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ABSTRACT This article studies local enactments of "smart" in and through visions of six smart district development projects. We show that smart cities' framings of the future are inevitably diverse, emerging from local assemblages consisting of a wide array of heterogeneous elements that translate global imaginaries of the smart city to meet local specificities, needs and agendas. We demonstrate that visions may describe the process of district planning and design, the materiality of the envisioned district and the governance of the district; and that smart visions may play three distinct roles – they may act as mobilizers, instrumentally (i.e. as tools to achieve specific sociotechnical goals) and to exclude alternatives. Knowledge forms a key constituent of smart visions, and acts to include some while excluding others. We therefore suggest that further research should focus on the political and controversial construction and use of knowledge in visioning processes.

Introduction

With "smart" emerging as the latest in a historical stream of city visions, many cities are pursuing smartness to address a plethora of urban problems.[1] Hitherto, the wide variety of understandings of what makes a city smart has typically been presented as a weakness of the smart city agenda.[2] At the same time, the signifier "smart" often remains malleable and undetermined, leaving ample space to accommodate different interpretations of and interests in smartness.[3] As a result, the "smartening-up" of cities is diverse, and smart as a malleable concept can be populated by different actors to work toward different ends and benefit specific stakeholders while excluding others.

In this article, we do not pose the question of what defines a smart city, nor do we examine whether the wide variety of existing understandings of what makes a city smart is a strength or weakness of the smart city agenda. Instead, we argue for building an increased awareness of how such meanings are invoked and play out in specific localities. Previous exploratory empirical work on individual smart city cases[4] demonstrates that local enactments of smart are highly diverse. They stress the importance of attending to smart cities' multiple framings of the future in practice, a topic which has so far received little consideration.[5]

In response, this article aims to make sense of the varied emergence and functioning of smartness set out in and constituted through visions based on six case studies of European district development projects. More specifically, we explore these projects by asking what aspects of district development are described in their smart visions, and what roles these smart visions play. District development projects, as opposed to smart cities, have relatively clear boundaries and organizational structures. They therefore provide well-traceable case studies to grasp how smart plays out in a multiplicity of urban domains in a coherent project. To study the varied emergence and functioning of smart visions in the city, engagement with different domains is important as cities pursue smartness to address a wide diversity of urban problems.

Our relatively large number of case studies allows us to explore a wide variety of smart visions, but also means that our engagement with each individual case study will be succinct. At the same time, we delimit our analysis by focusing on the content and roles played by visions only. We do not take into account the multiplying diversity that may emerge from the resulting smart districts, when people start living in and making sense of these smart districts.[6]

This article starts by outlining our conceptual approach, which primarily draws on science and technology studies' literatures on visions, expectations and knowledge politics – the latter is invoked because of the central role knowledge plays across all smart visions explored in this article. Based on our analysis, we argue that smart visions can describe: the processes of realizing the district through planning and design

strategies; the materiality of the envisioned district; and the governance of the district. Next, we discern three different roles these smart visions may play in smart district development: they may act as mobilizers; instrumentally, as tools to achieve specific sociotechnical goals; and to exclude alternatives. These inductive findings on the content and roles of visions are by no means exhaustive, but emerge from our comparative analysis and are a preliminary means to come to grips with the diversity of smart city visions.

Conceptual Foundations

Shared visions are often considered a necessary prerequisite to proactively enable and guide any form of development and change.[7] Therefore, exploring and understanding the content and roles of (smart) visions in (smart) district development projects constitutes an important research avenue. To do so, we draw on science and technology studies' literature on visions and on the related sociology of expectations literature to understand what visions are and how they emerge.

