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*Smart Cities for All: Usability and Disability Bias**

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ABSTRACT Smart city projects must consider the needs of vulnerable groups of people. This article advocates the full deployment of the principle of usability regarding smart city services and the participation of people with disabilities and their representatives in the design and development of the new city model.

1. *Introduction: disability and the right to the city*

This article aims to examine an issue that has hitherto been somewhat side-lined by legal theory (with some notable exceptions) when it has come to analysing the smart cities phenomenon: the relationship between the smart city and the rights of people with disabilities[1]. Our analysis will first explore the existing interconnections between the so-called "right to the city" and those with disabilities, then it will delve into the principle of accessibility by design. Lastly, we will address an issue that is even less discussed: the limitations of artificial intelligence and biases against disabled people that are beginning to emerge regarding its use. All these reflections will be framed in the concept of the smart city as the new paradigm of the urban environment.

The study is situated in the context of the UN Sustainable Development Goals (SDG, hereinafter), which state that by the year 2030, over 5000 million people around the world will live in urban environments. Objective 11.2 of the SDG specifies that by 2030, the following should be ensured: "access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons"[2]. There is therefore a direct relationship between the development, planning and management of the urban environment and the way public services must be designed in order to provide equal access to the most vulnerable groups in society.

However, before going into a detailed analysis of the concept of accessibility in the framework of smart cities, we must first establish our definitions for both "smart city" and "disability" in order to lay down how the concepts are used in this text and thus avoid possible ambiguities. Within the scope of the European Union, the provisions of the *Mapping Smart Cities in the EU* document consider a city to be *smart* if it has at least one initiative that adopts one or more of the following approaches: Smart Economy, Smart People, Smart Mobility, Smart Environment, Smart Governance, and Smart Living. This EU definition thus seems excessively broad and does not clearly identify the key concept in question[3].

For its part, the United Nations, in its *Habitat* program, highlights that there are several different definitions of a smart city; one of them is the following: 'smart cities are cities with "smart (intelligent) physical, social, institutional and economic infrastructure while ensuring centrality of citizens in a sustainable environment; they refer to key characteristics defined by distinct factors (e.g., smart economy, smart mobility, smart people, smart environment, smart living, smart governance), and focus on the strategic use of new technology and innovative approaches to enhance the efficiencies and competitiveness of cities" [4].

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[1] This article has been developed within the Spanish R&D project with Ref. n. PID2019-108274GB-100, entitled *Inteligencia Artificial Administrativa para un Estado Social y Democrático de Derecho* (2020-2023).

[2] UN, *Sustainable Development Goals*. Text available here: https://unstats.un.org/sdgs/indicators/indicators-list/ (last consulted 01.02.2021).

[3] EU Directorate General for Internal Policies. Mapping Smart Cities in the EU, 2014. Text available here: https://op.europa.eu/en/publication-detail/-/publication/-78882e80-fc4a-4a86-9c39-2ad88ab89f9b (last consulted 27.02.2021).

[4] UN-Habitat. Temas Habitat III. Ciudades inteligentes, 2015. Text available here: https://uploads.habitat3.org/-

The two definitions given above clearly show that there is currently no agreed-upon definition of what constitutes a smart city. The concept continues to be rather vague and changeable; in addition, it necessarily takes on different meanings when it is linked to each local culture, the technology available at each point in time and the priorities established by each specific society[5]. This means that the new model of the city needs to be viewed and analysed using a multidisciplinary approach[6]. However, despite this being self-evident, a narrow, overly technocratic (and dare we say, rather short-sighted) vision appears to persist in this regard[7]. This restricted definition of what the term smart city represents is based on prioritizing its technological aspects over all other considerations. In this overly narrow sense, smart cities must be run by following policies that use up-to-date data in order to "(...) attract companies, jobs, human capital, savings and, ultimately, productivity and competitiveness (...)".[8] The city is thus reduced to a space to be monitored and managed in real time using all kind of technologies, even so-called disruptive technologies.

However, it must be taken into account that cities that use the available technologies effectively "(…) can help solve very relevant problems in the cities of the 21st century -for example the efficient use of resources- and also provide services with an undeniable added value"[9]. Therefore, if the concept of smart cities is based on the effective use of technology to improve how services are managed and to guarantee a better form of government -one that is open and participatory- for *all* citizens, it is essential to adopt an approach that treats people with disabilities as equal members of society: full citizens who have the same rights as able-bodied ones.

This reflection is linked to some considerations that were recently highlighted by the OECD about the need to ask ourselves an important question as a society, but above all within the public administrations: is all the investment that is currently being made in smart technologies and digital innovations really helping improve the welfare of the people who live in cities? The OECD considers that it is paramount to take a people-centred approach to developing smart cities. Consequently, it defines smart cities as "initiatives or approaches that effectively leverage digitization to boost citizen well-being and deliver more efficient, sustainable and inclusive urban environments and services as part of a collaborative, multi-stakeholder process"[10]. For this to happen, as the legal theory[11] has emphasised, it is essential to approach any smart city project from the concept of accessibility by design, something we will examine later. In short, the creation of a smart city is nothing more than a new way of conceiving the city, in which the use of digital technology is incorporated into its physical infrastructure so that residents and users receive a better service[12].

Once we have taken this on board, we can highlight two pressing imperatives for smart cities. On the one hand, technological improvements must be made without delay to improve how public undertakings are developing the urban environment; on the other hand, it is paramount to establish and follow the principles of good governance and open government that the new digital tools

hb3/Habitat-III-Issue-Paper-21_Smart-Cities-2.0.pdf (last consulted 27.01.2021).

[5] S. Ranchordas, *Nudging Citizens through Technology in Smart Cities*, in *University of Groningen Faculty of Law Legal Studies Research Paper Series*, n. 1, 2019, 8.

[6] J. Ponce, *El derecho a la ciudad en la gestión inteligente del territorio: Planteamiento general. La transdisciplinariedad, el derecho a la ciudad y el reto de las smart cities*, in V. Aguado Cudolà, V. Parisio and O. Casanovas (eds.), *El derecho a la ciudad: el reto de las smart cities*, Barcelona, Atelier, 2018, 16.

