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PERSONAL DATA PROTECTION AS A NONFUNCTIONAL REQUIREMENT IN THE SMART CITY'S DEVELOPMENT

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ABSTRACT: "Smart city" is a fuzzy concept, evading a unitary characterisation. Its blurriness is highlighted by the broad array of definitions with which academic and corporate literature have attempted at delineating the notion. This paper derives from the elaboration of several definitions that have been given to the concept of smart city. It maintains that a smart city is, succinctly, the specific set of practices and design choices underlying the instrumentation and digitalisation of the urban environment. The ICT underlying the smart city is however inherently political, has regulatory capacity, and thus influences both urban governance and management practices, and the life and behaviour of individual city dwellers. Following the principle of Data Protection by Design, we thus argue for the conceptualisation of the right to personal data protection as a nonfunctional requirement to be applied to the design and development of smart cities. This paper aims at contributing to the delineation of the scope and definition of the notion of smart city and of its driving values. Its goal is to frame the concepts of privacy and data protection as naturally belonging to the smart city's teleology, to the stack of values, goals, and goods that the smart city concept aims at achieving or safeguarding.

KEYWORDS: data protection, smart cities, GDPR, privacy, urbanism.

1. INTRODUCTION

Over the past decades, a new concept has taken by storm the global narrative on contemporary urbanities: the "smart city", expression of a paradigm change deriving from the intertwinement between modern ICTs (Information and Communication Technologies) and the city. The concept of smart city refers to the deployment of ICT within the urban environment, and to its social and technological consequences. It indicates the instrumentation and digitalisation of cities, the synergy between code and space[1] within modern-day conurbations, big data deriving from and applied to every dimension of urban living, management, and governance. Urbanities face an increasing amount of challenges of social, economic, and environmental nature: instrumenting the city with ICT and data analytics solutions –making cities "smart"– can provide the necessary answers.

The smart city is conceptually linked to a multiplicity of other *topoi* that are core to contemporary discourses about the role of ICT in society. There is, however, not a univocally accepted characterisation, and the boundaries of the notion appear to be fuzzy at best[2]. The smart city can be framed considering the relationship between code and architecture, their confluence within the built environment, and their capacity as regulatory actors. It can be linked to big data collection and analytics, and hence to algorithmic transparency and governance; to data-driven urbanism[3], and to evidence-based policymaking. Indeed, the defining traits of the concept of smart city are overly blurry.

Ultimately, however, the smart city is all about data. The instrumentation of the built environment is symptomatic of a bigger trend where, as summarised by Shoshana Zuboff's three laws[4], everything that can be automated will be automated, everything that can be "informated" will be "informated", and –in the absence of countervailing restrictions and sanctions– every digital application that can be used for surveillance and control will be used for surveillance and control, regardless of its originating function. Considering their scale and role, smart cities are a prime example of the promises and the perils of the rampant "datafication" of society.

The purpose of this paper is to unfold the concept of smart city, highlighting the social consequences underlying the instrumentation of the built environment, and arguing for the conceptualisation of the right to personal data protection as a nonfunctional[5] requirement to be applied to its development. After this introduction, we delve

1 Kitchin, R., & Dodge, M. (2011). Code/space: Software and everyday life. MIT Press; Bratton, B. H. (2016). The stack: On software and sovereignty. MIT Press.

2 "*The consensus from the critical smart cities literature is that little is known about the underlying principles of the smart city model beyond the advertising campaigns of IT companies and the self-promotion of cities*": Gaffney, C., & Robertson, C. (2016). Smarter than Smart: Rio de Janeiro's Flawed Emergence as a Smart City. *Journal of Urban Technology*, 4.

