

Role of AI in promoting European Accessibility Policy

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Abstract. Following the wide-scope of adoption of digital transformation services, across every-day activities, there is a critical need to ensure all citizens are offered equal opportunities for interacting with such digital interfaces. To this end, the recently published European Accessibility Act (EAA) provides a regulatory framework, which formalises digital interface needs across several digital displays, such as computers, Automated Teller Machines (ATM), ticketing systems, and TV equipment, among others. On the other hand, the exponential growth of AI technologies has further facilitated launch of new products and systems in the market (such as Amazon Echo, Google Assistant and Apple Siri to name a few), which has offered the citizens new and improved ways of interacting with digital technologies. Addressing the changing landscape and paradigm shift, in this poster presentation, a systematic framework on the role of AI technologies in promoting EAA policy is presented. The proposed framework will establish a formal definition of digital content accessibility, that refers to the inclusive practice of making digital content usable and comprehensible by all citizens (for people with abilities and disabilities included). Within the current adoption of digital transformation strategies, the notion of accessibility has been widely addressed within the context of information being shared through Internet services. The relevant standards published from World Wide Web Consortium (W3C) on Web Accessibility Initiative (WAI) individuals' formulated recommendations on creating accessible for all content published online. The recommendations on adopting universal design, that includes the triple synergy between Usability, Accessibility and Inclusion has been well addressed in the literature. Nevertheless, the lack of support for integrating such accessibility standards within individual organisations has been well documented, resulting in the information published from cultural heritage institutions and other Creative and Cultural Industry (CCI) stakeholders to become inaccessible. Extending beyond the scope of the W3C standards, the proposed framework will consider a broad scope of AI-powered technologies such as chatbots, question-answering systems, speech synthesis tools, computer vision technologies, gesture recognition algorithms, multimodal haptic device interfaces and others.

Keywords: Media accessibility, Web Accessibility Initiative, Creative and Cultural Industry, W3C, Artificial Intelligence, Machine Learning, Digital Transformation

1 Introduction

Digital transformation, defined by Faddis [1], is a term used to describe the holistic effect created by a software application that fundamentally transforms a particular domain. While digital transformation has been on the rise at a slower pace for several years, the emergence of global pandemic has accelerated the adoption process, in which the use of digital technologies has seen exponential growth. Such a change has been observed across a wide range of industries including healthcare, education, media production and distribution, remote working environments, and many other examples. Extending beyond the fixed digital interface (such as display monitor), the emergence of digital technologies can be observed across a broader society as well. An example of such instances of encountering digital interfaces include (i) computers and operating systems; (ii) ATMs, ticketing and check-in machines; (iii) telephones and smartphones; (iv) TV equipment related to digital television services; (v) telephony services and related equipment; (vi) audio-visual media services, such as television broadcast and related consumer equipment; (vii) services related to air, bus, rail and waterborne passenger transport; (ix) banking services; (x) e-books and (xi) e-commerce. While the list is not comprehensive, the digital services rendered across such systems offers a meaningful insight into the challenges and opportunities that are being presented in developing technologies to ensure accessibility and inclusivity remain two pillars of the society.

One of the key challenges often encountered in addressing accessibility refers to the economic impact for the industries and service providers. As global economies become susceptible to the impact of pandemic, with regulations enforced for reduced social interaction, social distancing, lockdown, restrictions on movement, Kutnjak [2], observes that restructuring of business because of pandemic has significantly transformed the general citizens daily lives and set requirements for accepting and getting used to the “new normal” way of life of all humanity. The societies’ reliance on the information and communication technologies (ICT) have shown the importance of innovative solutions and become crucial for the continuation of personal and business services and interactions. Pandemic has affected the assessment of the use of ICT, but also the adoption of ICT in those segments where their potential has not yet been discovered to mitigate the social and economic effects of the spread of the virus. The impact of ICT technologies has offered a lifeline in communication, information exchange, strategic decision making, training, but also the supervision of business activities and thus reduce the burden imposed by the pandemic on employers in various industrial areas. Despite such positive impact, one of the key modes of adopting digital transformation is the creation and widening of the digital divide for citizens with disabilities.

For the purposes of the discussion, the definition of “digital content accessibility” will be restricted to the inclusive practice of making digital contents usable and comprehensible by all citizens (with abilities and disabilities included). Within the current adoption of digital transformation strategies, the notion of accessibility has been widely addressed within the context of information being shared through Internet services. The relevant standards published from W3C on Web Accessibility Initiative (WAI) individuals’ formulated recommendations on creating accessible for all content published

online. The recommendations on adopting universal design, that includes the triple synergy between Usability, Accessibility and Inclusion has been well addressed in the literature [3], which is presented in **Fig. 1**. Nevertheless, the lack of support for integrating such accessibility standards within individual organisations has been well documented¹, resulting in the information published from cultural heritage institutions and other CCI stakeholders to become inaccessible. Additionally, the lack of multimodal, user engagement tools has resulted in unimodal representation (in text) of historical content.