[7] C.I. Velasco Rico*, Datos y algoritmos en la ciudad inteligente* in *El derecho, la ciudad y la vivienda en la nueva concepción del desarrollo urbano: desafíos transnacionales y transdisciplinarios de la gobernanza*, in J. Ponce and W. O. Capdeferro (eds.), *Nueva Agenda Urbana*, Barcelona, Atelier, 2019, 209-226.

[8] A. López Folgues, Á. Fernández-Baldor, and A. Boni, *La innovación social digital colectiva y la administración en el entorno de la Ciudad Inteligente*, in *GAPP Nueva Época*, n. 18, 2017, 24.

[9] J. Valero Torrijos, *Ciudades inteligentes y datos abiertos: implicaciones jurídicas para la protección de los datos de carácter personal*, in *Istituzioni del federalismo*, n. 4, 2015, 1025-1026.

[10] Organisation for Economic Co-operation and Development (OECD), *Housing Dynamics in Korea: Building Inclusive and Smart Cities*, OECD Publishing, 2018. Text available here: http://dx.doi.org/10.1787/9789-264298880-en (last accessed: 27.02.2021).

[11] M. Caporale and J. Morcillo Moreno, *Smart cities and disability: digital accessibility as a precondition*, in J.-B. Auby (dir.), *The future of Administrative Law*, Paris, Lexis-Nexis, 2019, 396.

[12] On this point, see J.M. Fernández Güell, *Ciudades inteligentes: la mitificación de las nuevas tecnologías como respuesta a los retos de las ciudades contemporáneas*, in *Economía Industrial*, n. 395, 2015, 17.

make possible. This last requirement is something that must be insisted upon, since it is often side-lined by the vast impact that technology has made on public management. This impact could dazzle us into thinking that technology is an end in itself, or that it merely serves to provide services in a more effective and efficient way, something that is of course very important. However, it is not the only area in which new technologies and disruptive innovations are having an effect. As we all know, from the point of view of the rights of those who live in or go through the city, the public administration does not use technology in a neutral way. Quite the opposite is true: the way it is used can have profound implications regarding the definition and configuration of citizens' rights, as well as on the guarantees of those rights conferred by the legal system. In this sense, and as has already been pointed out, the city's relationship with its inhabitants, and above all, with its most vulnerable inhabitants, should be a priority for those who design or manage smart cities initiatives.

In the words of Caporale and Morcillo Moreno, "since smart cities are becoming one of the most powerful public policy tools, better prepared and participatory governments are needed to adequately integrate population, economy and environment"[13]. These authors also echo Auby's works, underlining his definition of the city as a "strategic site of living democracy", as well as his conceptualisation of the "right to the city", which revolves around the implication that a city's inhabitants must be guaranteed adequate access to essential services such as accommodation, security, mobility, electricity and water[14]. Mialot highlights that, at least in France, where the two authors cited are from, "in this definition, the right to the city is conceived as a public action aimed at promoting social cohesion through public services. But it does not enshrine the subjective right of the city's inhabitants, nor does is guarantee or consolidate a right that has a collective scope or a political impact"[15]. However, we must always remember that the right to the city as defined at the UN Habitat III summit is the "right of all inhabitants, present and future, to occupy, use, and produce just, inclusive, and sustainable cities, defined as a common good essential to the quality of life"[16]. As we can see, the right to the city implies building and developing "inclusive" cities that take into account the vulnerable groups in society.

In relation to technology and other related aspects, it has been pointed out that "the right to the city" is a new paradigm that provides an alternative framework for rethinking cities and urban planning. It envisions the effective fulfilment of the internationally agreed human rights and sustainable development targets expressed in the Sustainable Development Goals, as well as the commitments set out in the Habitat Agenda. It goes even further, and brings a new vision to this framework, which serves as a foundation for the New Urban Agenda; this is based on an understanding of the city as a "place that strives to guarantee a decent and full life for all inhabitants"[17].

Included in the vulnerable groups of inhabitants that the city must serve in a satisfactory and fair way are people with disabilities or, in other words, people with functional diversity[18], an issue that is still largely side-lined in smart city projects[19]. Today, hundreds of millions of people with disabilities live in cities around the world. By 2050, this number will grow to approximately 940 million people; in other words, people with disabilities will make up approximately 15% of a total of 6,250 million city dwellers[20].

[13] M. Caporale and J. Morcillo Moreno, *Smart cities and disability*, 392.
[14] J.-B. Auby, *La ville nouvelle frontière du droit administratif*, in *AJDA*, n. 15, 2017, 853-858.
[15] C. Mialot, *El derecho a la ciudad en la gestión inteligente del territorio: la perspectiva francesa*, in V. Aguado Cudolà, V. Parisio and O. Casanovas i Ibàñez (eds.), *El derecho a la ciudad: el reto de las smart cities*, Barcelona, Atelier, 2018, 25.
[16] UN-Habitat III. Policy Document 1: The right to the city and cities for all. (2016). Text available here: https://uploads.habitat3.org/hb3/Habitat III Policy Paper 1.pdf (last consulted 27.02.2021).
[17] UN-Habitat III. Policy Document 1: The right to the city and cities for all. (2016). Text available here: https://uploads.habitat3.org/hb3/Habitat III Policy Paper 1.pdf (last consulted 27.02.2021).
[18] On the use of these terms, see: J. Canimas Brugué, *¿Discapacidad o diversidad funcional?*, in *Biblid*, vol. 46 (2), n. 254, 2015, 79.
[19] N. Navarro Cano, *Innovación urbana para ciudades inteligentes inclusivas*, in M.T. López Cantó (dir.), *Gestión inteligente y sostenible de las ciudades. Gobernaza, Smart Cities y turismo*, Valencia, Tirant lo Blanch, 2018, 40. Similarly, M. Caporale, and J. Morcillo Moreno, *Smart cities and disability*, 392.
[20] These figures demonstrate the urgency with which the UN has been expressing for some years that poor accessibility "presents a great challenge". UN Good Practices of Accessible Urban Development, 2016. Text available here: https://www.un.org/development/desa/dspd/2016-/10/good-practices-of-accessible-urban-development/ (last consulted 27.02.2021).

