sign Language (ASL) into written English. The organisation sees this as an inspiring example of what could eventually be developed for Czech Sign Language (ČZJ) as well.

Ethical and Legal Issues:

Community center explained that it did not feel qualified to address the ethical or legal implications of AI in depth, recommending instead that such questions be directed to relevant specialists to ensure informed and accurate responses.

A Vision:

Community center interactions with public authorities. The organisation outlined a vision of a tool that could help clarify their written or signed communication, ensuring that their needs, questions, and intentions are clearly understood—helping to avoid misunderstandings in important settings.

The Future of Interpreting Services: AI as a Complement, Not a Replacement

Although AI is advancing rapidly, the organisation stressed that they do not believe it will replace human interpreters. The organisation added that AI can enhance communication and expand accessibility, but cannot match the nuance, contextual understanding, and cultural sensitivity that human interpreters provide.

Professional translating and accessibility services for the Deaf

We sincerely thank you for reaching out and for the initiative to open a discussion about artificial intelligence and sign languages. We consider this a highly relevant topic that, in the Czech context, has not yet been addressed systematically. Therefore, we believe it is crucial that any recommendations or positions in this area be formed only after an interdisciplinary discussion.

In our view, the debate should involve experts across fields – including artificial intelligence, sign language linguistics, the Deaf community, translation and interpreting studies, and service providers for Deaf users. Only in this way can we address the full scope of issues related to the development and use of AI in the field of sign language – and avoid the risk of overlooking important dimensions or heading in the wrong direction.

We are happy to offer our participation in future discussions, working groups, or roundtables. We would like to contribute from the practical perspective – based on our experience providing interpreting and translation services for Deaf clients. In particular, we see a need to focus on topics such as:

- protection against the misuse of AI for disinformation and deepfakes in sign language,
- the impact of automation on interpreter employment,
- the need to label AI-generated content, especially in sign language,
- the importance of the human factor in ethically or emotionally demanding situations.

We are also aware of certain concerns among our clients and users – AI is still hard to grasp for many of them, and its involvement in sensitive areas (e.g., communication with authorities or in healthcare) may cause uncertainty. That's why we see it as key that the discussion about AI in sign language be transparent, inclusive of the community, and focused on protecting the rights of Deaf people as a linguistic and cultural minority.

This is a topic we are very interested in. We are closely following developments internationally and would be happy to stay in touch.

Conclusion

The integration of Artificial Intelligence into sign language, Deaf services, and the broader Deaf community brings significant opportunities, but also serious ethical, legal, and cultural challenges. As AI technologies develop rapidly, they must not outpace the values, rights, and lived realities of the Deaf community. The responses gathered from leading Czech institutions and organisations working with and for Deaf people reflect both a cautious optimism and a critical awareness of the potential harms if AI is implemented without proper safeguards.

AI has the potential to enhance accessibility, especially in areas like text simplification, sign language research, or interpreting preparation. Yet, the risks of poor-quality data, deepfake misuse, lack of cultural understanding, and job displacement remain serious concerns, especially for vulnerable groups such as older Deaf individuals, those with additional disabilities, or those less technologically equipped.

Across all the responses, a consistent call emerges: any implementation of AI must center the Deaf community, involve real Deaf experts in its development, and ensure that AI serves as a supportive tool, not a replacement for human empathy, culture, and professional expertise. There is strong support for legislative protections (like the EU AI Act), labeling of AI-generated content, and for prioritizing real human interpreters in sensitive or impactful situations.

ADH Czechia (SNN v ČR) urges the EUD to proceed systematically, transparently, and ethically in setting a European framework for AI in sign languages. This includes not only technological standards but also robust legal and ethical principles that reflect the linguistic, cultural, and social uniqueness of Deaf communities across Europe. Let us not

miss the chance to shape this revolution together—wisely, responsibly, and inclusively.

