Arthur De Jaeger

Towards a Right to the Smart City?

Citizen Participation in Rotterdam's Urban Digital Twin

Msc. Sociology: Grootstedelijke Vraagstukken en Beleid

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Erasmus University Rotterdam
Naam: Arthur De Jaeger
Student number: 668107
Promotor: Dr. Thomas Swerts
Second Reader: Dr. Freek de Haan
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ERASMUS UNIVERSITEIT ROTTERDAM

Abstract

This thesis critically examines the potential of Urban Digital Twins (UDTs) to enhance citizen participation in urban development processes, with a specific focus on Rotterdam. Through a qualitative case study of a UDT pilot project on citizen co-creation for the revitalization of Slotboomplein in Oud-Charlois, this research highlights the moderate utilization and perceived supportiveness of digital applications in the participation process. The motivations behind utilizing UDTs for citizen participation include improving decision-making, complying with forthcoming legal requirements (*Omgevingswet*), experimenting with UDT development, and fostering citizen involvement in shaping the city. Despite significant efforts through a combination of online and physical meetings, the UDT pilot project faced internal and external obstacles that hindered effective citizen participation. On one hand, the project lacked integration within the municipality's decision-making structure, and the communication experiences of administrative actors were limited. On the other hand, only a select few residents were able to participate digitally in the UDT pilot by creating and submitting plans for the square. Many residents did not actively participate due to distrust, limited digital skills, language barriers, and concerns about the process's credibility. The uncertainty surrounding the municipality's utilization of citizen input eventually led to skepticism among citizens regarding the process. The research findings reveal limited citizen participation and empowerment in current UDT pilots, raising crucial questions about inclusivity and transparency in decision-making for future UDT developments and implementations. Theoretically, this study demonstrates that engagement, empowerment, and emancipation are interconnected conditions that must be fulfilled to ensure citizens' 'Right to the Smart City.'

Keywords: Urban Digital Twins, Citizen Participation, Right to the (Smart) City, Local Governance, Inclusivity

1. Introduction

1.1 Problem statement

Cities increasingly adopt technologies to become smart cities that employ networked technologies to manage urban services and regulate city life (Cardullo & Kitchin, 2019; Safransky, 2020). Smart city initiatives tend to be branded as citizen- or community-focused (UN, 2022) whereby the incorporation of citizens in digital urban innovations is said to produce more democratic urban governance outcomes (Holland, 2008; Cardullo & Kitchin, 2019). Practical illustrations encompass online and open platforms that facilitate the sharing of data and foster the inclusion of stakeholders in the domains of city planning, policy design, and evaluation (Hämäläinen, 2020). However, critics argue that smart city initiatives prioritize the interests of state and corporations over citizens and enact algorithmic forms of governance that control and discipline citizens (Greenfield, 2013; Kitchin, 2014; Kitchin, 2016). Such top-down, technocratic initiatives are grounded in a neoliberal conception of citizenship that prioritizes market-led solutions and individual autonomy over civil, social, and political rights and the common good (Hollands, 2008; Greenfield, 2013; Kitchin, 2014). This raises important questions about citizens' 'Right to the Smart City', understood as the notion to contribute to an empowering and emancipatory transformative ideal by harnessing digital and data-driven technologies to enhance citizens' democratic and active engagement in city-making, emphasizing their right to be co-creators of urban spaces (Leclercq & Rijshouwer, 2021, p4).

Over the last few years, Urban Digital Twins (UDT), referring to virtual representations that can simulate and analyze various scenarios to inform decision-making, have been presented as a significant advancement in the quest to make cities 'smarter' (e.g., Batty, 2018; Yang & Kim, 2021). It is predicted that by 2025, 500 cities will have developed a UDT (ABI Research, 2021). The endless applications of UDTs elucidate the ubiquitous and transformative role that they might play in shaping citizens' relationships with local governance (Markets & Markets, 2020). More, city governments propagate that UDTs can be used to enhance citizen participation in urban planning processes (Dembski, 2019; Dembski et al., 2020; Ruohomaki et al., 2018; Shahat et al., 2021; White et al., 2021). Through virtual simulations in a UDT, costs or physical obstacles can be considered before implementation and scenarios can be evaluated during citizen consultation rounds (Dembski et al., 2019; White et al., 2021). UDTs also serve as experimental environments for strategic planning, allowing for the testing and coordination of citizen- and state-led initiatives (Ferré-Bigorra et al., 2022).