The meaning of disability or functional diversity has been defined in the texts, letters and declarations approved by several international organisations, although, surprisingly, nothing was set out specifically in this regard in the two declarations of rights adopted after the Second War World: the UN Universal Declaration of Human Rights (1948) and the European Convention of Human Rights (1950)[21]. Specifically, and taking into account what most interests us here, it is accepted that the provisions of the UN Convention on the Rights of Persons with Disabilities (CRPD, hereinafter) must be complied with. This convention leaves behind the so-called "medical-rehabilitative model of disability"[22], and adopts a more modern approach to disability, the so-called "social model"[23]. The main objective of the convention is to reaffirm the principle of universality, indivisibility, interdependence and interrelation of all human rights[24]. According to article 1 of the convention, "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others". It should be noted that the definition emphasises that the various diversities that people can have - including those caused by aging - *generate* disability and are relevant when they *interact* - or collide - with impediments of all kinds that exist in their environments and that prevent them from exercising their rights to function fully in all areas of society. Thus, and merely by way of example, in urban areas, on the one hand, people with physical disabilities encounter barriers that can vary from ramps that block wheelchair access, to buildings without lifts, inaccessible toilets and shops whose only access is up steps. On the other hand, for people with learning disabilities or diagnosed with autism spectrum disorders (ASD), an over-stimulating and hectic urban environment can be a harmful and frightening place from a sensory and also a cognitive point of view.

Secondly, within the scope of the European Union, it should be noted that the EU ratified the CRPD in 2010 (Spain had already done so in 2007). This was preceded by the inclusion of articles in the Charter of Fundamental Rights of the EU guaranteeing the rights of people with disabilities (art. 21 -no discrimination- and art. 26 -integration). All this regulatory apparatus obliges the EU and, therefore, its member countries, to guarantee the rights of people with disabilities when they design public policies and approve all manner of regulations. These rights must be guaranteed across the board, and must also be taken into account in the planning and development of initiatives related to smart cities. As we will see below, the EU regulations have gone beyond the generic prohibition of non-discrimination, and have focused above all on the concept of accessibility by design as a tool to guarantee the rights of people with disabilities in regard to the use of technology.

Finally, in individual countries' internal regulations, we also find definitions for people with disabilities. For example, in Spain, the preamble of Royal Legislative Decree 1/2013, of November 29, which approves the consolidated text of the General Law on rights of persons with disabilities and their social inclusion, states the following:

> "People with disabilities make up a large, vulnerable group which has often been excluded by the way in which society functions and is structured. This fact has led to the restriction of disabled people's basic rights and freedoms, conditioning or hindering both their personal development and their enjoyment of the resources and services available to the entire population, and the possibility of contributing their capacities to the progress of society. All people are moved by the desire for a full life and the need for personal fulfilment, but these aspirations cannot be satisfied if the

[21] M. Caporale and J. Morcillo Moreno, *Smart cities and disability*, 394.
[22] V. Velarde Lizama, *Los modelos de la discapacidad: un recorrido histórico*, in *Revista Empresa y Humanismo*, vol. 15, n. 1, 2012, 115-136.
[23] J.A. Victoria Maldonado, *El modelo social de la discapacidad: una cuestión de derechos humanos*, in *Revista de Derecho UNED*, n. 12, 2013, 817. The author presents the social model of disability as a new paradigm of the current treatment of disability, which has undergone both a theoretical and a normative development. This model considers that the causes of a disability are not religious or scientific but derive principally from constructions and decisions of a social nature. This point of view emphasises that people with disabilities can be active members of society and make their contribution in the same way as other people, but that their inclusion must be championed and a respect for diversity in general must be upheld.
[24] M. Caporale and J. Morcillo Moreno, *Smart cities and disability*, 394.

> rights to liberty, equality and dignity are restricted or ignored. This is still the case today for men and women with disabilities, who, despite the undeniable social progress that has been made, see their rights limited in the access or use of places, processes or services that have either not taken their specific needs into account when they were conceived or that restrict their participation in them. There is, therefore, a varied and wide-reaching set of impediments that deprive people with disabilities of the full exercise of their rights; the effects of these obstacles cause situations of social exclusion and must be addressed without fail by the public administrations".

Thus, for the Spanish legislator, there is no doubt that discrimination against people with disabilities persists, despite advances of all kinds, including technological ones, that have led our Western societies to call themselves "advanced". To fight against this continued discrimination, the legal system has established a powerful principle that must inform any smart cities initiative. This is the principle of accessibility, which we will discuss below.

2. *From accessibility to usability in the smart city*

2.1. *The legal requirements regarding accessibility in international law and in EU law*

Smart city projects make extensive use of different technologies, some of which are seen as disruptive innovations. Even though ICTs have sometimes been a catalyst for expanding certain rights and services for people with disabilities[25], it is also the case that, paradoxically[26], smart cities can widen the exclusionary gap, if technology is applied as the "only mechanism for dialogue with citizens"[27] or if the technology used is not designed in an accessible way.

The articles of the CRPD enshrine accessibility as a transversal principle (art. 3.f.) and underline the right of disabled people to live independently and to participate fully in all aspects of life in society (art. 9.1). Accessibility, in turn, is defined as a "condition that environments, processes, goods, products and services, as well as objects or instruments, tools and devices, must comply with, in order to be understandable, usable and operable by all people correctly, safely and comfortably and in the most autonomous and natural way possible. Accessibility presupposes a 'design for all' strategy and is understood without prejudice to the reasonable adjustments that must be adopted"[28].

It is important to note that while section a) of article 9.1 of the CRPD requires the elimination of physical barriers, section b) of the same article refers specifically, although not exclusively, to barriers that hinder people accessing information, communications and other services, including electronic and emergency services. Section 9.2 states that, among other measures that may be adopted, states are obliged to "promote the access of people with disabilities to the new information and communication systems and technologies, including the Internet", as well as promoting "the design, development, production and distribution of accessible information and communication systems and technologies at an early stage, so that these systems and technologies are accessible at the lowest possible cost".

