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Design for values and the city

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ABSTRACT

This paper undertakes a critical and constructive investigation into the applicability of value sensitive design (VSD) and design for values (DfV) methodologies for urban technologies, as a means to envision and enact responsible urban innovations. In particular, this paper focuses on the identification and analysis of values in urban technologies. First, an important methodological critique is highlighted, namely the vague articulation of 'values' in VSD and DfV discourse. Next, cities are characterized as open, dynamic, and evolving systems, with 'urban technologies' as co-shapers of this process. This highlights the unique conditions requiring attention in order to arrive at a robust understanding of the relationship between values and urban technologies. Finally, these insights are combined to propose and sketch six heuristic principles aimed at surfacing and analysing values in urban technologies, offering a refinement of value-sensitive methodologies for the context of urban technological innovation.

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Design for values; value sensitive design; responsible urban innovation; urban technology; philosophy of the city; smart cities

1. Introduction: the medium(s) of the city

In *Electric Light: An Architectural History* (2018), historian of architecture Sandy Isenstadt introduces the concept of 'electric modernism.' Isenstadt argues that electric light was foundational to the changing design and use patterns of homes, factories, automobiles, and public space throughout the twentieth century. Because of this far-reaching influence, electric lighting is not positioned as a secondary or peripheral influence, but as formative to the physical and ideological conditions of the last century. 'If modernity itself can be characterized by rapid, incessant change – and modernism as the creative and conscious response to such change – then electric light – instantaneous, malleable, ubiquitous, evanescent – is modernity's medium' (Isenstadt 2018, 11).

Isenstadt's account of electric lighting can be read as much more than a rich historical description; he argues that the proliferation of, and successive innovations to, a specific technology effectively co-shaped 'modernity.' Electric light's influence extended well beyond its primary technical functions, coming to shape – and be shaped by – the social, economic, and political landscape of the early twentieth century. And, the influence of artificial illumination will arguably continue throughout the twenty-first

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century. Via the wide-scale adoption of LEDs and 'smart' lighting, we are in the midst of a shift from electric to *electronic* lighting (Gandy 2017), which will undoubtedly impact urban nightscapes over the coming decades. Underlying Isenstadt's analysis is, therefore, a normative claim relevant to considerations of urban technological innovation: in acting as the 'mediums' of urban spaces, technologies such as lighting co-shape the fabric in which we live, co-constituting our experiences, perceptions, and behaviours.

Accepting the formative role of urban technologies in our urban lifeworlds, at issue in this paper is the analysis of urban technological innovation. This is a practical question with applicability to urgent problems, but also a conceptual question. On what theoretical grounding are we analysing urban technologies, as constitutive mediums of our urban spaces? And critically, how can we properly appreciate the value-laden nature of technological innovation within the context of urban planning and design? By advancing these theoretical questions, this paper contributes to the refinement and advancement of responsible urban innovation – how technologies can be used to address specifically urban challenges (Nagenborg 2020). This is important to consider for at least two reasons. First is the increasing attention paid to cities and public space from within the philosophy of technology, catalysed by the emergence of the 'smart city' (e.g. Nagenborg et al. 2021). Of particular interest are the ethical issues created by these innovations and associated ideologies. This includes, for example, the evolving role of the public sphere brought about by the notion of the 'experimental city' (Pesch 2021), as well as the myriad of ethical concerns raised by living labs and smart urbanism (e.g. van der Sloot and Lanzing 2021). However, as I will argue below, the ethics of smart cities can benefit from a re-orientation towards the ethics of urban technologies. This reveals the social and technical histories, as well as the contextual specificities, within which urban innovations will be embedded. Second is the growing acknowledgement that cities deserve increased attention from practical philosophy as a whole, as they will be focal points for many of the social and ecological challenges facing the twenty-first century. In this broader sense, this paper can be positioned as a contribution to the burgeoning field of philosophy of the city (e.g. Lehtinen 2020; Meagher, Biehl, and Noll 2020; Simon 2021).

With these broader trends in mind, this paper specifically explores how the theories and practices of value sensitive design (VSD) and design for values (DfV) – as one framework through which to approach to responsible innovation[1] – can be applied to the city; or more precisely, to the analysis of urban technologies. While value-sensitive approaches are often advocated for in literature on responsible innovation, the full potential of VSD and DfV as universally applicable approaches to technology design has yet to be realized. 'It remains an open practical question how (if at all) the theory and method of value sensitive design developed primarily with information technologies will need to be adapted or extended to account for human values in the design process of other non-information technology' (Friedman and Hendry 2019, 21). Yet despite the relative nascency of these methodologies, recent years have seen their exploration and application to a variety of domains (e.g. van den Hoven, Vermaas, and van de Poel 2015). Relevant to the current inquiry, this has included analyses focused on architecture (Schrijver 2015; van den Hoven 2013a), housing (Elsinga et al. 2020), energy controversies (Dignum et al. 2016), and public participation in urban planning (Friedman and Hendry 2019). However, a focused consideration of how VSD and DfV methodologies can be

operationalized for the scale and problems of *urban* technologies has yet to be explicitly undertaken.