3 Kitchin, R. (2015). *Data-driven, networked urbanism* (Programmable City Working Paper No. 14).

4 Zuboff, S. (2013). The Surveillance paradigm: Be the friction - Our Response to the New Lords of the Ring. Retrieved 15 October 2016, from http://www.faz.net/aktuell/feuilleton/the-surveillance-paradigm-be-the-friction-our-response-to-the-new-lords-of-the-ring-12241996.html

5 Functional requirements dictate the functions a technology must have, specifying e.g. speed or efficiency. Nonfunctional requirements relate to the values and ideals on which that technology rests: see e.g. Manders-Huits, N., & van den Hoven, J. (2009). The need for a value-sensitive

into the notion of smart city, highlighting its defining traits, its social and technological scope, and the fact that the concept is still an umbrella label. The third section deals with the right to data protection, and makes the case for its inclusion as a nonfunctional requirement for the smart city's development. Our conclusions follow in the final section.

2. WHAT IS A SMART CITY?

The definitions of "smart city" given by literature, standards, and corporate output are highly diverse, and paint a chaotic picture. "Smart city" is an umbrella term, fit to indicate a large array of products, processes, and policies relating to the instrumentation of the built environment. Intelligent city[6], sustainable city[7], digital city[8], real-time city[9], even *Metropticon*[10]: the terminology changes according to the aspects of the built environment considered, and to the document in which the definition is included.

The lack of a commonly agreed-upon definition of smart city is to be expected: there cannot be a single model of smart city, as much as there cannot be a single model of city *tout court*. Every city is indeed certainly unique[11]. At the same time, it has some characteristics that are comparable to other cities, some functions performed in a similar way. It is thus certainly possible to discuss cities as a general category, and to compare

design of communication infrastructures. In P. Sollie & M. Düwell (Eds.), Evaluating New Technologies (51–60). Springer.; van den Hoven, J. (2013). Architecture and value-sensitive design. In C. Basta & S. Moroni (Eds.), Ethics, design and planning of the built environment (135–141). Springer.

6 Nam, T., & Pardo, T. A. (2011a). Conceptualizing smart city with dimensions of technology, people, and institutions. In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times (282–291). ACM.

7 ITU-T Focus Group on Smart Sustainable Cities. (2014). *An overview of smart sustainable cities and the role of information and communication technologies*.

8 Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. Journal of Urban Technology, 22(1); Cocchia, A. (2014). Smart and digital city: A systematic literature review. In R. P. Dameri & C. Rosenthal-Sabroux (Eds.), Smart City (13–43). Springer.

9 Kitchin, R. (2014b). The real-time city? Big data and smart urbanism. GeoJournal, 79(1), 1–14; Townsend, A. M. (2013). *Smart cities: big data, civic hackers, and the quest for a new utopia*. WW Norton & Company.

10 Finch, K., & Tene, O. (2013). Welcome to the Metropticon: Protecting Privacy in a Hyperconnected Town. *Fordham Urb. LJ*, *41*(5), 1581.

11 "*Each deployment of "smart city" technologies reflects local patterns of growth, urban governance models, and knowledge transfer networks*" – Gaffney & Robertson, 2016, 2.

them in function of their scale, but one must be mindful that each of them is the by-product of several factors that render it distinctive. Its environmental and geographical setting, for instance, and its climate; its history, demographics, and social context; its laws, norms, and economy; its governance, the division of competences between local and national government, and between the agencies operating within the city. Each conurbation has its own actors and activities, its hard and soft infrastructure, its priorities and objectives.

The smart city is highly contextual. The main finding deriving from the review undertaken is that a holistic understanding of the smart city implies considering how the instrumentation of the built environment is not only a technological issue, but implies a shift in urban governance and management too, and involves natural persons both as city dwellers and as human capital. In a nutshell, smart cities appear to be understood by the literature reviewed according to three different –yet connected– perspectives, each assigning a different weight to the factors characterising the concept of smart city. The first one, the technological perspective, reigns sovereign, its prominence[12] hardly questioned by the literature reviewed[13]. The second perspective focuses on the organisational aspects of the smart city. Central to this perspective is the fact that the digitalisation and networking of the built environment has a direct impact on the urban management, governance, and organisational practices through which cities are run. It highlights how a city's intelligence is not just a technological issue, but also a structural one. Finally, an anthropocentric view highlights how cities are inhabited by humans, run by people, and largely shaped by how individuals interact within them: the concept of smart city is thus deeply entwined to the one of "smart citizen" as well.