In the ambit of the European Union, beginning with the launch of the Digital Agenda for Europe[29], the importance of smart

[25] Regarding this, Orofino states: «So, information technology, by facilitating remote dialogue and communication in many different shapes and forms, can be useful for eliminating many barriers and reducing handicaps, both in the case of disabilities that are caused by from physical impairments, as well as disabilities that are the result of sensory disturbances; however, it is less useful for people suffering from mental disorders. The modern administrations have now taken on a central role within the socio-economic life of the country, which is what today drives and directs social development. Therefore, in order to allow widespread participation, which is free from discrimination, it is absolutely essential that these administrations develop remote means of dialogue with inhabitants that can be used by everyone who needs them, especially those who have greater difficulty in communicating with the public bodies by using the so-called "classic" tools of interaction». A.G. Orofino. *Forme elettroniche e procedimenti amministrativi*, Series of the LUM Jean Monnet University, Casamassima-Bari, 2008, 266.

[26] M. Caporale and J. Morcillo Moreno, *Smart cities and disability*, 396.

[27] M. Suárez Ojeda, *Smart cities: un nuevo reto para el Derecho público*, in J.L. Piñar Mañas (dir.), *Smart cities. Derecho y Técnica para una ciudad más habitable*, Madrid, Reus, 2017, 73-92, 89.

[28] Observatorio de la Accesibilidad y de la Vida Independiente, *Definiciones Básicas*. Text available here: https://observatoriodelaaccesibilidad.es/archivos/3104 (-last consulted 27.01.2021).

[29] Communication from the Commission to the European Parliament, the Council, the European Economic and

city projects has often been highlighted[30], and this topic has subsequently been developed in the EU's Urban Agenda[31], with one of the key points being the digital development of cities[32]. Also noteworthy is the influence of another European policy which has a direct impact on the development of smart city projects and concerns electronic government and administration: this is the Action Plan approved in this area for 2016-2020[33]. The European Disability Strategy 2010-2020[34], which has been recently replaced, was also remarkably interesting. It stated that "(...) Accessibility is a precondition for participation in society and in the economy, but the EU still has a long way to go in achieving this". Because of this, "The Commission proposes to use legislative and other instruments, such as standardisation, to optimise the accessibility of the built environment, transport and ICT in line with the Digital Agenda and Innovation Union flagships". This is intended to "(…) ensure accessibility to goods, services including public services and assistive devices for people with disabilities".

Moreover, on March 2021, the European Commission published the EU Strategy for the Rights of Persons with Disabilities 2021-2030. This is the second strategy of this kind and builds upon the work done based on the Disability Strategy 2010-2020.

This new Strategy sets the objectives of the EU as regards their commitment to improving the lives of persons with disabilities who constitute 25% of European. It focuses on 3 main themes, EU rights, independent living and autonomy and non-discrimination and equal opportunities. Accessibility still has an important role in the Strategy, as an enabler of rights, autonomy and equality. The main initiative announced by the Commission in this regard is that in 2022 will launch a European resource centre AccessibleEU to increase coherence in accessibility policies and facilitate access to relevant knowledge and experiences. This cooperation framework aims to bring together national authorities responsible for implementing and enforcing accessibility rules with experts and professionals from all areas of accessibility, to exchange good practices across different domains, to inspire policy development at the national and EU level, as well as to develop tools and standards aiming to facilitate implementation of EU law. In addition, and on smart city issues the Commission envisions also to include accessibility and inclusiveness in the reinforced EU digital government strategy (2021), to evaluate the application of the Web Accessibility Directive (2022), to review the passenger rights regulatory framework including rights for persons with disabilities and reduced mobility in transport by air, water, bus, coach (2021) and train and finally and revise its Urban Mobility Package to strengthen Sustainable Mobility Planning (2021).

Beyond the public policies outlined that affect the conception and development of initiatives in this area, the European Union has approved regulations that have not specifically been designed for this purpose, but that are applicable to the services provided in and by smart cities. So, despite the fact that there are no specific regulations in this regard, the EU does offer some form of regulatory framework here; it is a framework that is still fragmented, but which revolves around the principle of accessibility and is in line with the CRPD, which necessarily affects to the design of smart cities in a transversal way. We are referring to Directive (EU) 2016/2102 of the

Social Committee and the Committee of the Regions Text available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52010DC0245-&from=en> (last consulted 28.02.2021). You can consult activities developed in the Digital Agenda for Europe here: https://europa.eu/european-union/file/digital-agenda-europe_en (last consulted 28.02.2021).

[30] See all the Commission initiatives about Smart Cities here: https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en (last consulted 28.02.2021).

[31] The text of the Pact of Amsterdam that updates the Digital Agenda for Europe can be consulted here: https://ec.europa.eu/futurium/en/urban-agenda-eu/what-urban-agenda-eu (last consulted 28.01.2021).

[32] To read in detail about the evolution of the main tools and public policies in this ambit, see M. Caporale and J. Morcillo Moreno, *Smart cities and disability*, 399.

[33] EU, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and Committee of the Regions EU: eGovernment Action Plan 2016-2020 Accelerating the digital transformation of government*. *COM/2016/0179 final*, 2016. Text available here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=-CELEX%3A52016DC0179 (last consulted 28.02.2021).

[34] EU, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and Committee of the Regions: European Disability Strategy 2010-2020: A Renewed Commitment to a Barrier-Free Europe*. COM/2010/0636 final, 2010. Text available here: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML-/?uri=CELEX:52010DC0636 (last consulted 28.02.-2021).

European Parliament and of the Council, of October 26, 2016, on the accessibility of public sector bodies' websites and applications for mobile devices[35]. In accordance with this standard, which does not exclusively contemplate people with disabilities, accessibility should be understood as "(…), a set of principles and techniques that must be respected when designing, building, maintaining and updating websites and applications for mobile devices in order to make them more accessible to users, particularly people with disabilities" (Second clause). However, this provision imposes accessibility by design as long as it does not represent a disproportionate burden for the public body responsible for the web or the app, and states that it must be adequately motivated (art. 5). In addition, it does not exclude that specific applications or services can be developed to support people with disabilities (clause 12).