AI-Generated Sign Languages (AI-SL): Opportunities, Challenges, Recommendations and Legal Frameworks

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Abstract

Advances in AI-generated Sign Language (AI-SL) technologies offer promising avenues for enhancing accessibility and communication across linguistically and culturally diverse communities. Drawing on recent developments in machine learning (ML) and large language models (LLMs), this short paper discusses the technological, sociolinguistic, and ethical dimensions of AI-SL implementation in public services, education and structured interactions in public domains. The paper emphasizes the importance of modality-inclusive sign language datasets, co-design practices with deaf experts/professionals and with linguistically and culturally diverse deaf communities, and regulatory frameworks to mitigate challenges such as depersonalization, data protection, and technological over-reliance.

1. Introduction

The integration of artificial intelligence in sign languages (AI-SL) marks a significant shift in communication and information accessibility. With the emergence and proliferation of large language models (LLMs) trained on extensive multimodal corpora, AI now holds the potential to provide real-time sign language interpreting/translation, educational opportunities, and accessible public services. Despite these technological advances, fundamental linguistic, ethical, and legal concerns arise (De Meulder, 2021; Desai et al., 2024). These require careful, community-participatory responses from linguistically and culturally diverse deaf communities and from deaf experts

in interdisciplinary fields to ensure ethically and socially responsible implementation.

1.1. Relevance to Existing Legal Frameworks

- EEA Article 1-2 (Scope)

2. Sign Language Data Design

As sign language corpora informs all AI-based technological solutions, it is crucial that the design of sign language corpora involves principles and guidelines to ensure its tailored application in the construction of accurate AI models (Desai et al., 2024), while promoting the technical implementation of C.A.R.E principles (Carroll et al., 2020) adapting to the documentation of the sign languages and linguistically and culturally diverse deaf communities (Quadros et al., 2022), with special focus on the decentralized data governance and open access, shaping the technologies in dialog with Deaf stakeholders (Mesch, 2024). It should not be limited to majority sign languages only. (Gallaudet Linguistics Department, 2025)

2.1 Relevance to Existing Legal Frameworks

- UN-CRPD Article 31 (Statistics and Data Collection) – Ethical, inclusive, and transparent sign language corpus development.
- EEA Article 1-2 (Scope)
- EU AI Act Article 10 (Data Governance) – Emphasis on inclusive, quality sign language datasets.

2.2 Corpus Design and Training Requirements

Existing sign language corpora often suffer from limited representativeness. Effective corpora must ensure the diversity, large size, distribution and transparency (cf. Salonen et al. 2016) by satisfying the following criteria (Woodbury, 2003):

- It entails natural data from discourse-based direct interactions in respective sign languages, emphasizing the wide notion of data (Erdocia, 2024).

- It entails natural monologues, dialogues and group discussions produced by linguistically and culturally diverse deaf signers, including deaf signers whose sign language(s) were acquired within the first three years of life.

- It entails a wide range of linguistic registers across formal, semi-formal and informal contexts.

- There is a balanced representation of sociolinguistic variables including age, education, gender, and language acquisition background.

- Data sets cover multiple discourse types (e.g., narrative, expository, argumentative, descriptive and instructional).

- It entails domain-specific lexical items (e.g., STEM disciplines, healthcare, justice, performance, education).

- It entails the system of comprehensive corpus-based annotation, including ID-glosses, phonological, morphosyntactic, lexical and semantic information, and metadata (Keränen et al, 2016).

- Co-creation of systematic training opportunities in corpus design (and AI technology) for sign language users will be ensured.

- Sign Language corpora in local, regional and national sign languages and their respective written languages will have the same corpus design.

2.2.1 Relevance to Existing Legal Frameworks

- UN-CRPD Article 31 (Statistics and Data Collection) – Metadata and sociolinguistic diversity in datasets.

- EU AI Act Article 10 (Data Governance) – Emphasis on inclusive, quality sign language datasets.

3. AI-SL Systems: Access to Public Information

3.1 Opportunities

AI-SL systems can deliver on-demand interpreting and translation services, particularly in contexts where qualified human interpreters should be unavailable. This could substantially improve access to public information in public sectors such as healthcare, education, employment and public administration.

3.1.1 Relevance to Existing Legal Frameworks

- UN-CRPD Article 9 (Accessibility) – AI-SL systems improving access to public services (healthcare, education, employment).