Visions commonly refer to "desirable states in the future,"[8] and they are often the result of visioning approaches such as scenario workshops, designed to consider a range of future possibilities and to articulate shared expectations among stakeholders.[9] This implies that a successful vision promotes consensus, which in turn is a prerequisite for vision implementation and commitments made by the diverse stakeholders involved.[10] The ability of a vision to promote consensus partly arises from their interpretive flexibility: they can be interpreted differently by different actors.[11] Their ability to promote consensus also highlights that visions have the capability to act: they are performative. This means that they take an active part in the process of realizing their envisioned outcomes for development projects, given that they are shared among different actor groups involved in such projects.[12] This capability is influenced by, but not under the full control of, actors putting forward or deploying the vision(s) of concern.[13]

To understand the emergence of these performative visions, we start by exploring the role of allegedly universal imaginaries in co-shaping visions. In the urban context, important imaginaries include, for example, the smart city, the eco-city and the friendly city.[14] We approach these urban imaginaries as "floating signifiers": signifiers resulting from instability introduced by a plurality of global and local discourses.[15]

This implies that visions emerge from a local–global interplay. Specifically, local assemblages reconfigure globally present understandings of a smart city to meet local specificities, needs and agendas.[16] We use the term assemblages to highlight that local circumstances consist of a wide array of entangled (cooperating, competing and shifting) heterogeneous, human and non-human elements.[17] This enables us to take into account not only the role of local human actors and their ideologies, motivations and strategies, but also a

wide array of other elements that are highly relevant in the specific case of "smart" as a floating signifier.[18] These, amongst others, include the material specificities of space, place and the digital technologies proposed for usage; sociomaterial historical legacies; and institutional embedding. The entanglement of these heterogeneous elements – assemblages – and the smart visions emerging from them constantly change over time and place.[19]

Largely lacking in literature on visions and expectations is an understanding of the role of knowledge, both as an element of the local assemblages from which visions emerge and as a key constituent of these visions. Yet smart visions are often underpinned by (various forms of calculative rationales based on the production of) novel, more, better, real-time and/or aggregated knowledge.[20] However, knowledge is not a neutral entity: the construction of knowledge inevitably requires making disputable choices and is an open-ended process.[21] Next, knowledge itself is an active participant as it may suggest or facilitate specific courses of action while silencing others through the very way in which it understands and presents the reality it claims to refer to.[22]

This article draws on the insights presented. We study the diversity and dynamics of smart district visions as they emerge from interplays between local heterogeneous assemblages and global discursive understandings of smart. Next, literature on the performativity of visions directs our gaze toward the different roles these smart district visions play. Finally, we pay careful attention to the role(s) played by knowledge in envisioning smart districts, both as an element of local assemblages and as a key constituent of visions.

Methodological Approach

In line with this article's outlined conceptual agenda, we draw on fieldwork in six different and emblematic smart district projects in Europe: Schleusengraben in Hamburg-Bergedorf, Schöneweide and TXL Urban Tech Republic in Berlin, Merwedekanaalzone in Utrecht, Brainport Smart District in Helmond and Leeds Climate Innovation District (CID). We selected these cases to maximize diversity on key characteristics that do not intrinsically entangle with our empirical focus on visioning processes but which do facilitate the study of "smart" in its broadest definition and enactment: stage of development; greenfield or brownfield; initiator; source of funding; urban domains addressed; and residential or business areas.

Fieldwork consisted of an analysis of websites, newspaper articles and (policy, planning, consultancy, etc.) documents published about these projects, combined with interviews with key stakeholders and semi-ethnographic observations during project meetings (internal planning meetings, co-creation sessions with publics, etc.). This yielded a rich dataset that supports our article's interest in understanding the

diverse emergence, development and performativity of smart district visions.

In line with the exploratory nature of this article, data analysis was done inductively. Based on our literature review, we first distinguished between the content and agency of smart district visions. We then identified three salient aspects of smart urbanism described in these visions, and three different ways in which these smart visions were performative across our six case studies. While all six case studies were analyzed in depth in this way, we cannot present each case's full analysis in this article for reasons of space. Instead, we substantiate our findings with empirical examples from all cases, selecting the most relevant or illustrative example for each analytical point.