Recently, the provisions of this Directive have been joined by the provisions of Directive 2019/882 of the European Parliament and of the Council, of April 17, 2019, on the accessibility requirements of products and services[36]. This Directive is designed to help achieve of one of the main objectives of the European Union, which is to guarantee the free movement of certain products and the freedom to provide certain services, as well as full, fair and effective participation, by improving access to products and services for people with disabilities. The legal basis for the Directive is essentially Article 114 of the Treaty on the Functioning of the European Union. This article enables the Union to adopt "the measures for the approximation of the provisions laid down by law, regulation or administrative action in Member States which have as their object the establishment and functioning of the internal market". In no case was Article 19 of the TFEU used as legal support; this allows the Union to adopt "(…) appropriate action to combat discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation". Therefore, it can be concluded that the benefits that the norm may have in social matters, i.e. equality, non-discrimination and full exercise of the rights of people with disabilities, will always be secondary and are clearly subordinate to its main objective, which is none other than that of strengthening free competition.

It is also noteworthy that the Directive does not use, or even mention, the concept of universal accessibility; instead, it refers to the strategy of "universal design or design for all people", which is understood without prejudice to the reasonable accommodations that can be made to it. In addition, and despite the fact that the Directive includes the definition of a person with a disability in accordance with the provisions of the CRPD (Art. 3.1), in clause 3 it also includes people with functional limitations, such as the elderly, pregnant women, or even people travelling with luggage. This inclusion is important since if the norm indicates that an approach based on universal design or design for all people should be adopted, it should have no limitations of who could benefit from it. In this sense, design for all people should be understood as the necessary process whereby all environments, processes, goods, products, services, objects, instruments, programs, devices or tools are conceived and designed from their very inception, and whenever possible, in such a way that they can be used by all people, to the greatest extent possible, without any need to adapt them or create a different design.

Moreover, Directive 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code determines that "(n)ational regulatory authorities should be able, to the extent necessary, to impose obligations on undertakings to provide access to the facilities referred to in an annex to this Directive, namely application programming interfaces (APIs) and electronic programme guides (EPGs), to ensure not only accessibility for end-users to digital radio and television broadcast services but also to related complementary services. Such complementary services should be able to include programme related services which are specifically designed to improve accessibility for end-

[35] Directive EU (EU) 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the accessibility of the websites and mobile applications of public sector bodies. Text available here: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016L2102 (last consulted 28.02.2021).

[36] Recently, all directives have been accompanied by the provisions set out in Directive 2019/882 of the European Parliament and Council, from 17 April 2019, about accessibility requirements of products and services. Text available here: https://eur-lex.europa.eu/eli/dir/2019/882/oj?locale=en (last consulted 28.02.2021).

users with disabilities, and programme related connected television services" (Preamble). The main goal of this Directive is to "implement an internal market in electronic communications networks and services that results in the deployment and take-up of very high-capacity networks, sustainable competition, interoperability of electronic communications services, accessibility, security of networks and services and end-user benefits". For this to be done, Directive 2018/1972 obliges Member States to "ensure that the competent authorities specify requirements to be met by providers of publicly available electronic communications services to ensure that end-users with disabilities: (a) have access to electronic communications services, including the related contractual information provided pursuant to Article 102, equivalent to that enjoyed by the majority of end-users; and (b) benefit from the choice of undertakings and services available to the majority of end-users" (art. 111).

It is also necessary to highlight that the Directive envisages the possibility for Member States to "(…) impose reasonable 'must carry' obligations for the transmission of specified radio and television broadcast channels and related complementary services, in particular accessibility services to enable appropriate access for end-users with disabilities" (art. 114).

From what has been stated so far, it can be concluded that the principle of accessibility in smart cities is directly related to human rights and the fundamental rights of all people (equality, dignity, non-discrimination, freedom, security, etc.), not only people with disabilities. Accessibility is a necessary requirement in order to ensure that a growing part of society is not excluded from the new urban environments. Accessibility is therefore a wide-reaching, transversal prerequisite for any smart city project that intends to comply with the standards established in the regulations.

2.2. *From accessibility by design to usability in smart city projects.*

Cities that are moving towards the new city model in search of a more environmentally efficient and more human environment in most cases implement innovative technological solutions. These innovations generally have good intentions regarding being used by people with disabilities, aiming to make things easier in the day to day of this diverse group and to include them more in all facets of life in the city. However, in reality, this noble intention collides with the limited practical results obtained. The regulatory framework that we have been describing applies to the member countries of the European Union and can be examined in relation to the current reality of our cities and to many smart city projects. Upon doing so, we can affirm emphatically that there are investments and developments being made within the framework of smart cities that are not accessible and are thus outright discriminatory and therefore illegal[37]. In addition, in the Spanish case, it must be highlighted that, despite the fact that the local administrations can hide behind their respective regulatory norms and accessibility plans, and ultimately behind the regulations that are in force in each Autonomous Community, the truth is that there are norms that rank further up in the legal hierarchy, such as the General Law on the rights of people with disabilities and their social inclusion, which must be accommodated and which oblige us to proceed in a well-determined direction[38].

According to activist organisations that work to defend the rights of people with disabilities, the solutions proposed in many smart city projects are based on promising technologies that, however, continue to ignore the real needs and concerns of the people to whom they are addressed. Or sometimes they are based on real needs, but the sustainability of the solution that is finally adopted is compromised because it lacks a viable economic model[39]. It is clear that the way to make it easier for people with disabilities to benefit from the advances that smart city projects can make is to consider the needs of this group from the very moment they are conceived[40]. In the same way as with accessibility in regard to architectural barriers,

[37] J.L. Quincoces, *Accesibilidad y ciudades inteligentes* in *Economía Industrial*, n. 395, 130.
[38] J.L. Quincoces, *Accesibilidad*, 130.
[39] L. Wagner, *How Can a Smart City Make Life Easier for People with Disabilities*?. in https://www.inclusive-citymaker.com/how-can-a-smart-city-make-life-easier-for-people-with-disabilities/ (last consulted 01.03.2021). J.L. Quincoces, *Accesibilidad*, 131, and N. Navarro Cano, *Innovación urbana*, 40, are in agreement.
[40] J.L. Quincoces, *Accesibilidad*, 131, and, similarly, N. Navarro Cano, *Innovación urbana*, 40.

the cost of making digital technology used by smart cities accessible to all who need to use it is practically non-existent when this principle is integrated into their design from the very beginning[41]. In short, accessibility is a transversal parameter that must be taken into account in the ideation stage and throughout the development of any smart city project. It is not enough to make individual corrections or modifications, *a posteriori*, to patch up what has not been adequately designed. As well as later corrections tending to increase the costs derived from the execution of the project, the principle of accessibility and the requirements of "design for all" should inform any decision made regarding the project from the very beginning[42].