Despite the promise that UDTs hold to engage citizens with urban governance and urban development, there are doubts about whether this promise will materialize in the end. As a result of UDTs being in an early adoption stage, existing evidence on successful citizen engagement is scarce (Ferré-Bigorra et al., 2022). Nevertheless, several critical counterarguments have been made against UDTs. First, the development of UDTs has focused on the technical aspect and ignores socio-political conditions (Charitondou, 2022). Second, the unequal distribution of power between stakeholders involved in shaping UDTs could undermine the democratic and participatory character of citizen participation in urban planning processes (Nochta et al., 2020). Third, the 'digital divide' in cities, referring to varying levels

of digital participation among citizens according to class, ethnicity, and mobility (e.g., people with disabilities) (Vanolo, 2014; Kolotouchkina et al., 2022), can impede democratic representation and participation in UDTs (Min, 2010; Perez-Morote et al., 2020). Given the growing significance of UDTs in urban planning and decision-making, it is crucial to investigate how citizens participate in their development and how their 'Right to the Smart City' can be secured.

1.2 Research aims and questions.

This thesis critically examines the potential of Urban Digital Twins (UDTs) in enhancing participatory urban planning processes. With a specific focus on the municipality of Rotterdam, which is currently developing its own UDT, the study explores the effectiveness and implications of this technology in facilitating citizen engagement and shaping urban development. Although the city's UDT has not yet been implemented, a pilot project was conducted in 2021. As part of an open participatory citizen planning project, residents were asked to submit designs for Slotboomplein, in Oud-Charlois. Visualizing residents' designs was made possible using a 3D application, which is an example of how UDTs can be used. By analyzing this case, this thesis research aims to determine whether there exist discrepancies between the intended and actual forms of participation and identify opportunities and obstacles for further participation in the development of Rotterdam's UDT. The problem question results in the following research question:

How can the use of urban digital twins (UDTs) enhance citizen participation in urban development processes in Rotterdam?

In order to systematically address the main research question, the sub-questions that enable us to achieve the objective are as follows:
⇒ What are the municipality's motivations to use UDTs to stimulate citizen participation?
⇒ How do citizens participate in existing UDT pilots?
⇒ How can UDTs make existing urban processes more participatory?

1.3 Academic Relevance

The literature on UDTs is predominantly driven by positivist 'urban science' perspectives that emphasize technical and managerial requisites for integrating UDTs into urban decision-making. Given the Digital Europe Programmed funding (2020), statements by cities (e.g., Gemeente Rotterdam, 2022), and research of ABI (2021), it is evident to conclude that the shift towards UDTs is irreversible. Therefore, it is essential to not only consider whether UDTs will augment citizen participation but also how this can be achieved. A socio-political analysis of UDTs can offer a better comprehension of their characteristics, evaluate their potential impacts, and identify critical concerns and impediments that could hinder their widespread adoption (Ferreé-Bigorra et al., 2022). However, given the limited number of existing studies (e.g., Dembski et al., 2020; White et al., 2021; Shahat et al., 2021), further research and data are needed. Thus, this study aims to contribute to the existing literature by critically investigating the use of UDTs to foster citizen participation.

1.4 Social Relevance

Besides making a scholarly contribution to critical studies on UDTs, this research holds societal relevance for policymakers and citizens by advancing our comprehension of citizen participation in UDTs in practice. By scrutinizing and evaluating a pilot city project, this study aims to provide insights into the further development of UDTs. According to Ferré-Bigorra et al. (2022), UDTs are primarily employed by public administrations to facilitate operation and maintenance and, to a lesser extent, urban planning. Thus, the findings and recommendations from this research can serve as a guide for city planners and UDT creators to devise policies for a participatory shift to UDTs. In his work on the 'Right to the City', Lefebvre (1996) posits that citizen participation in decision-making related to urban development and planning is essential for creating an environment that promotes the enjoyment of city resources and benefits for all. Integrating citizens' experiences in participatory processes within a UDT facilitates learning, identifies obstacles and pitfalls, and promotes inclusivity. These insights are valuable for informing the future development of UDTs.

2. Conceptual framework

Enhancing citizen participation in urban development through UDTs (UDTs) is a critical area of inquiry in smart city planning. This chapter investigates three main areas: (1) citizen involvement in smart city planning, (2) the emergence of UDTs as a transformative technological tool, and (3) the relationship between citizen participation and the 'Right to the Smart City.'