Exploring Smart Visions' Content: Visions on …

At first glance, highly diverse visions emerge from the six smart district development projects. Key agents in Schöneweide (Berlin) foster collaboration between different actor groups to create a laboratory and showcase area for the creative and technology sectors, while the CID (Leeds) focuses on the disruption of current (unsustainable) practices in the UK housing industry. Brainport Smart District (Helmond) and Schleusengraben (Hamburg) envision a neighborhood with a plethora of desirable characteristics, including social and environmental sustainability, inclusiveness and circular economic systems. Merwedekanaalzone (Utrecht) and TXL Urban Tech Republic (Berlin) both aim to encourage business and innovation along with an environmentally sustainable neighborhood for living. In this section, we show that deeper analysis brings to the fore how these visions describe different aspects of the envisioned district: planning and design; the districts' materiality; and district governance. Distinguishing between these three aspects is a first step toward grasping and navigating across the diversity of smart visions.

… processes of planning and design

"Smart" features prominently in visions for processes of planning and designing smart districts. According to the developers of the Merwedekanaalzone project, knowledge emerging from experimentation with smart technologies designed for stakeholder interaction is envisioned to be key in designing the planning processes of the district. Concretely, "Slim City" was set up by the municipality as a design-based experiment in Merwedekanaalzone to explore how technology can contribute toward more participatory urban development in the area and elsewhere.[23] In Schöneweide, regional authorities foreground the vision of redeveloping the area through collaboration between different actor groups. For example, in the field of energy, a local marketing brochure quotes "this means that property owners should be motivated to think beyond their own property when making investments in energy supply."[24] This vision, however, ignores ongoing internal contestation: for example,

residential developments and local industries have contrasting interests when it comes to needs and options for a smart energy system, making collaboration difficult, particularly in the absence of a shared strategy that facilitates agreement of overarching interests.

One of the ways in which the UK's largest zero-carbon housing development project, the CID project in Leeds, characterizes its visions as smart is through its use of real-time building information management (BIM). Internationally, BIM is considered a necessity in modern construction projects.[25] The software is marketed as a digital project management tool designed to streamline and increase the efficiency of building design and construction processes. By integrating values, standards, timelines and plans used throughout the building lifecycle by different practitioners into a single model, use of BIM is intended to radically overhaul the risk-averse construction industry. The expectation is that such digital tools will enable smarter (i.e. more technically advanced) and more sustainable (i.e. more coordinated and less wasteful) district (re)developments and cities.[26] This digitally-enabled construction vision is gaining traction in the context of the UK's significant targets for increased newbuild housing provision[27] and the recognition that "UK homes are currently unfit for the challenges of climate change."[28]

In the context of the Leeds CID, BIM facilitates project management by coordinating and verifying the district's standardized carbon-neutral technical design (to ensure newbuild properties meet developers' carbon-zero home standard), the semi-automated prefabrication of timber-framed thermally insulated and air-tight wall panels, and the parallel (as opposed to phased) construction and "kitting out" processes by squads of multiskilled practitioners. Experiences encountered at this medium-sized innovative project highlighted how, whilst the common model, shared simulations and agreed schedules contributed to obtaining high thermal performance, compliance with BIM alone was not sufficient. Rather, relationships developed between the office, factory and construction site, the expertise of practitioners and vertical integration of the supply chain were crucial in adjusting to challenges not envisioned by the software and in ensuring building energy performance and quality. Furthermore, the need for creativity, flexibility and reflexivity meant that, for the CID, only certain key BIM functions were of value. This raises the question of whose knowledges, skills and expertise disappear from view in the production of a development envisioned through the BIM system; and, given that this software is most useful for developers and construction firms building standardized properties at scale, how it might constrain more innovative visions.