Elsewhere, we have claimed that a city's inhabitants should be provided with ample information about the smart city initiatives that are being promoted: as many details as possible about the projects, who the actors (both public and private) are, where the data -algorithmic or not- with which they will make decisions will come from, how this data will be collected, the project execution deadlines, and its expected results. We have also emphasised the need for the economic investment necessary to be transparent. In our opinion, the public should have access to all this information in a simple, clear and up-to-date manner (something much better than the publication of the dense evaluation reports that are produced in accordance with the regulations)[43]. In addition, and since non-accessibility results in discrimination, as well as evaluating the risks of exclusion that the project may eventually generate, and providing all the necessary measures to mitigate them, it would not be excessive to demand -just as environmental, sustainability or energy efficiency impact reports are required- a report on the impact of the project on people in general and people with disabilities or functional diversity in particular. Likewise, we consider that the more disruptive or ambitious the smart city project, the greater the need to specify its degree of impact on people, and on vulnerable groups in particular[44]. We believe that this provision in smart city projects would defend the rights of the public, and also solve many of the problems currently presented by these initiatives. Without these safeguards, smart cities could not only suffer serious legal consequences, but also earn the distrust and displeasure of their inhabitants and visitors.

In addition to everything that has been pointed out so far, some voices have advocated for going one step further in the conception and design of smart cities. They argue that smart cities should be governed by the principle of usability, which is "the characteristic that allows all products, services and environments that are present in the city to be used without any type of discrimination by its inhabitants. Usability intrinsically and logically encompasses the accessibility of these products, services and environments; but it goes even further. It also encompasses how, where and the manner in which the spaces in the city should be designed and built, so that they can be used by the people who live there"[45].

It would be absurd to have accessible products and services provided in an urban environment if they were distributed in an illogical way: disconnected from each other or with no way to reach them because of their remote location. To avoid this type of problem, the idea is to build the city by involving the end users of the services in its design and development, especially groups or minorities that are starting out from a disadvantaged situation, specifically people with disabilities. This would prevent the technological innovations of the smart city from serving only a part of the inhabitants of the urban environment, while excluding another group of its residents and therefore violating their rights.

3. *Artificial intelligence in the smart city and*

[41] L. Wagner, *How Can a Smart City Make Life Easier for People with Disabilities*?.

[42] Quincoces defends that: "Accessibility in a smart city must be built into all the different links that make up the so-called 'accessibility chain'. An example of this is the tourism sector promoting so-called 'smart destinations', in which the smart city must be accessible throughout: in the portals that offer the services, in the agencies that sell the packages, in the transport services (planes, trains, boats...) and their infrastructures (airports, stations,...), in the transfer services (taxis, underground trains, buses,...), in the hotels and restaurants, in the places that are visited at the destination (museums, beaches, ...), in all services and apps, etc.".

[43] C.I. Velasco Rico, *Datos y algoritmos*.

[44] J. L. Quincoces, *Accesibilidad*, 132.

[45] J.C. Ramiro, *La Usabilidad de las Smart Cities: más allá de la accesibilidad* in *Ágora. Inteligencia colectiva para la sostenibilidad*, in https://www.agorarsc.org/la-usabilidad-de-las-smart-cities-mas-alla-de-la-accesibilidad/ (last consulted 02.03.2021).

disability bias

Smart cities have begun to manage some of their services based on the use of algorithmic and/or artificial intelligence tools, either in their design them or to actually provide them[46]. Data is supplied to these systems using technological elements (sensors, cameras, and other electronic and digital devices) that are distributed throughout the city. These provide the working material for the software (algorithms) and for the artificial intelligence tools used. The use of data mining technology in order to search for patterns, which had until now been hidden from both public managers and policy makers, as well as from the public and from companies themselves, opens up a challenging panorama and turns us, with us barely noticing it, into "slaves to the algorithm"[47]. However, supporters say that this scenario facilitates the design and implementation of public policies and makes public contracts economically viable, since these can be adjusted to the actual "consumption" and "behaviour" of citizens, yielding better results in terms of efficiency. Detractors say the threat posed to our privacy and fundamental freedoms by all this is just too great, and that our democratic systems will not survive the technological tsunami that is coming, at least in their present form[48] .

One important advantage of these algorithmic and intelligent data mining tools is that they generate new information that can help to better understand how inhabitants really use a city. This should make it possible to personalise the provision of public services, as well as maximising their effectiveness and efficiency. This operation is not without its dangers: on the one hand, it poses a danger to the classic conception of public service[49], which aims to promote equality and equity (as a way of redistributing wealth); on the other hand, it risks putting practices into place that harm citizens' rights[50]. Artificial intelligence systems are rapidly being integrated into increasingly broad and central realms of people's lives. These systems are already being used to determine who receives certain resources and who is deserving of certain opportunities, and who is not[51].

However, these tools - whose marketing highlights their ability to make more intelligent, better, and more objective decisions - have been repeatedly proven to produce biased and incorrect results[52]. For example, it has been shown that there are voice recognition systems that do not "hear" the highest voices (i.e., the "more feminine" ones)[53]. Some diagnostic systems have also been found to work poorly for people with dark skin[54]. And, finally, certain algorithms that discard or downgrade women's job applications have been uncovered[55]. Ultimately, what happens is that the computer systems in questions -which have been built, designed, powered and trained by humans- are the sounding board for their implicit values. In truth, it would be naive, and even perhaps dangerous, to confuse the concept of "algorithmic" with "objective", or to think

[46] A. Cerrillo *Los servicios en la ciudad inteligente* in *La ciudad del siglo XXI: Transformaciones. Actas del XV Congreso de la Asociación Española de Profesores de Derecho Administrativo (AEPDA)*, Madrid, Instituto Nacional de Administración Pública, 2020.

[47] L. Edwards and M. Veale, *Slave to the algorithm? Why a 'Right to an Explanation' is probably not the remedy you are looking for*, in *Duke Law & Technology Review*, n. 18, 2017, 16.