- UN-CRPD Article 21 (Freedom of Expression and Access to Information) – On-demand sign language interpretation via AI-SL.
- EEA Article 1-2 (Scope)
- EEA Article 4 – Ensuring accessible design and implementation.
- EU AI Act Article 6-7 (High risk) – AI-SL access-enabling tech in essential domains

3.2. Language-based Challenges: Limitations of Interpreting-mediated Sign Language Data

Data from sign language texts produced by sign language interpreters (most of whom are L2M2 users) in interpreting-mediated settings tends to exhibit irregularities in terms of phonology, lexis, semantics and morphology (i.e. errors resulting from the interpreting process). Such data can introduce biases that compromise the accuracy and naturalness of models (Fox et al., 2024). For this reason, the use of interpreting-mediated sign language data should be discouraged altogether.

3.3 Ethical Challenges: Depersonalization

Using avatar-based systems raises potential concerns about how sign language is represented visually (Xia et al., 2024). Firstly, adequate representation of ethnicity, gender, age, region etc. may not be guaranteed, and tokenism may become prevalent. Second, the design of avatars might not be

accessible for certain end users (e.g. DeafBlind individuals) (Krausneker, 2022; Angelini et al., 2024).

3.3.1 Relevance to Existing Legal Frameworks

- UN-CRPD Article 33 (National Implementation and Monitoring) – GDPR compliance and data protection.
- EEA Article 4 – Ensuring accessible design and implementation.
- EEA Article 7 – Addressing depersonalization, ethical use and user diversity.
- EU AI Act Article 13 (Transparency) – Clarity around avatar systems and public-facing interfaces.
- EU AI Act Article 52 (Human Interaction Disclosure) – Avatar communication requires disclosure and accessibility design.

3.4 Legal Challenges: General Data Protection Regulation (GDPR)

Due to the visual nature of sign language data, compliance with the General Data Protection Regulation (GDPR) is essential. Member states may have their own legal frameworks that are subsidiary to the GDPR, and these shall be taken into account. In principle, sign language data should be considered sensitive and treated with the same privacy protections as gesture data, multimodal data and spoken language data.

3.5 Recommendations

In order to implement AI-SL systems for information access, there are five recommendations to be adopted:

- Employ community-centered co-design frameworks that involve deaf experts and deaf-led organisations/associations.
- Integrate the annotated corpora of natural sign language data provided by deaf signers with culturally and linguistically diverse backgrounds.
- Establish legal frameworks and legal provisions that provide robust protection of sign language data, complying with current data protection regulations.
- Develop AI models trained on datasets with a wide range of linguistically and culturally diverse sign language data.
- Ensure that the deployment of AI-SL adheres to the principles set out in the European Charter for Regional or Minority Languages (ECRML).

3.6. Relevance to Existing Legal Frameworks

- UN-CRPD Article 21 (Freedom of Expression and Access to Information) – On-demand sign language interpretation via AI-SL.

4. AI-SL Systems: Sign and Written Language Acquisition

4.1 Opportunities: Education

AI-generated sign language tools offer significant potential for various plurilingual and pluricultural learning and teaching environments. They promote the acquisition of sign language comprehension skills, sign language production skills, sign language interaction skills, and mediation skills. Moreover, it promotes autonomy of learners. (Rathmann et al., 2024)

4.1.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 24 (Education) – Use of AI-SL tools in multilingual education and development of sign language comprehension and production skills.
- EEA Article 1-2 (Scope)
- EEA Article 4 – Ensuring accessible design and implementation.
- EEA Annex I. (E-books / education) – Educational tools supporting sign language acquisition and self-learning.
- EU AI Act Article 6-7 (High risk) – AI-SL access-enabling tech in essential domains.

4.2 Technical Challenges

- Multimodal integration of spoken, written, and signed modalities remains a critical requirement for comprehensive learning platforms.
- Existing educational technologies often fall short in accommodating the unique needs of deaf learners with linguistically and culturally diverse backgrounds.

4.3 Language-based Challenges

The strict language standardization might cause less appreciation of sociolinguistic variation and cultural richness of sign languages at local, regional and national levels. As a consequence, it will lead to language inequalities between minority and majority sign and written languages.