2.1 Citizen involvement in Smart City Planning

Citizen participation is a crucial aspect of democracy, and its effectiveness is essential in contemporary times. Although the concept has been in use since ancient Greek city-states, its definition and boundaries remain unclear (Kamaci, 2014). In urban planning, the call for direct citizen involvement began with Davidoff's (1965) advocacy planning and Friedmann's (1973) transactive planning. Participatory approaches, including collaborative/communicative and deliberative planning, have dominated the urban planning discourse since the communicative turn of Habermas (1985). Later, strategic planning emerged in the 1980s and recognizes citizen participation as a crucial element of the planning process, promoting diverse channels, levels, and types of participation, yet the challenge lies in the scale-dependency and complexity of the intersections between social and spatial scales (Kamaci, 2014, p15). Arnstein's (1969) ladder of citizen participation, which categorizes citizen participation into eight levels, was the first attempt to systematically compare and evaluate citizen participation.[1] According to him, meaningful citizenship can only be achieved when individuals have power within the decision-making chain of public services. Additionally, participation has different styles (Dejaegerhere & Hooghe, 2006), motivations (Wagenaar, 2007), and expectations (Evans & Campos, 2013) contributing to the unclearness of the concept. Even though there are many different interpretations and views on what civic participation is and how it should be set up, literature shows that a high level of citizen participation is critical to achieve better public decisions in the planning process (Kamaci, 2014, p15).

This "communicative turn" in urban planning corresponds well with the increasing trend toward digitalization. The use of data-driven smart city technologies is increasingly common to address key challenges for the urban future (Kandt & Batty, 2021). De Waal (2011) argues that these technologies have the potential to enhance citizen participation in city-making processes and promote the development of democratic and sustainable cities, while Goodman et al. (2000) assert that citizen participation is crucial in smart city planning since it focuses on improving public life and requires public funding. As Anthopoulos and Reddick (2016) argue, participation through ICT is perceived to be more accessible, enabling citizens to engage more readily. In addition, Foth (2017) asserts that digital technologies can address criticisms of non-digital practices and take a positivistic stance on placemaking using digital technologies. As a result of digital technologies, more diverse groups of people can be engaged on a larger scale, grassroots democracy can be facilitated, and marginalized and economically threatened communities can be consulted beyond traditional practices (Foth, 2017).

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[1]Arnstein (1969) categorized eight stages of citizen participation ranging from manipulation, therapy, informing, consultation, placation, partnerships, delegated power, and citizen control.

However, critical scholars have addressed the limits of citizen involvement in smart city planning in several ways. First, academics have argued that the "communicative turn" in urban planning is overly idealistic and fails to work in a neoliberal context where there is a democratic deficit (Purcell, 2009). Purcell (2009, p. 144-145) identifies four factors contributing to the deficit: material inequalities causing political and social inequalities, local governments prioritizing capital accumulation and competition, outsourcing governance tasks, and confining policy discussions to competitive and neoliberal frameworks. Second, despite the rhetoric of citizen-centricity, observers contend that smart city initiatives often entail tokenism where citizens have little actual decision-making power (Cardullo & Kitchin, 2019; Leclercq & Rijshouwer, 2022). Technologically informed governance hereby treats citizens like clients or suppliers, rather than supporting citizens' 'Right to the Smart City' (Hollands, 2008; Greenfield, 2013; Kitchin, 2014; Kitchin et al., 2019; Shelton & Lodato, 2019; Leclercq & Rijshouwer, 2022). Third, the digital divide poses a serious challenge to achieving inclusivity and accessibility for all citizens (Vanolo, 2014; Kolotouchkina et al., 2022). Institutionally enforced participation mainly appeals to 'usual suspects' such as 'tech-savvy' and 'entrepreneurial youngsters' (Engelbert et al., 2019, p348) and could exacerbate inequalities with "technologically illiterate, the poor, and, in general, those who are marginalized from the smart city discourse" (Vanolo, 2014; Harvey 2008; Robinson et al., 2015).[2]

To analyze citizen participation in emerging urban models, a thorough understanding of UDTs is crucial. The following section aims to provide a comprehensive overview of UDTs, which will serve as the foundation for analyzing citizen participation processes and outcomes.