[48] Y.N. Harari, *21 lecciones para el siglo XXI*, Madrid, Debate, 2018.

[49] S. Ranchordas and A. Klop, *Data-Driven Regulation and Governance in Smart Cities* in *University of Groningen Faculty of Law Legal Studies Research Paper Series* 7/2018, in https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3126221 (last consulted, 18.04.2019).

[50] On the concept of the personalisation of public services see C.I. Velasco Rico, *Personalización, proactividad e inteligencia artificial. ¿Un nuevo paradigma para la prestación electrónica de servicios públicos?*, in *Internet, Dret i Política* (IDP), n. 30, 2020, 1.

[51] I. Alamillo, *El uso de algoritmos en las administraciones públicas de hoy, mapa de experiencias*, in *I Seminario internacional de Derecho Administrativo e Inteligencia Artificial*, Toledo, 2019. Programme available here: http://blog.uclm.es/ceuropeos/2019/02/21/i-seminario-internacional-derecho-administrativo-e-inteligencia-artificial-daia/ (last consulted 17.04.2019).

[52] M. Whitaker et alii, *Disability, Bias, and AI* in *AI Now*, 2019, in https://ainowinstitute.org/disabilitybiasai-2019.pdf (last consulted 02.03.2021).

[53] R. Tatman, *Gender and Dialect Bias in YouTube's Automatic Captions*, in *Conference: Proceedings of the First ACL Workshop on Ethics in Natural Language Processing*, January 2017, in http://www.ethicsinnlp.org/workshop/pdf/EthNLP06.pdf. (quoted by M. Whitaker, *et alii*).

[54] A.S. Adamson and A. Smith, *Machine Learning and Health Care Disparities in Dermatology*, in *JAMA Dermatol*, n. 154, vol. 11, 2018, 1247. Text available here: doi:10.1001/jamadermatol.2018.2348 (quoted by M. Whitaker, *et alii*).

[55] J. Dastin, *Amazon Scraps Secret AI Recruiting Tool That Showed Bias against Women*, Reuters, 2018, in https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK0-8G (last consulted 01.03.2021).

that the use of algorithms will necessarily eliminate discrimination against certain groups. The trust placed in the data collected does not make algorithms the representation of the truth. The data that we feed into the software may be biased, because, in general, it is derived from existing discriminatory practices[56]. As legal theory has emphasised, it is overly naive to consider that the mathematical nature of an algorithmic code does away with any possibility of ambiguity. As we have said, algorithms are not designed in a vacuum, and their weak point are the people who put them together and the selections that are made based on the results they produce. Therefore, a critical element in the regulation of algorithms is the regulation of humans. Algorithms change the landscape, they do not eliminate the problem[57].

Until now, when analysing the biases sustained by algorithmic or artificial intelligence systems, the focus has been on concepts such as race and gender, and on the issues that affect these two categories in an intersectional way. Other issues, e.g. people with disabilities, have been somewhat neglected. This issue -which has been left out of the study on AI biases- is crucial insofar as people with disabilities have historically been and still are the object of marginalisation. This marginalisation has systematically excluded them from accessing power, as well as certain resources and opportunities. This situation is especially relevant in the algorithmic age our cities are entering because "these patterns of marginalization are imprinted in the data that shape AI systems and this history is embedded in the logic of AI"[58].

In this sense, and as we have already highlighted, although technology, and especially AI, can potentially be a powerful tool to help reduce barriers for people with disabilities, and even to increase or enhance their capabilities, it is becoming an instrument that causes discrimination against different groups of people; this is an issue that is not being adequately addressed[59]. For example, tools that use natural language processing generate a greater number of errors when the algorithm processes texts written people with dyslexia or dysgraphia. In the same way, natural language processing mechanisms fail more when trying to process the speech of a person with depression or autism[60]. Likewise, facial recognition may not function correctly when it comes to recognizing people with Down's syndrome or a cleft lip when these conditions are visible in their facial features or expressions[61]. Similarly, it should be borne in mind that many AI systems, especially those that detect outliers, penalise users for the incorrect execution of certain tasks which are carried out, in order to discern whether they are in the presence of a human or a bot, depending on the time taken to perform certain tasks. People whose disabilities prevent them from complying with the task within the standardised times may be excluded or penalised in the provision of certain services. The bias that occurs in these cases may be caused by those who design the algorithms lacking knowledge about groups of people with various disabilities, or not knowing about medical conditions that might lead people to interact with new digital tools that deviate from the established standard. Likewise, this bias, according to Cerrillo, comes not only from "(…) the lack of social sensitivity regarding people with functional diversity" but also "from the fact that there are very few people with disabilities designing algorithms"[62]. Another difficulty in combatting bias in relation to people with disabilities is that they constitute a tremendously diverse group or groups, something that in turn makes it difficult for algorithms to extrapolate or to reach relevant conclusions[63].

It should also be noted that most AI systems are trained with data that is found in public data sets, such as Flickr images, which do not necessarily capture the complexity of

[56] C. Crawford, *The Hidden Biases in Big Data*, in *Harvard Bussiness Review*, 2013. Text available here: https://hbr.org/2013/04/the-hidden-biases-in-big-data (last consulted, 10.01.2019).
[57] J. Kleinberg, J. Ludwig, S. Mullainathan, and C.R. Sunstein, *Discrimination in the age of algorithms*, in *National Bureau of Economic Research (NBER) Working Paper*, n. 25548, 2019, 4.
[58] M. Whitaker et alii, *Disability bias*, 8.
[59] A. Cerrillo, *La inteligencia artificial y el control de sus posibles sesgos*, in *Nuevas tecnologías y control ciudadano: ventajas e inconvenientes, dilemas éticos*, Madrid, Instituto Nacional de Administración Pública (INAP), 27 October 2020.
[60] A. Guo et alii, *Toward Fairness in AI for People with Disabilities: A Research Roadmap*, in *ACM ASSETS Workshop on AI Fairness for People with Disabilities*, 2019. Text available here: https://arxiv.org/pdf/1907.02-227.pdf (last consulted 01.03.2021), 3-4.
[61] A. Guo et alii, *Toward Fairness*, 2.
[62] A. Cerrillo, *La inteligencia artificial.*
[63] A. Cerrillo, *La inteligencia artificial.*

real life. This prevents them from representing the true existing diversity of people and groups or communities, for example, people with disabilities. This can create "blind spots in the different AI models"[64]. Because of this, various specialists already advocate actively selecting inclusive data sets; this could be an important part of training and testing AI systems[65] .