4.4 Recommendations

In order to make AI-SL systems adaptable for language learning, teaching and assessment, there are three recommendations to be adopted:

- Design educational (especially self-learning) tools in alignment with the Common European Framework of Reference for Languages (CEFR CV).
- Utilize a variety of pedagogical strategies in the AI-SL environment tailored to diverse learning needs.
- Develop valid and reliable AI-based assessment tools within educational research settings.

4.4.1 Relevance to Existing Legal Frameworks

- UN-CRPD Article 24 (Education) – Alignment with CEFR and inclusive pedagogies

5. Structured Interaction in Public Services

AI-SL can facilitate structured, everyday interactions between service providers and deaf signers in public services such as

transport, post offices and administrative institutions like hospitals, police stations and fire stations.

For such systems to succeed, they must be robust and reliable, and capable of earning end users' trust through consistent, ethical performance.

Furthermore, it is worth noting that non-predictive public announcements, especially in critical, war or catastrophic situations, and non-structured everyday interactions require deaf and hearing sign language interpreters and translators to be deployed.

5.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 9 (Accessibility) – Ensuring robust and ethical AI-SL systems in daily life.
- EEA Article 1-2 (Scope)
- EEA Article 4 – Ensuring accessible design and implementation.
- EEA Article 5 – Platform for good practice and harmonized technical support.
- EEA Annex I. (E-commerce) – Structured interaction in services akin to e-commerce or transactional communication
- EU AI Act Article 6-7 (High risk) – AI-SL access-enabling tech in essential domains.

6. Broader Issues and Considerations

6.1 Over-Reliance on AI-SL

A disproportionate reliance on AI-SL for communication can undermine the benefits of direct personal interaction and Deaf-led, language-based services, as well as threatening the intergenerational transmission of natural sign languages at local, regional and national levels. A balanced strategy for integration is needed in the framework of community-based and sustainable language practices. These practices offer a healthy, holistic approach to AI-SL usage in everyday interactions (cf. De Meulder, 2021).

6.1.1. Relevance to Existing Legal Frameworks

- EEA Article 7 – Addressing depersonalization, ethical use and user diversity.
- EU AI Act Article 5 – Cautions against misuse, erosion of language rights.
- EU AI Act Article 14 (Oversight) – Encouraging human oversight in AI-mediated communication

6.2 Platform Integration

Effective and sustainable deployment of AI-SL solutions requires synergy-based partnerships with developers, interface designers, and accessibility consultants to ensure seamless integration across digital platforms and devices, taking the needs of the end-users with various backgrounds into account (cf. Börstell, 2023; Picron et al., 2024).

6.2.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 9 (Accessibility) – Ensuring accessible digital platforms for Deaf users.

- EEA Annex (General) – Platform integration and multimodal design.

- EU AI Act Article 13 (Transparency) – Clarity around avatar systems and public-facing interfaces.

6.3 Multimodal and Semiotic Resources

Future AI-SL systems must incorporate manual and non-manual components, such as facial expression, mouthing, body posture, prosodic cues, gestures and the use of gestural space (Malaia et al., 2024), which are essential for sign language comprehension and interaction. This is particularly important for avatar design (Zhang et al., 2025).

6.3.1. Relevance to Existing Legal Frameworks

- EEA Annex (General) – Platform integration and multimodal design.

- EU AI Act Article 52 (Human Interaction Disclosure) – Avatar communication requires disclosure and accessibility design.

6.4 AI-SL at the Global Level

It is important to acknowledge that International Sign Language and other major sign languages, such as American Sign Language, are becoming increasingly visible at international events and on social media. They will play a significant role in the development of AI-SL technology. However, in order to

ensure that minority, local, regional and national sign languages are included in universal AI-SL developments, it is essential to invest the necessary resources and raise awareness to their fullest extent and in accordance with the European Charter of Regional and Minority Languages. (De Meulder, 2025)

6.4.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 30 (Participation in Cultural Life, Recreation, Leisure and Sport) – Inclusion of minority and regional sign languages in global AI-SL systems to ensure equitable cultural participation.