… the materiality of the district

In our six case studies, smart visions also describe the material (physical, technological) characteristics of the actual neighborhood that is to be (re)created. For example, in the German Schleusengraben area, Dutch

architecture firm Mecanoo developed a masterplan for the area in 2010, envisioning the creation of a neighborhood with physical infrastructure that is flexible, is sustainable and stimulates encounters. The smart dimension was added later, when the mySMARTlife project was developed in 2015 for the area in the context of bidding for funding within the H2020 Smart Cities and Communities program. This sequence of rather independent visioning exercises for a single district development highlights the moldable and fluid character of visioning processes. Such processes obviously respond to changing local–global interactions and in this case were instrumentally adapted to support Hamburg's claim for "Smart City Lighthouse" status: adapting Mecanoo's 2010 vision for the area to the discourse and demands of the European H2020 program, the mySMARTlife project claims to equip buildings and infrastructures with innovative smart technologies. For example, homes are envisioned to digitally track energy consumption, allowing for optimal control and resource efficiency – values which are very different from and may even compete with the initial Mecanoo vision focused on flexibility and stimulating encounters. As such, the incorporation of smart has moved ambitions from the original 2010 Mecanoo masterplan to the background, in particular that Schleusengraben should "enable interested parties to create spaces for themselves, within the boundaries of the urban masterplan and that they can develop further in accordance with their own wishes."[29] Instead, a more accurate, real-time understanding of energy consumption is argued to allow for more efficient management of energy use and thereby legitimizes the vision of using smart technologies to collect such information while silencing alternatives that are low-tech or geared toward values such as privacy and sovereignty. In this light, the visioning process of Schleusengraben becomes a tale of visions changing and dismantling, of winners, losers and survivors.

Brainport Smart District aims to infuse smart in every aspect of life in the neighborhood: "[Brainport Smart District] is a place to experiment, together, on every aspect: from buildings, energy and mobility to safety and health."[30] The project was initially conceived when Eindhoven University of Technology (TU/e) was looking to create a testbed for its innovations. Throughout project documentation, public presentations and interviews with project coordinators during the project's initial planning stage, smart always referred to a neighborhood's ability to contribute to a better quality of life through the use of smart technology. It was intended that experimentation with new technologies would enable them to embed smart within every aspect of day-to-day life situations occurring in the district, with a view to generating knowledge and enabling their development simultaneously. The project's visions changed notably when overall leadership shifted to the district's local government, which stress the creation of an attractive neighborhood built in such a way that it would enable greater citizen participation. The neighborhood's revised vision was to be socially inclusive, safe, healthy,

circular and sustainable, and to incorporate use of digital technologies to achieve these goals.[31] These shifted yet still vaguely defined visions hide potential contradictions, such as the high cost of smart technologies versus community inclusion; and smart technology's increased demand on electricity and other resources versus sustainability visions. Indeed, anticipated social goals such as inclusivity, safety and sense of community may not need or benefit from technological interventions.

… the governance of the district

Lastly, we distinguish visions on the (smart) governance of smart districts. For example, when the CID is completed, a Community Interest Company will be established, and every household will become a member. This company will own the land, infrastructure and renewable energy systems within the development and collectively residents will arrange to pay for or profit from the energy management of the site.

During public project meetings, the idea that residents join an association to manage the data produced by all smart technologies embedded in the development also featured as a central element of Brainport Smart District. Through this association, residents will collectively decide who can access the neighborhood's data, and under what conditions. Key features of this set-up is that these data will be anonymized, that every resident owns his/her own data and receives benefits from sharing these data, and that residents can always opt out from selling their data. According to the project's protagonists, this adequately addresses concerns of privacy and sovereignty. At the same time, they express responsibility in ensuring that residents feel comfortable to share their data.[32] However, whether this will be the case remains to be seen: this vision hides from view the frictions that may emerge when residents who decide not sell or share their data with third parties turn out to be (severely) limited in their ability to participate in the neighborhood's collective life. Additionally, with regard to knowledge politics, our observations during Brainport's planning co-creation sessions show the theme of data to be widely perceived as a "difficult" topic by potential inhabitants, who feel they understand very little about the consequences of owning, sharing and/or selling their data.

Exploring Smart Visions' Agency: Smart Visions Acting …

Smart visions are not only descriptive, they are also – and crucially – performative. From our six case studies, three different ways in which smart visions can be performative emerged: they acted as mobilizers; instrumentally, as tools to achieve specific sociotechnical goals; and to exclude alternatives. In this section, we elaborate on each of these distinct ways in which smart visions may be performative.