In short, it is clear that the public authorities that plan to use AI systems to provide services in the smart city are faced with a huge challenge. The challenge is to meet the requirement to build or contract fair and inclusive algorithmic or AI systems within a democratic, social state based on the rule of law; consequently, its workings must not directly or indirectly discriminate against any person or group.

It should be noted that the European Union is already taking a clear position on these issues. Ethics guidelines for Trustworthy Artificial Intelligence developed by the High-Level Expert Group on AI were published in December 2019 and followed the guidelines' first draft in December 2018. According to this document, a reliable AI must be legal (respecting all applicable laws and regulations), ethical (respecting ethical principles and values), and robust (both from a technical perspective and considering its social environment). The guidelines presented a set of six key requirements that AI systems must meet to be considered trustworthy: (1) agency and human oversight; (2) technical robustness and security; (3) privacy and data governance; (4) diversity, non-discrimination and equity; (5) social and environmental well-being; and (6) accountability (AI and its results must be accountable to external and internal auditors).

In addition, the Commission has very recently (21.04.2021) adopted a Proposal for a Regulation of the European Parliament and the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). This new proposal assumes that AI applications will bring many benefits, but may, if unregulated, carry risks that will undermine user/citizen confidence. The aim of the future European AI Act is to regulate these risks, differentiating between those that are directly prohibited, those that are high risk and those that are medium or low risk. The typology of risk proposed by the Commission is as follows:

1. Prohibited risks: The Commission considers that some risks are unacceptable. AI that contradicts EU values will be banned, including AI systems that are considered a clear threat to security, livelihoods and human rights. For example, this bans AI systems or applications that could lead to the manipulation and/or exploitation of children or mentally disabled people, resulting in physical/psychological harm, facial or biometric recognition in public spaces (with exceptions, such as anti-terrorism measures, or predictive policing) and systems that enable "social scoring" by public (but not private) authorities.

2. High-risk: permitted, but subject to compliance with AI requirements and *ex ante* conformity assessment. AI systems considered as high risk include technologies used in critical infrastructure, product safety components, recruitment of employees, essential public and private services, law enforcement, which may interfere with the fundamental rights of individuals, migration management, asylum and border control, and the administration of justice and democratic processes.

3. Limited risk: these are considered AI systems with specific reporting/transparency obligations. For example, in conversational robots, users must be aware that they are interacting with a machine in order to make an informed decision to proceed or not.

4. Minimal or no risk: most AI systems fall into this category and pose only minimal or no risk to citizens' rights or security. The proposal allows, among others, the use of applications such as AI-based video games or spam filters.

All these limitations would apply to software and devices manufactured in the EU or imported.

In short, it seems that the European Union is going to take matters into its own hands and intends to curb the risks caused by the biases embedded in algorithmic and AI tools. These provisions should in turn serve to improve the performance of AI applications and software implemented in smart city projects.

4. *A final reflection: some ideas from improvement*

Throughout this article we have addressed

[64] A. Guo, et alii, *Toward Fairness*, 3.
[65] A. Guo, et alii, *Toward Fairness*, 5.

the issue of the relationship between the smart city and people with disabilities. We have discussed how this new urban paradigm should be designed with everyone in mind, since it could otherwise prevent people in this heterogeneous group from fully exercising their rights. As well as providing an account of the existing problems and discrimination suffered by people with disabilities in the city -problems which could be aggravated by this new era that is dominated by AI-, we intend to go further and as a final reflection, to put forward some proposals that would allow us to better respond to the problems raised.

In the first place, all services and features implemented in any smart city initiative must be thought out and designed in a global and inclusive way, to answer everyone's needs. When a project in this area is being conceived, the principle of accessibility by design, the accessibility chain and a usability mandate must all be addressed in a transversal way in designing the city in order to guarantee the needs of people who are often neglected due to their disabilities. In order to find out their true needs, concerns and difficulties, a complete census should be carried out. This should both collect relevant information about all people with disabilities in the area in question, and also involve them in the entire process: designing, testing and implementing any smart city solution. Only by using all the participation tools possible to promote direct dialogue with end users, especially those in vulnerable groups and communities of disabled people, can we step in to stop design or concept errors from being committed early on. Correcting them at a later stage is either impossible or comes at a very high cost in terms of time and resources. Since the group of people with disabilities is extremely diverse, special attention should be paid to gathering the opinion of the various medical conditions and points of view that make it up. Good practices and tools that have already been developed in other places and that have shown positive results should also be considered. When successful, tried and tested solutions already exist, it makes sense to use them.

Secondly, in order to combat the algorithmic discrimination that may result from the implementation of AI systems used in different smart city initiatives, it is imperative to have, on the one hand, people with disabilities on the teams that design the algorithms and train the AI systems, making the teams as diverse as possible to avoid some of the aforementioned bias; and on the other hand, it is paramount to have good databases, which are also as diverse as possible in order to approximate the real world as closely as possible. To build these new data sets, it is necessary to question and not be afraid to criticise the ones currently in use, and to actively include data that includes the true diversity of the city's inhabitants. Likewise, the algorithms used by the public sector -also used by the private sector- should be programmed in such a way that they do not discriminate or penalise perfectly legitimate behaviours or attempts to access services. They must be designed so that no matter how much their interaction with the tool deviates from the standardised form or time taken to access it, their behaviour is not confused with abusive use or bots. And if necessary, alternative solutions should be found to allow disabled people's access to public services while preserving their rights and equal opportunities.

Glaeser's phrase that introduces this article says that the real city is made of flesh, not concrete. In the same way, smart cities are not innovative technology solutions, they are the people that these technologies should be serving. Any city project, new or already begun, that leaves its most vulnerable citizens by the wayside is unfair, and is far from being smart. The public administration has the opportunity to change the urban paradigm, and hopefully this will also bring about a change in attention to diversity, especially disability. We are still in time.