The main driver of the smart city is ICT. There is a wide range of technologies that have been identified as building blocks of the concept of smart city. Ubiquitous compu-

12 "*ICT is central to the operation of the future city*": Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., … Portugali, Y. (2012). Smart cities of the future. *The European Physical Journal Special Topics*, *214*(1), 481–518.

13 Even if the smart city deals with innovation in general, which does not necessarily have to be ICT based: see Anthopoulos, L. G., Janssen, M., & Weerakkody, V. (2015). Comparing Smart Cities with different modeling approaches. In Proceedings of the 24th International Conference on World Wide Web Companion (525–528).

ting – pervasive computing, ambient intelligence[14], "*everyware*"[15] –enables computation everywhere and through many devices. Broadband networking and cloud computing remove the constraints which bound information before– low bandwidth, and local storage. Big data technologies allow to process high-dimensional, complex, and dynamic datasets. Large arrays of distributed and networked sensors embedded in several devices –the Internet of Things (IoT)– allow to gather huge and varied amounts of data, often in real time, with increasing granularity and detail. GISs (Geographic Information Systems) and BIM (Building Information Modelling) tie the spatialities of the smart city to its informational components, allowing its digital representation and modelling. E-Government facilities provide a new interface between the city's administration and its citizens, linking them through ICT infrastructure and services[16]. The smart city definitions examined have in ICT a common element, sometimes as their core, some other times as a component to be present –necessary but not in itself sufficient– when qualifying a city as smart.

The literature examined highlights how cities becoming smart also means a shift in the organisational and decisional practices on which urban governance, management, and development are based[17]. Urban governance is bound to become evidence-based, data-driven[18]: "*governing a smart city is about crafting new forms of human collaboration through the use of information and communication technologies […] technology by itself will not make a city smarter: building a smart city requires a political understanding of technology, a process approach to manage the emerging smart city and a focus on both economic gains and other public values*"[19]. The smart city is thus more than the sum of the technologies it employs. It is a shift towards different governance frameworks, a new

14 Ahonen, P., Alahuhta, P., Daskala, B., Delaitre, S., De Hert, P., Lindner, R., … Verlinden, M. (2008). *Safeguards in a world of ambient intelligence*. (D. Wright, S. Gutwirth, M. Friedewald, E. Vildjiounaite, & Y. Punie, Eds.). Springer; Crang, M., & Graham, S. (2007). Sentient cities ambient intelligence and the politics of urban space. *Information, Communication & Society*, *10*(6), 789–817.

15 Greenfield, A. (2010). Everyware: The dawning age of ubiquitous computing. New Riders.

16 See ISO/IEC JTC1, 2014.

17 E.g. Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J. R., Leung, S., Mellouli, S., … Walker, S. (2012). Building understanding of smart city initiatives. In Electronic government (40–53). Springer; Nam & Pardo, 2011a; Nam, T., & Pardo, T. A. (2011b). Smart city as urban innovation: Focusing on management, policy, and context. In Proceedings of the 5th international conference on theory and practice of electronic governance (185–194). ACM.

18 Kitchin, 2015.

19 Meijer, A., & Bolívar, M. P. R. (2015). Governing the smart city: a review of the literature on smart urban governance. *International Review of Administrative Sciences*, 1.

approach on urban management, based on the information gathered by the sensors the city is instrumented with, and then further processed by its computing infrastructure. In the majority of the instances examined, even when the perceived focus would lie on the governance and organisational aspects of the smart city, ICT and analytics still occupy a prominent role within its definition.