… as mobilizers

Smart visions play a key role in processes of mobilizing actors, and gaining institutional support and funding. This observation has been made repeatedly with regard to visions more generally, not only for visions on smart urbanism.[33] In our case studies, Schöneweide deploys smart as a vision capable of bringing diverse actors with different interests together, garnering enthusiasm amongst these actors to co-create an agreed development plan. In Schleusengraben, a smart vision was only added – like a layer – to existing visions for the area to access H2020 funding earmarked for smart city developments. In TXL Tech Republic, the smart agenda is formulated to appear like a continuation of Berlin's given agenda to transform industrial brownfields into business and technology parks, but emerged only after the project was conceived. Indeed, it is striking that the term smart is largely absent from documents on the early (2008–2010) planning process. The later addition of smart elements and language tied well with the original project's narrative of transforming an airport into a sustainable district with a model residential area and an innovation campus, and attracted stakeholder support. Not least, Tegel was defined as a Lighthouse location in Berlin's overall smart agenda for targeting European Union funding.

These brief examples also show that smart visions do not function independently but work together with other visions. This is particularly visible in the case of Brainport Smart District, where smart ideals interact with notions of best practice learning and situated experimentation, inclusion and responsible innovation with the intention of attracting (financial) support. For example, TU/e scientists advocate best practice learning and situated experimentation with novel smart technologies, but also – in the name of responsible innovation – to set right whatever may go wrong during experiments.[34]. At the same time, the different visions that can be discerned in this argument are rather vague and ambitious. This supports our position that, through these visions, a diverse set of actors with varying interests can be mobilized, each capable of "filling up" vague visions with their own interpretations.[35]

Interestingly, the vision of being a model city or site for learning as a key aspect of being smart is enacted as an attractive mobilizer for district and city administration in the case of Schleusengraben (turning the supposedly exemplary district planning process into an asset for the "Lighthouse Smart City" competition). In contrast, the responsible civil servant and an elderman of the municipality of Helmond both expressed in interviews how they are not keen on framing Brainport Smart District as a site for experimentation and learning, for fear of compromising day-to-day quality of life.[36] This view is much less visible in much project documentation, which is the result of a balancing act between: the interests of TU/e researchers who initiated the project, those of the municipality and pressures to perform in local elections, the need to

attract support from local present and future residents, and that of attracting funding from local, national and international bodies. This observation underlines how the capacity of smart visions to act as mobilizer is constituted through complex interactions between local assemblages and an array of global understandings of smart as a floating signifier. Whilst local authorities are leading actors in each of these smart district projects, local assemblages (of social and material histories, other involved actor groups, technologies intended to be deployed, etc.) within which each of these actors act as well as the global smart narratives with which these projects interact thus differ considerably; as well as the ways in which these local assemblages interact with global smart narratives. Together, this results in different smart visions being formed through and reinforcing varying "contents" in order to mobilize support and funding (see "Exploring Smart Visions' Content" section).

It is important to realize that mobilization is not always successful, and may also act to exclude alternatives ("Smart Visions Acting … to exclude alternatives" section). For example, in Merwedekanaalzone, visions characterizing the district's future inhabitants does not match with the current position of the district in the city (geographically as well as socially) and are controversial for inhabitants living in the neighboring area. This resulted in a failure to enthuse local residents when the project developed from an abstract visioning stage toward material actualization. In visions of the future Merwedekanaalzone, smart is presented as a sine qua non to accommodate the city's (Utrecht) growing number of inhabitants. Smart technologies – in particular those related to smart mobility – are perceived as the necessary means to reach the ambitious goal of constructing 10,000 newly built houses in the area. As developments in the Merwede unfold, broader sets of actors question the municipality's "obsession"[37] with reaching this ambitious goal to the extent that residents from the adjacent district formed a local collective "Stop Manhattan aan de Merwede" (Stop Manhattan at the Merwede).[38] Whilst the municipality is searching for policies that enable realization of the envisioned densely built neighborhood, for example by lowering the parking standard to 0.30 parking spaces per house,[39] the action group highlights the negative effects of such plans for the larger area (e.g. impact on diversity) and is skeptical about the district's capacity to change embedded mobility routines.