6.5 Research Ethics

The development of AI-SL technologies should be based on ethical principles and guidelines developed by Deaf experts and researchers, with the active involvement of linguistically and culturally diverse Deaf communities (Desai et al., 2024, see also Rathmann et al to appear). These technologies should promote contemporary linguistic research practices in terms of reproducibility. This will ensure that the research agenda, priorities, and data handling practices align with the needs, expectations, linguistic values, and cultural values of Deaf communities, as well as the principles of linguistic integrity and inclusivity (Börstell, 2023; De Meulder, 2025, Rathmann et al, to appear).

6.5.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 4 (General Obligations) – Involvement of Deaf communities in research; co-design principles.
- EEA Article 7 – Addressing depersonalization, ethical use and user diversity.
- EU AI Act Article 5 – Cautions against misuse, erosion of language rights.
- EU AI Act Article 10 (Data Governance) – Emphasis on inclusive, quality sign language datasets.

6.6 Resources: Good Practice

As the development of AI-based technologies and applications is accelerating, we are promoting the creation of a platform that provides a comprehensive and up-to-date list of legal documents, toolkits, guidelines, procedures, and other products addressing the above considerations and recommendations. This could help developers, IT designers, researchers, deaf professionals, experts and policymakers to promote good practice.

6.6.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 33 (National Implementation and Monitoring) – Need for toolkits, guidelines, and legal frameworks to ensure compliance and ethical standards.
- EEA Article 5 – Platform for good practice and harmonized technical support.
- EU AI Act Article 11 (Documentation) – Repository of legal tools, datasets, ethical guidance.

7. Conclusion

Artificial intelligence has the potential to transform sign language inclusivity and accessibility. However, without deliberate design in a stakeholder-based process, it poses potential threats. To realize the potential of AI-SL, we must develop inclusive datasets, community-centered designs, and legal safeguards. Ethical frameworks must be informed by Deaf-led research to ensure that AI-SL technologies do not compromise the linguistic richness, autonomy, or cultural identity constructions of linguistically and culturally diverse sign language communities and lead to social injustice. A sustainable and inclusive future for AI-SL depends on collaborative innovation grounded in equality, equity, transparency, and respect that fulfill the individual civil, political and cultural rights.

7.1. Relevance to Existing Legal Frameworks

- UN-CRPD Article 4 (General Obligations) – Rights-based approach to AI-SL development grounded in equality and dignity.
- UN-CRPD Article 21 (Freedom of Expression and Access to Information) – On-demand sign language interpretation via AI-SL.
- EU AI Act Article 6-7 (High risk) – AI-SL access-enabling tech in essential domains.

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Annex 1: Legal frameworks I: UN-CRPD

The following articles of the UN Convention on the Rights of Persons with Disabilities (CRPD) are particularly relevant and each cited article is accompanied by the specific sections or themes from the paper to which it applies.

Article 9 – Accessibility

- **Sections:**
  (i) *3.1 Opportunities*: AI-SL systems improving access to public services (healthcare, education, employment).

  (ii) *5. Structured Interaction in Public Services*: Ensuring robust and ethical AI-SL systems in daily life.

  (iii) *6.2 Platform Integration*: Ensuring accessible digital platforms for Deaf users.

Article 21 – Freedom of Expression and Access to Information

- **Sections:**
  (i) *3. AI-SL Systems: Access to Public Information*: On-demand sign language interpretation via AI-SL.

  (ii) *3.5 Recommendations*: Co-design and data diversity to ensure equal access.

  (iii) *7. Conclusion*: Promoting transparency, respect, and inclusion in access to information.

Article 24 – Education

- **Sections:**
  (i) *4. AI-SL Systems: Sign and Written Language Acquisition*:
    - Use of AI-SL tools in multilingual education.
    - Development of sign language comprehension and production skills .
  (ii) *4.4 Recommendations*: Alignment with CEFR and inclusive pedagogies.

Article 30 – Participation in Cultural Life, Recreation, Leisure and Sport

- **Sections:**
  (i) *6.4 AI-SL at the Global Level*: Inclusion of minority and regional sign languages in global AI-SL systems to ensure equitable cultural participation.