As the physical structure of cities, urban technologies inevitably mediate the social, political, and even ecological processes essential to cities and city life. That they are value-laden (purposefully or unreflectively) should be seen as a fundamental component of urban technologies. However, the ontological characteristics of cities also points towards a need to refine *how* we approach the ethics of urban technologies; and, how we identify, analyse, and operationalize values in urban technologies. As has been argued elsewhere, dominant approaches to responsible innovation risk treating values as ready-made; something 'out there' that is immediately knowable and available for deliberation – what Boenink and Kudina (2020) refer to as an 'entity trap.' Instead, Boenink and Kudina advocate for an in-depth hermeneutic approach to identifying values, towards improving the theory and practice of responsible innovation. Further, recent work within philosophy of the city has argued that urban technologies – and especially urban infrastructures – require a modified approach to their moral appraisal (e.g. Epting 2016a, 2016b, 2017; Nagenborg 2020). Urban technologies, such as electric lighting, are complex systems with multifaceted impacts, functional and symbolic dimensions, and a far-reaching temporal resonance. Further, they can affect millions of people over multiple generations in varying ways. This necessitates a refined framework that is responsive to the unique aspects of urban technologies. At a theoretical level, this requires a solid conceptualization of 'values' in urban technologies, and a means to surface and analyse said values.

The goal of this paper is therefore twofold. First, to conceptualize the category of 'urban' technologies, in relation to the characterization of cities as open and evolving systems. Second, to use this categorization to develop an analytical framework for surfacing values in/of urban technologies. For this, six heuristic principles are outlined that serve to elucidate value-level considerations in urban technological innovation. The application of these principles is exemplified via a running case study of urban nighttime lighting. With these principles in hand, we can take first steps towards establishing a *design for values of – and for – the city*.

2. Ethics by design: the promise and challenge of designing for values

Before moving into the domain of urban technologies, it is useful to ground this inquiry by briefly reviewing the basic tenets of VSD and DfV, as well as a key methodological challenge. At least since Langdon Winner's (1980) article 'Do Artifacts Have Politics?' – in which he argued, among other things, that Long Island highway overpasses were designed to enact racist ideologies – ethicists of technology have been pre-occupied with the relationship between technical artefacts and moral values. In addition to ongoing theoretical discourse, this has spurred practical approaches aimed at incorporating moral values into the development and design of technologies. An early – and arguably foundational – approach is the framework and methodology known as *value sensitive design* (VSD). Originating in the information technology domain and developed by Batya Friedman and colleagues in the United States (e.g. Friedman and Kahn 2002), it has since been expanded into a general framework for technological innovation (Friedman and Hendry 2019). VSD typically employs the 'tripartite' method of conceptual,

empirical, and technical investigations, to analyse the values at stake, the needs and desires of stakeholders, and the technical possibilities for achieving the established goals.[2] Aligned with VSD and sharing the overarching goal, but not necessarily adhering to the tripartite methodology, is the broader approach known as *design for values* (DfV). A comprehensive overview of theoretical debates, methodologies, and domains of applications for DfV can be found in the *Handbook of Ethics, Values, and Technological Design* (van den Hoven, Vermaas, and van de Poel 2015).

A variety of methodological approaches have been proposed under the headings of VSD/DfV, with the goal of identifying, analysing, and ultimately operationalizing values in the design process.[3] Most important for the present inquiry are a few core theoretical axioms that unify the approaches, relating to the relationship between values and technology. First is the assumption that technologies – as well as processes of technological innovation – are *not* value-neutral, but that moral values can be expressed or even embedded in technologies. As Winner (1980, 127) argued,

> The things we call 'technologies' are ways of building order in our world. Many technical devices and systems important in everyday life contain possibilities for many different ways of ordering human activity. Consciously or not, deliberately or inadvertently, societies choose structures for technologies that influence how people are going to work, communicate, travel, consume, and so forth over a very long time.

Second, value-sensitive approaches are explicitly forward-looking, in that they aim to proactively incorporate values into artefacts, systems, or services – presumably improving the moral acceptability of innovations by steering them towards desirable end goals. Thus, both VSD and DfV posit that moral values can – and should – be identified and incorporated early in the design process as 'supra-functional' design requirements (van den Hoven 2017). Regardless of the specificities of the chosen methodology, value-sensitive theories therefore assume the possibility of doing 'ethics by design.'

This is undoubtedly an attractive proposition. To align technological innovation with moral values – or more profoundly, to have innovation processes that can anticipate and foster social and environmental goods – is a noble goal. But like any theory, it is not without criticism. As conceptual debates and case studies have developed, critiques have been raised regarding metaphysical foundations, epistemic limitations, and applicability. One perennial critique deserves highlighting, which is significant for the application of VSD and DfV to urban technologies: the problem of how 'values' are conceptualized and defined (e.g. Manders-Huits 2011; Davis and Nathan 2015). The conceptual stage of the VSD tripartite method serves to provide theoretical grounding for empirical and technical investigations, and is thus often generative in that it frames the values at stake in any project (Friedman and Hendry 2019). Likewise, different design methods within DfV – for example the 'values hierarchy' that follows a process of translating abstract moral values into prescriptive norms, and then specific design requirements (van de Poel 2013) – relies on an initial conceptualization of moral value (s). Yet despite the need to conceptualize values, it has been argued that much of the literature avoids questions about the metaphysical foundations of moral value (and practically, which values matter in which circumstances, and why). This can, in turn, lead to downstream issues regarding how supposedly value-sensitive designs are realized. It may compromise the efficacy of the intervention or design proposal, and more

fundamentally the ability to anticipate use contexts – what has been described as the 'positivist problem' (Albrechtslund 2007) or the 'designer fallacy' (Ihde 2008).