… instrumentally, as tools to achieve specific sociotechnical goals

In addition to mobilizing support and funding, smart visions also act instrumentally, to achieve other (not necessarily smart) goals such as economic development, inclusion or environmental sustainability. Indeed, those goals, in turn, also serve to legitimize a smart vision. The production, exchange and application of knowledge plays a central role in enabling smart visions' ability to act instrumentally, or as tools to achieve

other goals. Examples include how new forms of knowledge are generated about the urban through real-time ubiquitous monitoring (Brainport Smart District; Schleusengraben), smart participatory planning generating knowledge about stakeholders' potential preferences for and contributions to the area (Merwedekanaalzone; Schöneweide) and the use of interactive platforms to integrate diverse practitioner knowledge concerning the expected material impacts of different kinds of design approaches and planning choices (CID). In Brainport Smart District, visions for smart co-creation allow leading actors to emphasize their own lack of knowledge about the future. This has the rhetorical effect of leveling out perceived asymmetries between the organizers and future residents during co-creation sessions, seemingly distributing responsibility for the future equally between actors while also obscuring that taking final decisions is beyond the control of potential future residents attending these sessions.[40]

Some of these instrumental visions are potentially disruptive, while others may optimize and reinforce existing systems and practices. Potentially disruptive instrumental smart visions could include the CID's BIM platform, because it may offer a route to improve the risk-averse UK construction industry's control over building quality by demonstrating a standardized approach for building a (profitable) carbon-zero district at scale. Plans to adopt smart mobility solutions to facilitate high-density inner-city construction in Merwedekanaalzone reinforce idealized visions on inner-city living and may have negative effects on nearby neighborhoods if smart traffic systems fail to radically alter mobility practices (e.g. if residents park outside the district due to limited parking availability in Merwedekanaalzone itself). In Schleusengraben, smart technology aims to contribute to more effective use of energy and resources, in an attempt to improve existing infrastructural systems and make them more cost-effective to operate.

… to exclude alternatives

We have demonstrated how smart as a floating signifier can be stretched in many directions. Such all-encompassing smart visions can function as an obligatory passage point in the project, which means that alternative visions (and the actors putting forward such alternative visions) may be excluded from view. It is difficult to imagine, mobilize and empower countervisions in the context of a broad, all-encompassing smart vision and this can prevent alternative logics and perspectives from entering the political discursive arena. As such, this performativity of smart visions acts to exclude rather than being inclusive to innovative ideas.

This is most visible in Brainport Smart District, which first came into being as part of the dream of project initiator and TU/e built environment professor E. Nelissen to create a neighborhood that would benefit from innovative, smart technologies infused in every aspect life.[41] Similar to visions acting instrumentally, all-encompassing "all singing, all

dancing" smart visions that promise to enable multiple aims may disrupt existing systems, but can equally be about stabilization, reinforcement or optimization of prevailing systems. Brainport Smart District aims to make a clear break with the existing mobility system in the name of sustainability by disembedding from personalized motorized mobility completely, but its parallel focus on ensuring "comfortable living" may also strengthen increasing reliance on individual preferences and energy-consuming devices.[42] Countervisions that take sustainability, rather than all-encompassing smart solutions, as their starting point would contain different understandings of what these would constitute and prioritize different routes to enable a desirable future for the neighborhood. Such "sustainability-driven" countervisions would open up the contradictions inherent to the current Brainport Smart District's vision, but have difficulty entering this discursive arena: since sustainability is encompassed by the wider term smart, there is no need or space for a vision that takes sustainability as its starting point.