Article 31 – Statistics and Data Collection

- **Sections:**
  (i) *2. Sign Language Data Design*: Ethical, inclusive, and transparent sign language corpus development.

  (ii) *2.1 Corpus Design and Training Requirements*: Metadata and sociolinguistic diversity in datasets.

Article 33 – National Implementation and Monitoring

- **Sections:**

(i) *6.6 Resources: Good Practice*: Need for toolkits, guidelines, and legal frameworks to ensure compliance and ethical standards.

(ii) *3.4 Legal Challenges*: GDPR compliance and data protection.

Article 4 – General Obligations

- **Sections:**
  (i) *6.5 Research Ethics*: Involvement of Deaf communities in research; co-design principles.

  (ii) *7. Conclusion*: Rights-based approach to AI-SL development grounded in equality and dignity.

Annex 2: Legal frameworks II: European Accessibility Act, EAA

The following articles of the European Accessibility Act (EAA, Directive (EU) 2019/882) are particularly relevant and each cited article is accompanied by the specific sections or themes from the paper to which it applies.

The EAA sets out requirements for making digital products and services accessible to persons with disabilities, including Deaf people. Below is a detailed mapping of relevant EAA articles and annex sections to specific parts of this paper.

Article 1 – Subject Matter and Scope

- The paper's focus on AI-SL in public services, education, and digital platforms falls directly within the EAA's scope, which includes ICT-based services, e-books, e-commerce, and electronic communication services.

Article 2 – Scope of Application

- The AI-SL systems discussed in Sections 3 and 4 apply to:
  (i) Public sector bodies

  (ii) Transport and communication

  (iii) Education and online learning platforms

Article 4 – Accessibility Requirements

- **Sections:**
  (i) *3.1 Opportunities* (AI-SL for public information)

(ii) *4.1 Opportunities* (AI-SL in education)

(iii) 5. Structured Interaction in Public Services

These sections align with Article 4, which mandates that relevant products and services:

- Be perceivable, operable, understandable, and robust.
- Support non-visual and non-auditory modes of communication (i.e., sign languages).

Annex I – Accessibility Requirements for Products and Services Section I: General Accessibility Requirements

- **sections:**
  (i) 6.2 Platform Integration
  (ii) 6.3 Multimodal and Semiotic Resources

These sections emphasize **multimodal input/output**, including:

- visual representation of sign languages.
- avatar design.
- compatibility with assistive technologies.

Section IV: Specific Requirements for E-Books and E-Readers

- *4.1 and 4.4 (Education sections)*:

AI-SL learning tools should meet accessibility for digital educational materials.

Section V: E-Commerce

- *3.1 and 5*: AI-SL systems supporting communication in digital public services and transactions, similar to e-commerce accessibility needs.

Article 5 – Provisions for Harmonised Standards

- *6.6 Resources: Good Practice* aligns with EAA's goal of establishing common technical specifications and guidance.

Article 7 – Functional Performance Requirements

- The ethical and design-focused parts of the paper (*Sections 3.3, 6.1, 6.5*) are highly relevant here, ensuring that AI-SL tools:
  (i) Respect user diversity

  (ii) Enable independent and effective use

  (iii) Are inclusive of diverse needs (e.g., DeafBlind users)

Article 1–2 (Scope)	Intro, Sections 3–6 (use in public, education, and digital tools)
Article 4	Section 3.1, Section 3.3, Section 4.1, Section 5 – Ensuring accessible design and implementation
Article 7	Section 3.3, Section 6.1, Section 6.5 – Addressing depersonalization, ethical use, and user diversity

Annex I (General)	Section 6.2, Section 6.3 – Platform integration and multimodal design
Annex I (E-books / education)	Section 4.1, Section 4.4 – Educational tools supporting sign language acquisition and self-learning
Annex I (E-commerce)	Section 5 – Structured interaction in services akin to e-commerce or transactional communication
Article 5 / 6.6	Section 6.6 – Platform for good practice and harmonized technical support

Annex 3: Relevant legal frameworks: European Artificial Intelligence Act, EU AI Act

EU AI Act (adopted in May 2024) is directly relevant to the paper on AI-generated Sign Language (AI-SL). The Act classifies AI systems based on risk levels and sets obligations for providers, deployers, and users. Below is an overview of the most relevant provisions of the Act, matched to the specific sections of this paper.