It has been suggested by Manders-Huits (2011) and Jacobs and Huldtgren (2018) that a way to overcome this challenge is by explicitly adopting a specific meta-ethical commitment – for example the capability approach – as metaphysical grounding. While I agree that a robust account and justification of the meaning of 'values' is necessary, I take a different approach to resolving (or at least making progress on) this metaphysical critique. Seeking to establish a chosen meta-ethical theory as *the* necessary foundation for VSD and DfV may ultimately just 'pass the buck,' instead requiring a justification of why that theory is the appropriate foundation, leading down a rabbit hole of meta-ethical debates. An alternative way forward is to appreciate that technology and society co-evolve, which will continually change the definition or prioritization of values (van de Poel 2018, 2020). Thus we can adopt an interactional perspective, appreciating that 'human beings acting as individuals, organizations, or societies shape the tools and technologies they design and implement; in turn, those tools and technologies shape human experience and society' (Friedman and Hendry 2019, 29). Such a perspective is pragmatic, in that it eschews a final articulation of moral value in place of a dynamic, context-sensitive perspective. As will be discussed below, such a perspective is particularly useful when locating and analysing the value-ladenness of urban technologies.

3. Technology and the city

The emergence of 'smart city' ideologies and applications, driven by innovations enabled by real-time data collection and monitoring, automation, and AI, have brought renewed attention to the city as a site of technological innovation. This has led to interdisciplinary discourse on the ethics of the smart city, as well as the political ideologies and socioeconomic agendas driving smart urbanism (e.g. Cardullo and Kitchin 2019; Kitchin 2016; Johnson 2020; Sadowski 2020; Sadowski and Bendor 2018; Sadowski and Pasquale 2015; Shelton, Zook, and Wiig 2015; van der Sloot and Lanzing 2021). This body of literature is largely critical, analysing the dangers related to values such as privacy, surveillance, and inclusion; questioning the dominant (neoliberal) ideologies; and, drawing attention to power dynamics created by the increasing presence of corporate actors and interests in the public sphere.

These critiques are undoubtedly important. Yet largely absent from this discourse is an ontological consideration of technology in/of the city, and the underlying framing of city-technology relations in smart city debates. It has been noted that proponents of smart urbanism frame cities as a machine to be optimized (Battencourt 2013), leading to what Sennett (2019) has described as the *prescriptive* smart city – a form of top-down planning that seeks to impose rationalistic control with the goal of efficiency (and as a result reducing transparency and public participation in place of technocratic control). This, in turn, leads to a focus on short-term strategic management (Batty 2013), and an over-emphasis on values such as efficiency. Smart cities are thus focused on optimizing routines and short-term patterns and behaviours, rather than longer-term goals in urban planning and city building (Batty 2013, 2018b).

An alternative framing is to adopt an evolutionary perspective of cities that has been advocated in different lines of planning theory, positioning cities as social and infrastructural networks co-located in space and time; as complex structures that are emergent and

dynamic rather than static (Batty 2018b; Battencourt 2013). Key to this framing is that cities are conceived as open-ended and will necessarily evolve dependant on changing cultural and socioeconomic trajectories, as well as design and policy choices – akin to the interactional theory of technology and society mentioned above. Further, this framing invites a much larger temporal perspective than those driving smart urbanism and associated innovations (Batty 2018a). Along this line of thinking, Kitchin (2016, 11) argues that smart urbanism urgently requires a re-framing of the city:

> Rather than being cast as bounded, knowable and manageable systems that can be steered and controlled in mechanical, linear ways, cities need to be framed as fluid, open, complex, multi-level, contingent and relational systems that are full of culture, politics, competing interests and wicked problems, and often unfold in unpredictable ways.

To see cities as open, complex, and dynamic systems likewise leads to a different framing of the role of technologies within cities. First is an attention to the *mereology* of cities and their technological components, or the relation between parts and whole. Cities are comprised of a multitude of artefacts and systems, creating a complex interaction of micro and macro parts (Epting 2016a). This inherent characteristic of cities, as complex interactions between various actors and systems, makes it difficult to disentangle the holistic notion of a city from its many interwoven (social and technological) components. A second important characteristic is the *temporality* of cities. They persist through time, gradually changing their physical structures, population size (as well as distribution and demographics), social and economic systems, etc. Varzi (2019) proposes that we should think of cities *as* processes – not just metaphorically, but literally. Cities are four-dimensional, unfolding and extending in time and space. Just as a river is defined by its constant flow, a city is in a gradual but constant flux. Parts evolve, change, emerge, or dissipate. Thus, the interaction of city components is both spatial and temporal: cities are built over, and rely upon, a complex entanglement of infrastructures, which in turn embody past ideologies, values, and politics. This is figurative but also literal, in that the underground of cities is a rhizomatic interplay of transit lines, service tunnels, sewers, pipes, cables, and more. A close look at these systems also blurs the distinct boundary of cities, as these underground structures extend outward to water reservoirs, power stations, highways, etc. (Vogel, forthcoming).