The same holds for visions that would prioritize data privacy and technological sovereignty as their starting point, an issue discussed earlier in this article in relation to Brainport Smart District. A vision commencing with ideals for privacy and sovereignty would most likely not be based on sharing data by default and having an "opt-out option" for concerned local inhabitants. Instead, data sharing would be carefully considered each time the option arises. A final striking example of smart visions acting to exclude alternatives is the following discussion held during a co-creation session with potential future inhabitants at Brainport Smart District. When a participant expressed a desire for a peaceful retirement in the new neighborhood instead of "smart," the session hosts responded with the assertion that "smart" need not be opposed to peace, reaffirming the conception of "smart" held by the organization – which ended the entire discussion on what this meant for the district's design.[43]

Alternatively, in Schöneweide, district authorities push "smart" as an integrating vision, with the aim to bring together different actor groups including a local university, industries, land-owners, real-estate developers and energy providers, but also artists and residents. This attempt was part of Berlin's "Future Places initiative" that sought to define places for future economic development. Workshops were planned and organized to involve key stakeholders from the area. While the branding of Schöneweide as a Future Place was successful as a means of external marketing, the internal dynamics around a smart vision could not tackle conflicts that already existed in the neighborhood. As a local artist expressed in an interview, "in Schöneweide we are still very much fighting with analogous arms" (translation by the authors), showing that the notion of "smart" as a means for integration could not withstand existing conflicts in the neighborhood between, for example, the industry and residential developers on potential emissions; and artist/residents versus

residential developers on the issue of gentrification. As a result, the original idea to use smart projects, such as the smart energy grid project, as both a mobilizing vision and an instrument to bring diverse actors together to manage the area's growth and development actually resulted in exclusion of perspectives and deepened political contestation.

Conclusion and Discussion

In the context of diverse meanings being attributed to the floating signifier smart – as the latest in a historical stream of city visions – this article has aimed to make sense of the varied emergence and functioning of smartness set out in and constituted through visions based on six case studies of European district development projects. We examined the nature and role of visions, because they are important in enabling and guiding processes of development and change. District development projects constituted an interesting, well-delineated and well-analyzable unit of analysis when compared to entire cities, while at the same time they address – like smart city programs – multiple domains of life simultaneously. Our focus on smart enhances research on visions: whilst this literature is extensive, there has to date been little insight provided into the specific content and agency of smart visions.

Not taking a universal notion of smart for granted, but instead exploring the diverse enactments of smart in and through visions of district development, has demonstrated how smart visions constitute more than the use of digital technologies according to the calculative logic that urban challenges can be addressed more efficiently through access to greater or "better" data.[44] We have shown how smart urbanism visions can refer to sustainable and low-energy development; community inclusion; collaborative partnerships; systemic disruption; quality of design; managing urban flows; economic/business models such as sharing economies and circularity; construction standards; collective learning; health; mobility; and living laboratories or testbeds. In alignment with the existing literature, we have found that smart visions: differ among actors; emerge from interactions between local, spatial and historical specificities and globally circulating notions of smart; and undergo change as global–local relations shift and local assemblages evolve.[45]

To make sense of this diversity, we contend that it may be helpful to distinguish between what these visions describe and the roles they. Based on inductive analysis of visions advocated by specific cases, we have shown that smart visions may describe: the process of realizing the district through design and planning; the materiality of the envisioned district; and governance of the district. Next, we have identified three contrasting, and potentially overlapping, roles these smart visions may play in smart district development: they may act as mobilizers; instrumentally, as tools to achieve specific sociotechnical goals; and to exclude alternatives. While the role of visions as a mobilizer is well known in the literature on the performativity of visions, this threefold distinction

of visions' agency calls demands for more attention to be paid toward visions' ability to act instrumentally – as tools to achieve other sociotechnical goals – and their role in excluding alternatives and muting contestation. This is particularly pertinent when urban development visions are shaped by an all-encompassing signifier such as smart, which paradoxically seem to have more power to exclude alternatives during early, creative visioning phases of district development projects. Such a variously interpreted signifier, whilst potentially enabling achievement of related goals that are identified in design and planning processes, may make reaching consensus in district development projects very difficult (as particularly identified in the Schöneweide case).