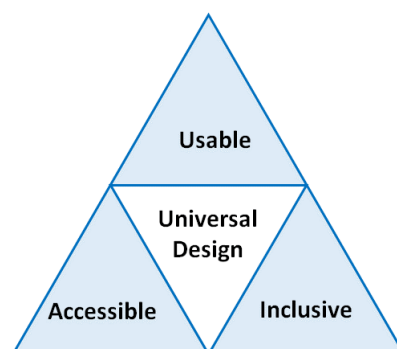


Fig. 1. – Triple synergy of universal design

The representation of conservative and generic content, that cannot address different individuals' needs and preferences, has been identified as a key limitation in engaging wider public. Despite the popularity of the audio-visual content, commonly encountered within the Creative and Cultural Industry (CCI), limitations and barriers are still preventing Audio Visual Media Accessibility, being related to usability, interoperability, and standards issues, as well as lack of business-case for take-up by mainstream actors, legal barriers (for example for the transnational reuse of accessible content), difficulties in the reuse of accessible content over time and across different platforms [4]. These challenges need to be overcome for delivering wider access to the cultural heritage content to many communities. For people with a disability such as a hearing, sight or mobility impairment, effective engagement with digital media content and interacting with social media applications provide extra barriers. Following the reports on aging population across Europe, there is a critical need to develop digital technologies considering inclusion by design principles. Addressing the challenge, in 2015, Netflix launched the Accessible Netflix Project (ANP), with the vision of offering audio description of its original content for its vision-impaired audience. Despite an increase in the design and development of assistive technologies which has been released in the market for over a decade, the lack of content production tools and services focused on cultural heritage has negatively impacted the market uptake of such assistive technologies. As an instance, the use of Haptic solutions to offer a sensory experience of touch

¹ <https://unesdoc.unesco.org/ark:/48223/pf0000232026>

and otherwise, has not gained popularity among people with disabilities and otherwise, because they offer limited and very basic functionality to the users, e.g., white canes².

Addressing the scope and challenges presented by the need for establishing accessibility and inclusion as two pillars of the society aimed to minimise the digital divide among citizens with disabilities, the paper aims to present a framework of AI technologies that is designed to promote the wider adoption of EAA policy. The rest of the paper is structured as follows. In Section 2, a review of the EAA is presented, followed by the AI framework for promoting EAA outlined in Section 3. The conclusions and future work is presented in Section 4.

2 European Accessibility Policy

Since the dawn of the Internet and web content, the topic of accessibility can be traced back to the early efforts of World Wide Web Consortium (W3C)³ dedicated to promote guidelines on web accessibility initiative (WAI). The first draft of the published version was released in 1999, which have become an international benchmark. Subsequently, WCAG 2.0 was published in December 2008, WCAG 2.1 in June 2018 and the first public draft of WCAG 2.2 in February 2020. WCAG 2.0 became the international standard ISO/IEC 40500:2012. WCAG 2.1 contains all the success criteria of WCAG 2.0 plus 17 additional success criteria. The European Union adopted WCAG 2.1 in September 2018 as a standard for websites and electronic documents. The WCAG recommendations help website designers and developers to better meet the needs of users with disabilities and older users. These guidelines are intended for website developers and designers, creators of authoring tools for website design and programming, developers of web accessibility evaluation tools, and anyone who needs a reference standard for checking the accessibility of specific web content. Web accessibility benefits people with and without disabilities and improves the usability of websites.

The EAA is a step⁴ forward in reducing barriers for people with disabilities within the EU: better accessibility of products and services that citizens use every day, such as phones, transport, or banking services, will help people with disabilities to be able to fully participate in society on an equal basis with others, to have better access to education and to enter more easily the open labour market. Accessibility is also necessary for older people to maintain an active role in society, including extending their working lives. In general, accessibility is beneficial to all EU citizens. For example, people trying to hear travelling information in noisy environments like train stations or trying to get money from ATMs on a sunny day, or employees working with enlarged documents to avoid eye strain will also greatly benefit from further accessibility.

² <https://op.europa.eu/en/publication-detail/-/publication/d657a81b-184c-11e8-ac73-01aa75ed71a1/language-en>

³ Empirical Studies on Web Accessibility of Educational Websites: A Systematic Literature Review

⁴ <https://ec.europa.eu/social/BlobServlet?docId=14869&langId=en>

Bringing together these four principles of accessibility, a generic AI powered framework that aims at addressing new and innovative technologies is presented in **Fig. 2**. The framework presents a holistic representation of key innovations from six interdisciplinary research themes extending from computer vision technologies to haptics innovations. The computer vision toolkit is included to extract knowledge embedded within the pictures and video sequences. The extracted knowledge in terms of objects or key terms, will be converted into full-fledged sentences by the linguistic toolkit. The textual descriptions are then subsequently transformed into speech with audio synthesis tool. The use of semantic technologies powered by Resource Description Framework (RDF) will ensure the semantic interpretability of information and ensure cross linking of relevant information. Finally, the semantic repository populated by the analysis tools are then transformed into haptic language to be closely integrated within the wearable devices. To achieve such a multi-modal interoperability among the technologies, it is important to establish metadata standards using semantic language to enable accessibility of media content.

4 Conclusions and future work

In this poster presentation, the role of AI powered framework in promoting EAA policy and the critical need to establish interoperability standards has been presented. The paper builds on the triples synergies of universal design philosophy based on usability, accessibility and inclusion and proposed a framework that exploits the recent advances in the field of machine learning and artificial intelligence. To framework brings together multi-modal data formats representing computer vision, audio processing, linguistic toolkits, and haptic language developments. Following the exponential growth in digital transformation strategies, it is vital to ensure new technologies adopt accessibility and inclusion by design paradigm to minimise the digital divide among citizens.

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