What such a perspective reveals is that cities have many facets, and each can be taken as a point of departure for definitions, categorizations, and analysis.[4] They have a physical footprint comprised of buildings, roadways, infrastructures, and public spaces. This responds to – and often contends with – their environmental conditions (e.g. weather, topography, and local ecology). Layered overtop is the sociality of cities: the people, institutions, and politics that constitute city life. A central question is thus the relation between the physical and the social, between the dominance and influence of the built environment or the socio-political factors of city life; between 'building' and 'dwelling' (Sennett 2019). In critiques of the smart city and smart urbanism, the focus is largely on contemporary power structures. Yet this risks overlooking the formative and interactive role of technology in urban lifeworlds, and the role of technological innovation in the open and evolving process of cities. Cities are, and always have been, technological: 'technologies of all scales – artefacts, buildings, systems, and infrastructures – are inexorably intertwined with the very concept of "city"' (Nagenborg et al. 2021, 2). Thus, smart

innovations are not an imposition of technological capital on an otherwise non-technological system known as the city; rather, cities are fundamentally technological. While smart urbanism and other modern initiatives seemingly impose new tools and innovations, they can also be understood as one iteration in a larger process of technological innovations shaping cities and city life (see Shelton, Zook, and Wiig 2015).

Conceptualizing cities as open and evolving, as well as fundamentally technological, re-orients the epistemic and ontological grounding through which we analyse urban technologies. First, it allows us to move away from a dualistic view of the physical and social (Varzi 2019), instead seeing these as inherently entwined within an unfolding process. Equally important, it allows us to step back, and think about *how we think about* cities – not as finite and stable entities, but as evolving, composite processes comprised of distinct but interrelated components. Taken together, we can appreciate the interactions and processes that facilitate the ongoing construction and deconstruction of cities, and re-frame our thinking away from a static notion of 'city,' instead towards ideas of *cityness* (Sassen 2010; Nagenborg 2020).

What, then, constitutes an *urban* technology? Or rather, what is the role of technologies in the complex process of designing, building, maintaining, and destroying cities? Here, I follow Nagenborg (2020) in approaching urban technologies as a hermeneutical, rather than ontological, category. Nagenborg explains that the label of *urban*

> … does not refer to a specific type of technology that shares certain properties. The concept is meant to offer a specific perspective on a technology that considers it as urban technology by (a) claiming an interdependence between the technology and the city and (b) focusing on the interplay between the two. (Nagenborg 2020, 347)

It is not an exclusive category, but one of context. As Nagenborg explains, the elevator can be scrutinized as an urban technology, in the sense that it enables the inhabitation of skyscrapers, and thus the verticality and density of city centres. And as mentioned in the introduction, electric lighting can likewise be analysed as an urban technology, in that it fundamentally shapes the visual and experiential landscape of urban nights. Considered from this perspective, cities are inexorably intertwined with technology. Put otherwise: if a city is a process, then urban technologies are fundamental movers of that process. Developments to urban technologies, be they mundane or profound, gradual or disruptive, thus serve as stimuli to the process of *cityness*.[5] Importantly, this categorization allows us to probe the formative role of different urban technologies, the origins and meanings of associated values, and ultimately how this can inform urban technological innovation.

4. Surfacing values in/of urban technologies

With an ontological framing of cities as open and evolving, as well as a hermeneutical categorization of urban technologies, we can return to the challenge of asking what framework could strengthen the application of VSD and DfV methodologies in this domain. Combining the above insights, here I propose six principles to assist in identifying, defining, and ultimately operationalizing values in urban technological innovation. Important to note at the outset is that these principles are envisioned as a set of heuristics, in the sense of offering general guidelines for analysing and interpreting 'values' via their manifestation within urban technologies, rather than a rigid framework. This provides a

foundation for surfacing the 'mediums' of our cities (to use Isenstadt's term), at least on a descriptive level. With this, we can become better positioned to move towards making normative claims about the desirability of different policy or design interventions.

To concretize the six principles, Section 4.2–4.6 will continually return to a running case study: nighttime lighting. As briefly presented in the introduction, electric lighting can be understood as a paradigmatic urban technology. Further, it carries a rich (and well-documented) social and technical history; it has an enduring and complex interrelation with various values (e.g. safety, sustainability, modernity); and, it is arguably in a phase of innovation and evolution, driven by the introduction of LED outdoor lighting and 'smart' lighting initiatives. Further, it is a technology presently undergoing a moral and political re-evaluation, due to rising concerns over the costs and impacts of light pollution (Stone 2017; Challéat, Lapostolle, and Bénos 2015). Thus, it allows for brief reflections on how the heuristic principles can be applied, in the service of surfacing values in, and of, urban nighttime lighting.