Indeed, this article has shown how smart visions often hide potential contradictions or controversies while strengthening smart visions in their capacity as mobilizers. In seeking to avoid friction, it remains to be seen whether potentially conflicting ambitions will be achieved in practice.[46] Ultimately, some visions will amass greater legitimacy than others. This can not only be attributed to a vision's appeal to a wide range of interests but also to actors' abilities to dominate discourses on the multiplicity of alternative futures encapsulated by the same vision.[47]

Finally, we have shown how knowledge and its politics form a key element of smart district development visions. Visions describing processes of district planning, design and governance all contain a knowledge components. For example, new and better knowledge from previously untapped sources (such as future inhabitants) facilitates better planning and design: in Merwedekanaalzone's Slim City project, the use of creative digital methods was intended to contribute to improved city planning processes through mediating participatory and inclusive co-creation sessions. New knowledges created by the district (such as knowledge derived from data on inhabitants' behavior in the case of Brainport Smart District) require the development of new visions on district governance. The promise of generating new and better knowledge may strengthen the ability of visions to mobilize particular development approaches and outcomes, and informs their instrumental capacity to achieve other sociotechnical goals. For example, in Schleusengraben, knowledge about residents' energy consumption practices envisaged to be created by smart devices already contributes to the justification and legitimacy of both the particular district development and of the ambition to develop Hamburg into a primary Smart City: smart (i.e. in this case digital and mostly sensor-based) data are considered to provide a more accurate and more complete picture of residents' practices and its analysis is therefore thought to enable better quality of life and resource efficiency through optimal control. However, in all of the cases, the politics of knowledge in enacting particular smart visions remains largely uncontested – a puzzling observation that calls for future research with regard to the reasons for this lack of contestation.

Indeed, examining our findings through the lens of knowledge politics raises a range of questions for further research on smart city

visions. Being attentive toward knowledge as a political entity and seeking to understand tensions and controversy around how it is used to legitimize actions would enable a more nuanced and critical engagement with smart visions, in particular relating to claims of inclusion and participation. A deeper understanding of inclusiveness would benefit from a thorough investigation of whose knowledge is made to count with regard to which visions, and by what means, and at which stage of district development processes consultation occurs. Other questions include: how may smart visions act to change understandings of skills and expertise, quality and performance? What kind of society is envisioned based on the use of smart tech, considering assumptions about how smart tech – through its production of knowledge – may be able to nudge people's behavior in specific ways.[48] What kinds of knowledge are envisioned to be produced by the district in order to serve as a source of inspiration or power capable of informing the development of smart districts elsewhere in the respective countries and across the world? This short discussion on the relationship between knowledge politics, smart district development and visions clearly shows that the literature in the field of architecture and planning as well as the visions' literature would benefit from a further exploration into the role of knowledge politics in envisioning smart district development.

All authors are involved in the Open Research Area project "KNOWING: Exploring the Knowledge Politics of Experimenting with Smart Cities." This project starts from the understanding that the use of smart technologies in our day-to-day city lives draws on and creates new forms of knowledge about our cities and ourselves. This is knowledge which we may not have had previously, or which may have been created differently in the past. If we know our cities differently, this creates new possibilities for practice and for governance. In other words: the processes of knowledge creation and use are intimately intertwined with politics. Therefore, this research project asks questions such as: what kinds of knowledge are being produced? What do these knowledges shed light on, and what do they withdraw from our gaze? How do these different forms of knowledge production, circulation and use inform urban governance? How does this differ from existing ways of knowing, doing urban governance and fulfilling urban functions?

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Notes

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6 Throughout this article, we repeatedly distinguish between visions and their materialization, enactment or realization. We would like to stress that we by no means suggest this is a linear process. For the purposes of this article, we only focus on visions and the roles they play in the smart district development projects that we study. The resulting smart districts are therefore beyond the scope of analysis.

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