Article 5 – Prohibited AI Practices

- **Sections:**
  (i) 6.1 Over-Reliance on AI-SL
  (ii) 6.5 Research Ethics

Although AI-SL is not in a prohibited category, these sections emphasize avoiding harmful practices, such as:

- dehumanization or over-dependence
- erosion of language rights or exclusion of minorities

Article 6–7 – High-Risk AI Systems

AI-SL systems used in public services, education, and employment may be classified as

high-risk, particularly if they:

- provide access to essential services (education, healthcare, administration)
- affect fundamental rights (freedom of expression, linguistic rights, privacy)

Sections:

- *3.1 Opportunities*
- *4.1 Education*
- *5. Structured Interactions*
- *7. Conclusion*

These sections stress access to rights and services, which places AI-SL tools under stricter obligations.

Title III (Articles 8–29) – Obligations for High-Risk AI Systems
Article 10 – Data and Data Governance

Sections:

- 2. Sign Language Data Design
- 2.1 Corpus Design
- 6.5 Research Ethics
- It requires:
  - high-quality, representative, and bias-mitigated training data.
  - inclusive data practices (as your paper advocates).

Article 11 – Technical Documentation Sections:

- 6.6 Resources: Good Practice

- Our recommendation for a repository aligns with documentation standards for high-risk systems.

Article 13 – Transparency and Provision of Information
Sections:

- 3.3 Depersonalization

- 6.2 Platform Integration
- AI-SL systems must inform users they are interacting with an AI tool and make interfaces accessible.

Article 14 – Human Oversight Sections:

- 6.1 Over-Reliance on AI-SL
- Our recommendation for human-in-the-loop approaches to avoid AI-only communication in critical situations

Article 52 – Transparency Obligations for AI Systems Interacting with Humans Sections:

- ⇒ 3.3 Ethical Challenges
- ⇒ 6.3 Multimodal and Semiotic Resources
- Relevant for avatar-based sign language systems

The paper discusses avatars and non-manual markers which qualify as systems that simulate human behavior—thus requiring transparency.

EEA Articles	**Sections**
Article 5 (Prohibited Uses)	6.1, 6.5 – Cautions against misuse, erosion of language rights

Articles 6–7 (High-Risk)	3.1, 4.1, 5, 7 – AI-SL as access-enabling tech in essential domains
Article 10 (Data Governance)	2, 2.1, 6.5 – Emphasis on inclusive, quality sign language datasets
Article 11 (Documentation)	6.6 – Repository of legal tools, datasets, ethical guidance
Article 13 (Transparency)	3.3, 6.2 – Clarity around avatar systems and public-facing interfaces
Article 14 (Oversight)	6.1 – Encouraging human oversight in AI-mediated communication

Article 52 (Human Interaction Disclosure)	3.3, 6.3 – Avatar communication requires disclosure and accessibility design

About this Publication

As Artificial Intelligence (AI) becomes increasingly embedded in communication technologies, its impact on sign languages and deaf communities demands urgent attention. Sign Language in the Era of Artificial Intelligence provides a pioneering exploration of this intersection, placing deaf people's linguistic rights, cultural heritage, and digital inclusion at the centre of the debate.

This publication introduces the concept of Deaf Tech and the emerging framework of Deaf Digital Law, proposing a new ethical frameworks, a legal analysis, and rights-based approaches to AI systems involving sign languages. Drawing on interdisciplinary contributions and key international instruments – including the UN CRPD, the EU AI Act, and the Council of Europe's Framework Convention on AI – it makes a compelling case for co-creation, accountability, and human-centred design.

This report is essential reading for policymakers, researchers, developers, and civil society organisations working at the crossroads of technology, language rights, and social justice.

Author: Prof. Dr Filipe Venade
Publisher: European Union of the Deaf
ISBN: 978-90-83573-20-5
Cover Design and Typesetting: David Hay
Published in Belgium

EUD
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ISBN 978-90-83573-20-5
9 789083 573205