However, two caveats are necessary. First, these principles were formulated via a reflexive analysis into the above methodological critiques of VSD/DfV, the categorization of cities and urban technologies, and ongoing work on a specific urban technology (namely, nighttime lighting – see Stone 2019). As such, they represent a generalized framework drawn from a specific urban technology. Because of this, and because of the heuristic nature of the principles, they are not put forward here as final or complete. Rather, they offer a first step towards identifying values in urban technologies, which can be iterated, revised, or expanded upon – either as a universalized framework, or in relation to other urban technologies (see Section 4.1). Second and relatedly, these principles are explicitly focused on a conceptual analysis into the relationship between moral values and urban technologies. These are therefore not meant to offer a *complete* analysis of urban technologies, nor a comprehensive framework for applying VSD, DfV, or responsible urban innovation. Just as the conceptual stage of VSD's tripartite methodology is one step in an iterative process, the framework articulated here must necessarily be introduced into the specific context of each inquiry. Cities are not homogenous, but have large variations in size, scale, geography and climate, culture, politics, governance, economics and industry, etc. Further, there can be large social and economic discrepancies *within* a particular city. Thus, any analysis should be, to a degree, dependent on the context of the specific city (or region, or neighbourhood). It then becomes a question of balancing the requirements or idiosyncrasies of a particular context and situation with broader frameworks and values (see Epting 2016b, 442). Likewise, addressing the political and socioeconomic concerns raised by the critiques of smart urbanism, as well as an engagement with (in)direct stakeholders, are necessary steps in realizing responsible urban innovations. This analysis does not de-prioritize these issues; rather, it compliments these perspectives and approaches by working to identify and analyse values at stake, towards developing a comprehensive approach to responsible urban innovation. Thus, the below principles offer a means to theorize about the relationship between values, urban technologies, and cities.

4.1. Technology matters

Following the 'empirical turn' in ethics of technology (Kroes and Meijers 2000), VSD and DfV have moved away from analyses of 'Technology,' instead focusing on the specificities of a

particular artefact, system, or otherwise. The analysis of urban technologies should be no different, and likewise move beyond analyses based on abstracted categories such as 'smart.' This is exemplified by the running case study of nighttime lighting in the following sections. Urban lighting is a topic unto itself, with rich and interdisciplinary internal debates regarding the multifarious ramifications of technical, policy, and design innovations. The vignettes in Sections 4.2–4.6 thus explicitly frame the case study, *not* as an investigation into the ethics of smart lighting, but rather as in inquiry into the ethics of urban lighting. Critically, this frames smart streetlights and associated innovations as the latest iteration in a temporally and spatially extended sociotechnical system, rather than as novel impositions onto the city. As will be shown, this can reveal a much more historically and contextually contoured view of the relationship between artificial illumination, urban nightscapes, and moral values.

4.2. Boundary conditions and externalities

Accepting the conceptualization of cities and urban technologies above opens up important foundational questions of scope and scale: to what degree we can analyse (and eventually operationalize) values related to any one urban technology without accounting for external influences. Urban technologies are generally not isolated artefacts, or even an isolated system, but a conglomerate of parts, systems, and infrastructures operating interdependently with (or within) other urban systems. These systems are deeply intertwined, just as individual components intersect. Thus, innovations to one urban technology may affect seemingly disparate social, political, or environmental issues. This means that value-sensitive analyses should examine the complex interactions within this network of urban technologies, and the inter-value dynamics at play therein. By expanding the boundaries of inquiry, we can arrive at a better understanding of the values at stake, as well as how to eventually evaluate the individual components – not as isolated artefacts, but as both shaping and reacting to the process of *cityness*.

Boundary Conditions: Nighttime Lighting

The various studies of the history of urban nights consider nighttime illumination in its totality, as an encompassing infrastructure that shapes perceptions, behaviours, social practices, and politics (e.g. Nye 1990; Schivelbusch 1988; Schlör 1998). 'Urban nighttime lighting' is thus approached as a holistic concept (at the city, regional, or even global level). Yet even as an encompassing sociotechnical system, the boundaries between nighttime lighting and other urban technologies are fluid. Assuming a distinct boundary and discrete delineation between artificial lighting and, for example, transportation infrastructure, risks overlooking intertwined ethical issues. Elsewhere, we have argued that the introduction of autonomous vehicles could be used to reduce light pollution, via an anticipatory technology development strategy aimed at goals such as 'dark highways' (Stone, Santoni de Sio, and Vermaas 2020). In doing so, we connect seemingly disparate ethical and technical discussions, bringing autonomous vehicles into debates about light pollution, as well as inserting values associated with urban lighting as *prima facie* considerations for the development of high-automation vehicles and surrounding infrastructure.

4.3. History matters

In addition to the above spatial considerations, urban technologies have an elongated temporal resonance – decisions made today can last for decades or longer, effecting future generations as well as framing future design and policy choices (Epting 2016b). Further, urban technological innovations are often not entirely 'new' but respond to a complex history of moral and political decisions, reactions to the consequences of past

innovations, and the impacts of evolving behaviours and use patterns. Urban development is a gradual process – when ethical issues emerge, the values, politics, and technologies that precipitated the current situation are crucial to know and understand, before looking forward. This necessitates that value-focused inquiries also look *backwards* at the layered, iterative history of an urban technology, to appreciate the origins and evolution of identified values (see Vogel, forthcoming). Arguments have been made for the importance of historically and contextually situated inquiry within fields such as environmental ethics and aesthetics (e.g. Holland 2011; Maskit 2014; O'Neill, Holland, and Light 2008), and more recently within smart urbanism discourse (e.g. Odendaal 2020; Sadowski and Maalsen 2020; Shelton, Zook, and Wiig 2015). A similar case is made here for the ethics of urban technologies. Knowing the history of an urban technology – both its technical development, as well as the associated cultural forces that shaped its use – is crucial for appreciating the present context.