The organisational perspective is closely linked to what could be defined as a humanist or anthropocentric perspective[20] on smart city environments. It focuses on smart citizens –informed, creative, inclusive and included people– and on their role in the cities of the future. This approach emphasises how inhabitants are the main beneficiaries and the main agents for and through which cities are turning smart, and how human capital[21] is one of the main drivers behind this shift. City residents are what cities revolve around, both in their capacity as individuals and collectively, as belonging to those social formations in which individualities aggregate. "Smart citizens" are considered a major driver pushing cities' intelligence forward[22]. As it has been noted, "*the issues for the creative city of the future will focus upon its 'soft infrastructure' [...] This more 'humanist' emphasis ties in with other related discourses of smart communities*"[23].

2.1. The instrumentation of the built environment

The smart city is the urban facet of the data revolution[24]. A paradigm shift, enabled by modern technological developments and by the deployment of ICT within the built environment, which influences people both as single human beings and as the social formations they collectively form. ICT is instrumental for the smart city's development, but ultimately the paradigm shift is driven by data –by its availability and granularity, and by our possibility to process it to foster efficient decision-making, determine service

20 "*(W)hat defines the smart city is not the infrastructures or networks it offers, but the ways in which its citizens interact with these systems as well as each other":* Walravens, N., Breuer, J., & Ballon, P. (2014). Open Data as a Catalyst for the Smart City as a Local Innovation Platform. *Communications & Strategies*, (96), 20. See also Albino, Berardi and Dangelico, 5: "*(T)he smart city concept is no longer limited to the diffusion of ICT, but it looks at people and community needs*".

21 E.g. Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart Cities in Europe. *Journal of Urban Technology*, *18*(2), 65–82; Albino, Berardi and Dangelico, 2015, 9: "*[people] are the protagonists of a smart city [...] The social infrastructure [...] is an indispensable endowment to smart cities*".

22 Six dimensions are considered by most smart city definitions and models: people, government, economy, mobility, environment, and living; Anthopoulos *et al.*, 2015.

23 Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? City, 12(3), 309.

24 Kitchin, R. (2014a). *The data revolution: Big data, open data, data infrastructures and their consequences*. Sage.

provisioning within a geographic area, and rationalise the existing resources to maximise their utility[25]. Data infrastructures have the same kind of significance the introduction of cars had for last century's urban development: it is not only about the technology itself, it is about how it shapes the environment. The diffusion of automobiles caused urbanities' structure to change, adapting to that revolution in transportation; people's individual and collective habits changed accordingly. Data infrastructures change cities the same way, shaping them –and their citizens' behaviour– according to what results from the information they process.

There is a good case for the instrumentation and "datafication" of the built environment, particularly where the information gathered by public administrations is subsequently released as open data to foster scientific innovation and economic growth. Data allows for more efficient service delivery, accurate enforcement actions, evidence-based and data-driven governance, and more rational infrastructural improvements[26]. For example, datafication allows for benchmarking a city's performance and characteristics through a multiplicity of urban indicators, and then to report and represent them visually through dashboards[27]. Urban indicators, benchmarks, and dashboards enable or facilitate data-driven governance and evidence-based decision-making[28], and are one of the main links that binds the right to data protection to cities' instrumentation

The representation of the urban environment must be considered within its broader social and political context. Cities are too complex to be represented as a collection of data points. Any technological system monitoring and measuring a city's performance and indicators is not merely translating that city's characteristics into information, but is actively contributing to its framing and future development. Kitchin *et al.*[29] underline that urban indicators, benchmarks, and dashboards are data assemblages –socio-technical systems "*composed of many apparatuses and elements that are thoroughly entwined*"[30]. Rather than offering a neutral portrait of a city's reality, they actively produce it[31]. In-

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25 Goerge, R. M. (2014). Data for the public good: challenges and barriers in the context of cities. In J. Lane, V. Stodden, S. Bender, & H. Nissenbaum (Eds.), Privacy, big data, and the public good: Frameworks for engagement. Cambridge University Press, 153.