2.2 The emergence of Urban Digital Twins

Digital twins (DT) are digital replicas of physical objects that integrate the Internet of Things, artificial intelligence, and data analytics to create living digital simulation models that update and change in real time with their physical counterparts (El Saddik, 2018; Luo et al., 2019; White et al., 2021). Originally defined by NASA as a paradigm for future vehicles, DTs have now found applications in several manufacturing projects to ensure that designs are feasible, safe, efficient, and reliable (Singh et al., 2021). However, the potential applications of DTs extend beyond product design and manufacturing, including creating DT for cities that rely on data collected from smart city services, owing to the increasing availability of data and machine learning (Seo & Oh, 2020; Shahat et al., 2021). A UDT consists of several layers of data, including information about the environment, infrastructures, mobility, and data produced by the smart city (White et al., 2021). The connection between the digital layer and the virtual layer (digital twin) enables the production of simulations, such as mobility and infrastructure simulations, which can enhance more informed decision-making by the local government. It is expected to improve the city's management and operation abilities for complex problems leading to a better quality of life for citizens and the establishment of sustainable cities (Khajavi et al., 2019; Hurtado & Gomez, 2021; Shahat et al., 2021).

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[2] Similar examples can be found in Callahan (2007); Innes and Booher (2004).

Among the advantages of UDTs are the integration of city planning and management, faster response times, and increased efficiency in one tool (Ferré-Bigorra et al., 2022). However, the authors also state that challenges including interoperability, data quality, resource limitations, funding constraints, and cybersecurity persist. The rapid expansion and interest in UDTs have led to a fragmented landscape with inconsistent definitions and implementations. Additionally, the functionality of UDTs is contingent upon the comprehensiveness of the included models, as incomplete models impede informed decision-making and future scenario prediction (White et al., 2021; Shahat et al., 2021). The selection of model components is influenced by subjective perspectives, introducing value-based considerations (Nochta et al., 2020). UDTs have faced criticism due to their inherent value-laden nature, raising concerns about their effectiveness in promoting citizen participation in urban planning. Moreover, scholars have emphasized the excessive focus on technical aspects, neglecting socio-technical (human) considerations (Charitonidou, 2022). Their current top-down, expert-driven approach focused on efficiency and rationality falls short in managing conflicts in urban planning. According to Yang & Kim (2021) planning theories, such as progressive, advocacy, and participatory planning, have been suggested to address these limitations and promote citizen participation. In this perspective, UDTs can be utilized as platforms for citizen involvement and public-private partnerships that ensure equity, fairness, and transparency in the process (Yang & Kim, 2021, p376).

Empirical evidence shows that in cities like Herrenberg, Sofia, and Dublin, UDTs enable citizen interaction, feedback submission, and problem identification (Dembski et al., 2020; White et al., 2021). Moreover, citizen interaction with UDTs in Dublin and Sofia has facilitated additional data collection to enhance the development of UDTs (White et al., 2021; Hristov et al., 2022). Although empirical evidence indicates that virtual replicas offer better interactivity and scene visualization quality than physical replicas, the latter is considered more user-friendly (Luo et al., 2022). Another difference with traditional participation processes, is the exclusion of some age groups due to internet concerns, as supported by Thuvander et al. (2022) and Fares et al. (2018). However, the use of virtual replicas, such as Urban Digital Twins, has the potential to increase accessibility and reduce barriers to including typically marginalized groups, such as children, teenagers, and residents with migrant backgrounds or language barriers (Dembski et al., 2020).

In conclusion, the literature suggests that UDTs offer the potential for improving citizen participation. Yet, despite growing interest in the subject, limited knowledge exists about the socio-political consequences of UDTs and their application to enhance citizen involvement in urban planning (Shahat et al., 2021). The subsequent section endeavors to present an overview of the 'Right to the Smart City' concept, which will establish the groundwork for analyzing citizens' experiences before, during, and after the pilot project.

2.3 Citizen participation in and the Right to the Smart City

Recent studies have developed frameworks to assess citizen engagement in smart city projects. To examine citizen participation in the UDT from a critical social science perspective, this study combines insights from the literature on Smart Citizen Participation with the concept of the Right to the Smart City.

The 'Scaffold of Smart Citizen Participation' is an updated version of Arnstein's 'Ladder of Participation' and is better suited for analyzing citizen participation in the digital age (Cardullo & Kitchin, 2019). It includes an additional mode of participation called 'Consumerism' and addresses the shortcomings of Arnstein's (1969) framework. Through an inductive case study perspective, the scaffold was reconstructed reflecting on the roles, form, and nature of citizen involvement, and underlying political discourse. The conceptual framework allows us to better understand who is involved and in what capacity beyond the powerful rhetoric of the smart city discourse (Cardullo & Kitchin, 2019). This conceptual tool reveals the many ways in which citizens are construed in a smart city, and it has been empirically tested in Smart Cities like Dublin (Cardullo & Kitchin, 2019) and Eindhoven (van Badel, 2019).