History Matters: Nighttime Lighting

The modern development of public nighttime lighting can be traced back across multiple technological leaps (i.e. oil lamps, gaslight, and electric light), which occurred over several centuries. While each new technology created significant ruptures in the design and use of nighttime lighting, each was also layered over the existing landscape of values and use patterns. As an example, we can return to the 'smart city' trends currently driving a new generation of streetlights, with lampposts being fitted with sensors, cameras, and a host of other novel technologies aimed at monitoring and data collection. While these innovations may offer improvements in efficiency and data-collection, they raise concerns about privacy, surveillance, and power dynamics. More fundamentally, such smart systems appear to extend the technical functions and ontological boundaries of streetlights. No longer simply providing illumination, they actively monitor their environment and those who inhabit it, creating a vast network of nodes encompassing urban spaces. Combined, the novel functions and capabilities of smart streetlights seemingly create a new terrain of moral concerns.

However, the history of nighttime lighting offers a different perspective: these supposedly novel issues represent a continuity of the values fundamental to the modern foundations of public lighting. Debates over social order at night – and the resultant tension between safety, privacy, and surveillance – have been a recurring theme for centuries (Edensor 2017; Schivelbusch 1988; Schlör 1998). Streetlights have long been utilized as a form of policing and perceived as a symbol of authority, creating ongoing conflicts between control and liberation in urban nightscapes. At least since the French Revolution, streetlights have embodied a tenuous relationship between safety at night, public order, and citizen's rights. In reference to the practice of 'lantern smashing' during the French revolution as a means of revolt, Edensor (2017, 172) notes: 'Ever since, there has been continuous conflict between seekers of dark spaces and those who authoritatively aim to extend surveillance across the nocturnal city.' While perhaps offering significant improvements in accuracy and monitoring, smart streetlights embody a continuity of values – and value tensions – that can be traced back to the origins of public lighting in the seventeenth–eighteenth centuries. Contemporary innovations represent new means of realizing these long-held goals, just as resistance to them offers fresh versions of protest and critique. Placed in this historical context, we can situate smart lighting innovations as layered over, and responding to, a much longer struggle. Omitting this history risks uncritically repeating past debates (and mistakes), ultimately leading to a short-sited understanding of the value tensions inherent to lighting and public order in urban nightscapes.

4.4. Symbolism matters

Closely tied to situating urban technologies within their broader history, it is crucial to appreciate their symbolic dimensions. Technologies that shape, and are shaped by, cities do much more than fulfil their technical requirements. Rather, there is an entwinement of symbolic meanings and functionality, which itself often relies on inherited symbolism. This symbolism goes beyond subjective impressions or placebo effects, but is rather an essential and foundational feature driving the development and use of

urban technologies. Through acknowledging and analysing their historical and cultural importance, the (perceived) meaning of urban technologies can surface. Appreciating these deeply entrenched symbolic dimensions is key to analysing the morality of urban technologies; and importantly, it allows for taken-for-granted values to surface.

Symbolism Matters: Nighttime Lighting

Artificial light at night continues to function as far more than a practical source of illumination. It represents and embodies ideals such as safety and progress, to the degree that it is difficult to disentangle and disassociate the *actual* functions of lighting from its perceived role. The relationship between safety and lighting is complex, and the measurable benefits of increased illumination are contentious at best (e.g. Gaston et al. 2015; Henderson 2010; Marchant 2004). However, it is undeniable that people *feel* safer in brightly lit spaces (e.g. Boomsma and Steg 2012; Haans and de Kort 2012), even if bright spotlights and strong contrast can actually reduce visibility of the surrounding area. Taking note of the principle *History Matters* above, we can also appreciate that throughout the development of modern public lighting, this assumed link between lighting and safety has endured (e.g. Schivelbusch 1988). Further, this is built on much deeper associations between illumination and darkness. 'However efficiently artificial light annihilates the difference between night and day, it never wholly eliminates the primitive suspicion that night people are up to no good' (Alvarez 1996, xii–xiv). The relationship between illumination and safety is often assumed in policy and design choices, even if this does not align with empirical findings.

The symbolism of artificial light also extends to more abstract notions. In *Electric Light*, Isenstadt (2018) explains in great detail how the advent and proliferation of electric illumination was a driver of modernity. Similarly, in *Electrifying America* historian David E. Nye (1990, 35) explains how this technology was utilized to symbolize progress at world's fairs: 'Organizers looked for elements of display at once refined, abstract, expensive, and as modern as possible, and electricity had all of these qualities … Electricity became more than the theme for a major exhibit building; it provided a visible correlative for the ideology of progress.'