26 Goerge, 2014; Walravens *et al.*, 2014.

27 Kitchin, R., Lauriault, T. P., & McArdle, G. (2015). Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. Regional Studies, Regional Science, 2(1), 6–28.

28 Kitchin *et al.*, 2015, 15 ss.

29 Kitchin *et al.*, 2015.

30 Kitchin *et al.*, 2015, 17.

31 Kitchin, R. (2016). Urban data and city dashboards: Six key issues. Retrieved 15 October 2016, from osf.io/sv8eb.

dicators, benchmarks, and dashboards reflect a top-down approach to the smart city in that both their architectural design and their interpretation are expression of the choices made by the local government and by who developed them. Code and architecture come together to shape human behaviour according to a predefined set of decisions and values on which individual city dwellers have often little to say.

2.2. Technology as policy

Technology functions as a regulatory instrument. Its physical dimension (architecture)[32], its digital counterpart (code)[33], and their merger (code/space)[34], have the potential to shape human behaviour as much as the law or social norms have. To curb cars' speed in a residential neighbourhood, a local administration could rely solely on regulation by law –e.g. setting a low speed limit and a high speeding fine– or on architectural design, e.g. by placing speed bumps or speed traps. To keep intruders out of a computer network, one could rely on the norms that criminalise unauthorised access, or deploy an intrusion detection system as well. Architecture performs a regulatory function by expressing and imposing cultural or symbolic meanings; by directly affecting how people interact; and by being biased towards certain social groups, values, or practices[35].

At the same time, artefacts are inherently political[36]: they embody a set of values deriving from the choices of who engineered them. If their scope is sufficiently wide, their regulatory capacity shapes both individual and collective behaviour according to the values transferred by who designed or deployed those technologies. The smart city relies on technologies of such a scale and regulatory capacity. For example, to promote sustainable growth and efficiency, a local administration might decide to instrument rubbish bins and rationalise waste collection. It might decide to use sensors to detect when the bin is at capacity, hence alerting waste collection operators only when necessary, saving some expenditures to the city. It might also decide, however, to instrument those bins with access control mechanisms so that only e.g. households that have paid

32 Boyd, D., & Crawford, K. (2012). Critical Questions for Big Data. Information, Communication & Society, 15(5), 662–679.

33 Lessig, L. (1999). *Code and other laws of cyberspace*. Basic books; Leenes, R. E., & Koops, B.-J. (2005). 'Code' and Privacy - Or How Technology is Slowly Eroding Privacy. In E. Dommering & L. Asscher (Eds.), *Essays on the Normative Role of Information Technology*. TMC Asser Press.

34 Kitchin & Dodge, 2011.

35 Shah & Kesan, 2007.

36 See Winner, L. (1986). The Whale and the Reactor: A Search for Limits in an Age of High Technology. University of Chicago Press.

waste disposal taxes have access to it, or with a sensor system designed to identify (and then fine) who violates recycling norms[37].

The artefacts that instrument that system of systems we define as city have regulatory capacity, are a political issue[38], and embody an underlying set of values. The realist epistemology through which the smart city is portrayed as a mere stack of neutral technologies is a misleading narrative: the instrumentation of the built environment actively translates certain values into reality[39], and regulates human behaviour.

3. DATA PROTECTION AS A NONFUNCTIONAL REQUIREMENT

We claimed, so far, that there is not a unitary definition of smart city, and that its best characterisation is of a paradigm shift in urban governance and management, enabled by ICT developments, towards data-driven and evidence-based urban policy-making. We also underlined how the ICT that instruments the built environment actively shapes individual and collective behaviour according to its underlying set of values.