A critical analysis of the symbolic meaning of nighttime lighting can reveal that something like 'designing for safety at night' requires a nuanced understanding of how the very notion of 'safety at night' is linked to the perceived meaning of lighting, not just the functional qualities of streetlights. It can likewise reveal, for example, that efforts to reduce light pollution cannot rely on technical fixes alone, but must address the inherited ties between artificial illumination, modernity, and progress.

4.5. Valuableness over values

Striving for practical solutions to complex urban challenges requires a shift in focus from values to questions of what is *valuable* – a balance between abstract articulations of moral values and 'what is important to people in their lives' (Friedman and Hendry 2019, 24). By focusing on what is meaningful about a specific urban technology, we can re-position discourse away from meta-ethical debates about the nature or definition of value, and instead draw out practical, workable ideas. This follows from the interactional theory of technologies and values supported in Section 2, as well as the categorization of urban technologies articulated in Section 3. Further, it closely aligns with the practical end goals of VSD and DfV. Importantly, this leads to a prioritization of *things we find valuable* for a specific time and place, rather than a focus on philosophical values themselves. However, I am not advocating for the abandonment of the word 'values' in discourse, or of value-sensitive approaches as a theoretical and methodological starting point. Rather, for re-orienting inquiries to focus on those things we find valuable, rather than striving to arrive at a final, defendable definition of certain values (or the philosophical nature of value).

Valuableness Over Values: Nighttime Lighting

In recent years a novel moral issue has surfaced regarding nighttime lighting: light pollution. Put simply, this is an umbrella term used to identify and categorize the adverse impacts of excess or poorly designed artificial light at night. This is often sub-categorized into economic costs, energy waste, ecological damages, health effects, and the disappearance of the starry night sky. A great deal of research is underway to quantify these negative impacts (e.g. Davies and Smyth 2018; Falchi et al. 2016; Gaston et al. 2015), and a recent body of literature has emerged examining the ethics and politics of light pollution.[6] All of these studies share a common problem frame: that some aspects or uses of artificial illumination are bad, and we should focus on reducing or mitigating these negative effects.

While useful efforts, an alternative approach is to adopt a refined DfV perspective, highlighting those valuable features of contemporary nightscapes that require preserving and fostering. For this, I have proposed elsewhere that *darkness* should be understood as valuable for contemporary urban nightscapes, and as something through which claims to value both emerge and are fostered or hindered (Stone 2018, 2019, 2021). Instead of diving into meta-ethical debates regarding environmental values, we can position darkness as something by which, or through which, values can be fostered or promoted. This does not require a defence of darkness *as* a final or intrinsic value – it simply acknowledges that in our world of abundant artificial illumination, re-introducing darkness into our cities and lived experiences would be valuable. When put into dialogue with the context, history, and symbolism of nighttime lighting, a focus on darkness can allow for creative – and importantly value-sensitive – design innovations to emerge.

4.6. Abandon completeness

A final, summative principle is the abandonment of (conceptual) completeness as a goal. The temporal and spatial longevity of cities and urban technologies means that relevant values – and what urban dwellers find valuable – will necessarily evolve. Some may endure, but many will evolve, others will fade, and new values may emerge. This requires an abandonment of the goal of achieving a final, definite understanding of the values under investigation. Instead, it acknowledges that the topic under study is emergent and open to change (e.g. van de Poel 2018). Thus, we must appreciate that analyses of urban technologies must themselves be iterative and conceived as an open-ended process, like cities themselves. To put it more poetically: Winston Churchill's oft-cited and paraphrased quote 'we shape our buildings, thereafter they shape us' is incomplete. Rather, first we shape our buildings, thereafter they shape us, *then* we shape our buildings again, *then* they shape us again, and so on.

Appreciating the dynamic relationship between cities and urban technologies provides an overarching framing, but also a starting point for value-focused analyses. A first step is exploring the emergence and foundations of the value(s) at stake, before moving to a systematic application. This requires combining open and explorative inquiries into the topic at hand with testing findings via their practical applicability. The back-and-forth deliberative and iterative exercise between conceptual debates and practical interventions allows for the topic of concern to take shape, and ideally for a useful framing of the problem at hand. It will not be perfect, but perfection is an unrealistic goal – consider the VSD motto of 'progress, not perfection' (Friedman and Hendry 2019). In sum, this leads towards a pragmatic approach to the ethics of urban technologies, for which 'The aim … is not perfect rightness, then, since there is no absolute standard for reference, but rather creative mediation of conflicting claims to value, aimed at making life on the planet relatively better than it is' (Parker 1996, 27).

Abandon Completeness: Nighttime Lighting

In the early days of electric lighting, an argument to 'design for darkness' as a means to reduce 'light pollution' would have been – at best – a fringe concern. And, it will hopefully be different 50 years from now. Any success brought about by re-introducing darkness into cities, as well as light pollution mitigation, will change the relative meaning, importance, and priority of values for the future of urban nighttime lighting. This is not a problem for the focus on darkness discussed in Section 4.5, but rather an approach that abandons any desire for a definite or complete framework. Light pollution, and the re-introduction of darkness in urban settings, are not issues that can be 'solved' with complete finality. Darkness and illumination are competing interests, but also complimentary. There will – and should be – a continuous striving towards an acceptable balance, which is itself a moving target.