The smart city, if ill-conceived or poorly scoped, is possibly threatening for individuals' rights to privacy and data protection[40]. The instrumentation of the built environment means the placement of an array of interconnected sensors, CCTV cameras, big data analytic platforms, cloud computing infrastructures, IoT devices –potentially very intrusive technologies. It also means the "datafication" of the built environment, and its visual representation through dashboards– activities that do not merely represent reality, but shape it on their own. The smart city is however bigger than the mere sum of its technological parts: it implies a holistic shift in urban governance and management, and pushes forth an anthropocentric view of the built environment's development that is, in our view, necessarily bound to take data protection into account.

In the absence of a countervailing push, every digital application that can be used for surveillance and control will be used for surveillance and control, regardless of its

37 Example inspired by van Zoonen, L. (2016). Privacy concerns in smart cities. Government Information Quarterly, 33(3).

38 See Sadowski, J., & Pasquale, F. A. (2015). The spectrum of control: A social theory of the smart city. First Monday, 20(7); van den Hoven, 2013.

39 "*Information technology has become a constitutive technology […] It shapes our discourses, practices and institutions and experiences in important ways*": Manders-Huits & van den Hoven, 2009, 68.

40 See Edwards, L. (2016). Privacy, Security and Data Protection in Smart Cities: A Critical EU Law Perspective. *European Data Protection Law Review*, *2*(1).

original function[41]. The "datafication" of the built environment and the technologies enabling it can be engineered or used for such purposes, evading the checks and balances that legitimise those activities in a democratic society. The smart city's design must therefore consider data protection as a right and as a value, since the regulatory capacity of the technologies, practices, and policies in which the concept unfolds shapes what we do and are, as individuals and as a collectivity.

We argue that the instrumentation of the built environment can threaten individuals' rights to privacy and data protection to an unprecedented scale, scope, and granularity, and that thus those rights should be considered as a primary nonfunctional requirement in the design, development, and deployment of the technologies underlying the smart city. As opposed to functional requirements, which dictate the concrete functions a technology must have, nonfunctional requirements relate to the overarching values and ideals on which a technology is based. The objectives of the smart city are extremely multifaceted, and yet all somehow aiming at increasing its citizens' general quality of life. For that, it is paramount for the technologies underlying the smart city environment to consider, from their very outset, the rights and interests their misuse might infringe. Amongst them, the ones to privacy and data protection are prominent.

3.1. The right to data protection in the smart city environment

The right to data protection stems from the right to privacy. Traditionally, the right to private life as protected under Article 8 of the European Convention of Human Rights (ECHR) was interpreted as covering the right to privacy, its scope extended to data protection by the case law of the European Court of Human Rights (ECtHR)[42]. However, as attested by Articles 7 ("*Respect for private and family life*") and 8 ("*Protection of personal data*") of the Charter of Fundamental Rights of the EU (CFR), there is a difference between privacy and personal data protection.

Indeed, "*privacy embodies a range of values that are only partially advanced by data protection*"[43]. The right to data protection has been framed both as integral to privacy – a subset of its norms – or, by more modern doctrine, as an entirely different right[44].

41 See Zuboff, 2013.

42 De Hert, P., & Gutwirth, S. (2009). Data protection in the case law of Strasbourg and Luxemburg: Constitutionalisation in action. In S. Gutwirth, Y. Poullet, P. De Hert, C. de Terwangne, & S. Nouwt (Eds.), *Reinventing data protection?* (3–44). Springer.

43 Bennett, C. J., & Raab, C. D. (2006). *The governance of privacy: policy instruments in global perspective*. MIT Press, 237.

44 González Fuster, G. (2014). *The Emergence of Personal Data Protection as a Fundamental Right of the EU*. Springer, 214.

While privacy relates to some qualitative requirements (e.g. legality, necessity, legitimacy, proportionality) deriving from the European Court of Justice's (ECJ) and ECtHR's jurisprudence, data protection can be likened to a set of rules stemming from the Fair Information Processing Principles (FIPPs). Through those rules, the regulator set up a legislative wireframe meant to ensure fairness in data processing operations – the same kind of activities on which the smart city ecosystem's analytics are based.

Data protection stemmed from the advances in computing capabilities, which grew exponentially from the mainframe era on, and from the risks that became associated with them. Over the years, many scholars, professionals, tinkerers, and thinkers[45], drew attention on the threats arising from the power and information asymmetries deriving from the capacity of some actors to store, process, and make sense of a quantity of information that was not conceivable only a few decades before. The debate around the interaction between computers and privacy gave rise to the notion of privacy as control over one's personal information[46], a precursor to the right to personal data protection. Computers were novel, and potentially scary, considering the values upheld by the concept of privacy: it appeared sensible to constrain data processing with an amount of principles meant to ensure fairness within information processing activities. The right to data protection is a set of rules instrumental for the safeguard of all the rights and freedoms that can be dented by the power and information asymmetries running between controllers and data subjects.

In the modern smart city ecosystem the power of technology and its regulatory capacity still warrant a system of checks and balances meant to curb information asymmetries. While computing capacity became distributed –from mainframes to personal computers to ubiquitous computing– real informational power remains arguably centralised by a network of private and public actors with unparalleled access to data and processing capacity. Technology corporations, social networks, Internet providers, data brokers, and state administrations have –each in its own way– a processing capability and an information availability that allows them to exert a considerable power on individuals and on the social formations in which they assemble. The smart city is a prime example of a bundle of technologies whose regulatory capacity warrants a cautionary approach, just as mainframe computing and databanks were.

45 E.g. Miller, A. R. (1971). The assault on privacy: computers, data banks, and dossiers. University of Michigan Press; Packard, V. (1964). *The Naked Society*. D. McKay Co.; Westin, A. F. (1967). *Privacy and freedom*. Athenaeum.

46 González Fuster, 2014, 27 ss.

It would be unfair to characterise the smart city's "quest for a new utopia"[47] as a measly bundle of technologies[48]. If the smart city revolution really is a paradigm shift where "*investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel [...] a high quality of life, with a wise management of natural resources, through participatory governance*"[49], then the technologies underlying its functioning need to be informed to the same principles and values on which its theory rests. We argue that data protection must be considered from the outset of the process of instrumenting the built environment – from the design phase on – as a nonfunctional requirement in the development of the smart city ecosystem. We ground our argument on the values that the smart city's development is purportedly meant to uphold, and on the recent explicit introduction of the principles of data protection by design and by default within the EU legal framework.[50]

3.2. Value-Sensitive Design and data protection

In the past three decades, there has arguably been a disciplinary shift within the fields of design and ethics, a convergence of interests that has led to see technology as bound to accommodate a range of human values. Design turned to ethics, and ethics to design, in what has been dubbed "The Design Turn in Applied Ethics"[51]. Value-Sensitive Design (VSD) aims at embedding values in technology's design. It assumes that values and norms can inform the things we build, and exhorts at taking into consideration in advance the ethics, regulatory capacity, and political value of technology.

Data protection is instrumental to those values. Its violation, as a right[52] and as a principle[53], has been linked to a variety of harms[54]. Its balancing with opposing rights and values is often conflictual, each clash to be solved on a case-by-case basis. However, its essence and importance as human right and value is hardly questionable.

47 Townsend, 2013.

48 Mattern, S. (2017). A City Is Not a Computer. Places Journal.

49 Caragliu *et al.*, 2011, 50.

50 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), 2016, OJ L 119/1, Art. 25.

51 Manders-Huits & van den Hoven, 2009, 54.

52 Solove, D. J. (2006). A taxonomy of privacy. *University of Pennsylvania Law Review*, *154*, 477–560.

53 van den Hoven, J. (1997). Privacy and the varieties of moral wrong-doing in the information age. *Computers and Society*, 27, 33–37.