5. Conclusion: towards responsible urban innovation

This paper develops an analytic framework, in the form of six heuristic principles, which can be utilized to surface values in urban technologies. The principles build upon an ontological conception of cities as open, evolving and dynamic systems, and a categorization of 'urban technologies' as those technologies that influence and co-shape cities and city life. Taken together, the framework sketched in this paper offers a means to apply VSD and DfV methodologies to the domain of urban technologies, and thus cities. Principles 1–4 (technological specificity, boundary conditions, historical context, and symbolic meaning) articulate criteria and perspectives to be utilized as a method of inquiry. They ask researchers to carefully examine the urban technology in question, towards arriving at nuanced understanding of the origins, meaning, and interpretation of specific values. Principles 5–6 (valuableness over values, abandoning completeness) are overarching considerations, articulating an orientation that acknowledges the complexity of cities, appreciates technology-value interactions, and cautions for some epistemic humility. As such, they are meant to highlight the limitations of our foresight, and offer a modest framing of the ultimate goals of value-based inquiries into urban technologies. Given as a running example, the brief analyses of urban nighttime lighting reveal a complex value-landscape that value-sensitive approaches must confront to make useful contributions lighting policy and design. Apparently straightforward notions such as 'safety at night' are shown to be nuanced and layered concepts, which in turn rely on past decisions and historical associations. It further shows that underlying values, such as modernity and public order, continue to influence the uses and perceptions of cities at night. And, it reveals how innovations outside the traditional boundaries of nighttime lighting, such as autonomous vehicles, may influence lighting-related issues.

As argued in relation to both responsible innovation generally (e.g. Boenink and Kudina 2020) and VSD/DfV specifically (e.g. Manders-Huits 2011; van de Poel 2018), continued work is needed to identify and conceptualize values and their relation to technologies (and technological innovation). Responsible innovation will benefit from continued work on processes and frameworks for value identification, and responsible *urban* innovation is no different. In developing an account of values in urban technologies, and a set of principles aimed at their identification, this paper offers a refined to approach to designing for values in – and for – the city. Further, as the principles are aimed at elucidating substantive values in urban technologies, they can compliment the political critiques of smart urbanism, as well as the procedural and participatory approaches to urban innovation found in urban theory (e.g. Williams 2020).

The six principles offer a starting point for the analysis of urban technologies, towards realizing value-sensitive urban technological innovation. Thus, while contributing to the development of VSD and DfV as universalized approaches to technology design, they should also be seen as a contribution to the critical and creative re-imagining of our urban futures. At the core of this analysis is a call to think about how we think about urban technologies. Responsible urban innovation can be utilized as a tool to assist in the process of city-building – in envisioning and enacting the types of cities we want. But, it should be done with the acknowledgment that no innovation will be perfect or complete. However, they will ideally move our ever-evolving cities in directions aligned with the values we strive to foster and preserve.

Notes

1. As a general categorization, here I situate VSD and DfV as frameworks for design and innovation that align with what von Schomberg (2013, 65) describes as the '*product* dimension' of responsible innovation – evaluating and designing products via 'normative anchor points' (see also Koops 2015). Elsewhere this is referred to as a 'substantive' approach to responsible innovation, which emphasizes outcomes over processes (e.g., Boenink and Kudina 2020), in contrast to procedural approaches such as the framework of Stilgoe, Owen, and Macnaghten (2013). For an expanded discussion on the utilization of value-sensitive design methods as an approach to responsible innovation, see also van den Hoven (2013b).
2. See Winkler and Spiekermann (2018) for a review of the tripartite methodology in practice.
3. For an overview of methodologies, cases, and critiques of VSD/DfV, see for example the *Handbook of Ethics, Values, and Technological Design*, edited by van den Hoven, Vermaas, and van de Poel (2015), as well as Friedman and Hendry's *Value Sensitive Design* (2019). However, while these books focus specifically on the methodological approaches and challenges of VSD and DfV, they are certainly not the only 'value-sensitive' methodology or framework associated with responsible innovation. As mentioned in the introduction, this paper aligns with the substantive approach to responsible innovation typically associated with von Schomberg (2013). However, the procedural framework of Stilgoe, Owen, and Macnaghten (2013) also emphasizes the importance of aligning innovation with societal values – although the specificity of values in this framework has been criticized (see Boenink and Kudina 2020). For an overview of the conceptual frameworks and drivers of responsible innovation, see for example Burget, Bardone, and Pedaste (2017) and Koops (2015).
4. Exactly *what* constitutes a city is a complex question that has been considered from many angles by various philosophers and theorists, illuminating different aspects of urbanism and city life (see Meagher 2008). Indeed, the meaning of 'city' varies by discipline and topic of interest, and it is debatable if such a unified theory is possible or necessary (Noll, Biehl, and Meagher 2020).
5. This definition leaves open the critique that all and any technology can therefore be considered an 'urban' technology. However, I do not see this as a weakness, but rather a consequence of the ambiguous borders and boundaries of cities. Positioning an artefact as an urban technology simply requires that we take a context-sensitive perspective and framing, and ask to what degree this technology has affected urban form, urban design, city maintenance, or the socio-political aspects of city life.
6. See for example: Stone (2017), Bogard (2013), Meier et al. (2014).

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