54 See Christl, W., & Spiekermann, S. (2016). *Networks of Control.* Facultas.

The smart city is a prime example of the push towards embedding values in design. The city's instrumentation aims at ensuring better living conditions to inhabitants, embedding certain values (e.g. safety, sustainability, efficiency) within the urban tissue. The ICT underlying the smart city can however enable a disproportionate level of tracking and surveillance, in the absence of a countervailing push. Data protection embodies that drive: a set of values, and a related right, that aim at ensuring the respect for individuals' privacy, autonomy, and (informational) self-determination. Data protection by policy acts through the law as a regulatory instrument. Data protection by design embeds fair information processing within a technological artefact's requirements, making its design sensitive to the values and rights data protection is meant to uphold, and exploiting the regulatory capacity of technology. Considering data protection as a nonfunctional requirement in the development of the ICT used to instrument the built environment is in line with the smart city's purposes, and contributes to framing such a blurry notion.

Such an approach is now explicitly sanctioned by EU law: according to the General Data Protection Regulation (GDPR), individuals' right to data protection must be considered *ex ante*, from the design phase on, not as an afterthought but engineered within the technologies through which urban environments are being instrumented. As clarified by the GDPR's recital 78, when developing, designing, and deploying any technology or service based on the processing of personal information, producers must consider individuals' right to data protection, and make sure that the entities using the technologies or running the services are able to fulfil their obligations. Article 25, "*Data protection by design and by default*", mandates that – considering the state of the art, costs, nature, scope, context, and purposes of processing, and the related risks for individuals – the controller must implement appropriate technical and organisational measures, designed to apply the GDPR's principles.

Article 25 of the GDPR, if read on its own, could be mistaken for a mere statement of principle. However, when considered in conjunction with e.g. the articles relating to administrative fines *ex* Art. 83, or to the security of the processing operations *ex* Article 32, its practical and concrete enforceability results clear. The legislator explicitly mandates the inclusion of the values data protection is meant to uphold within the design of information processing technologies and processes. It implicitly recognises the political character and regulatory capacity of the technology on which the notion of smart city is based. The smart city embodies exactly the kind of area in which data protection by design is crucial: a stack of potentially highly intrusive technologies that inevitably inform and regulate citizens' behaviour, and that has a profound impact on its social context. The instrumentation of the built environment is highly sensitive to the values on which its development is based, as smart as the design of the ICT on which it runs. Data protection must therefore be recognised by the smart city's stakeholders as a nonfunctional but vital requirement in the development of the built environment.

4. CONCLUSION

The smart city is a fuzzy concept, evading a unitary definition. From the review undertaken, it resulted how the notion of smart city is broader than its technological components, and could be better understood as a paradigm shift. The smart city, while enabled by technological development, is the inception of a horizontal social change whose consequences are yet to be seen. The ICT underlying the smart city has regulatory capacity, and thus influences both urban governance and management practices, and the life and behaviour of individual city dwellers.

It is paramount to recognise how the technologies underlying the smart city ecosystem have an inherently political nature. The instrumentation of the built environment, its "datafication" and subsequent visualisation, are not neutral processes, but have a normative effect, and shape reality according to the values on which they are based. The technologies on which smart cities run can be used to the detriment of individuals' fundamental rights, if carelessly designed or repurposed.

Data protection needs therefore to be considered from the outset of the process of instrumenting the built environment, eventually balanced with other conflicting rights, interests, and values, but still embedded in the city's ICT from its design phase on. On one hand, this is unequivocally sanctioned by EU data protection law. On the other, the purposes for which the smart city is supposedly being built – sustainability, democracy, participation, evidence-based governance – embed the very values to which data protection is instrumental to. We thus argue that data protection must be considered as a nonfunctional requirement in the design of the technologies on which the smart city runs, its rules hard-coded into the built environment. Ultimately, a city is as smart as the values on which its development is informed.

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