The scaffold consists of five columns that facilitate a comprehensive analysis of citizen participation, encompassing power relations and political theories (Table 1). The model is supplemented by an additional column that focuses on the political discourse employed to rationalize and promote citizen involvement, as well as another column addressing the relationship between citizens and the smart city. In their work, Cardullo and Kitchin (2019) present four modes of citizen participation in the smart city. The first mode, termed 'non-participation,' is characterized by a lack of citizen power and influence. The second mode, referred to as 'consumerism,' treats citizens as consumers, with the market determining what is deemed in their best interest. The third mode, known as 'tokenism,' involves providing citizens with a voice without granting them actual decision-making power. Lastly, the fourth mode, called 'citizen power,' empowers citizens to assume a leading role in policy and managerial aspects of initiatives through partnership, delegated power, and citizen control. At the partnership level, citizens are involved in planning and decision-making processes but lack ultimate decision-making power. At the delegated power level, citizens have delegated some decision-making authority but do not possess complete control. Finally, at the citizen control level, citizens possess full control and participate in all aspects of the initiative (Arnstein, 1969). Despite Arnstein's belief that citizen power is crucial for creating cities that reflect citizens' desires and aspirations, Cardullo and Kitchin (2019) argue that most current initiatives fall into one of the aforementioned three modes and that achieving bottom-up, inclusive, and empowering citizen involvement is challenging in practice.

Form and level of participation		Role	Citizen involvement	Political discourse /framing	Modality
Citizen Power	Citizen Control	Leader, Member	Ideas, Vision, Leadership, Ownership, Create	Rights, Socio/political, Citizenship, Commons	Inclusive, Bottom-up, Collective, Autonomy, Experimental
	Delegated Power	Decision-maker, Maker			
	Partnership	Co-creator	Negotiate, Produce	Participation, Co-creation	
Tokenism	Placation	Proposer	Suggest		Top-down, Civic Paternalism, Stewardship, Bound-to-succeed
	Consultation	Participant, Tester, Player	Feedback	Civic Engagement	
	Information	Recipient	Browse, Consume, Act		
Consumerism	Choice	Resident, Consumer		Capitalism, Market	
Non-participation	Therapy	Patient, Learner, User, Product, Data-point	Steered, Nudged, Controlled	Stewardship, Technocracy, Paternalism	
	Manipulation				

Table 1, adjusted from Cardullo & Kitchin, 2019, p5.

The insights of the 'Scaffold of Smart Citizen Participation' on 'citizen power' will be combined by bringing them into dialogue with the emerging literature on the 'Right to the Smart City' (see Leclercq & Rijshouwer, 2022). In Lefebvre's conceptualization of the 'Right to the City,' all inhabitants have the 'absolute' right to shape the city according to their everyday needs and concerns (Leclercq & Rijshouwer, 2022, p2). To achieve the 'Right to the City,' citizens must be able to actively participate in urban planning, policymaking, decision-making, and management processes through democratic processes that emphasize engagement, empowerment, and emancipation (Lefebvre, 1996). Lefebvre (1976, 2001) expands upon this notion by proposing a further progression and advocates for a generalization of *autogestion*, emphasizing self-management and self-governance. He promotes the idea that individuals and communities should have direct control over their decisions and operations, breaking free from hierarchical structures (Lefebvre, 2001; Butler, 2023). In the Lefebvre movement, *autogestion* represents the cultivation of empowerment, autonomy, and social transformation through active grassroots participation and cooperative decision-making (Brenner, 2009).

Leclercq and Rijshouwer (2022) effectively used this framework (Table 2) to examine how digital and data-driven practices contribute to citizen engagement, empowerment, and emancipation in participation projects in Amsterdam and Rotterdam. The research identified engagement, empowerment, and emancipation as key elements of citizen participation in the smart city. Engagement involves actively involving citizens in claiming and executing their 'Right to the Smart City,' while empowerment provides citizens with the necessary resources and knowledge to participate fully (Fraser, 1990, 2005; Leclercq & Rijshouwer, 2022). Empowerment pertains to a transformative process involving individual and collective enhancement, wherein individuals, organizations, and communities attain mastery over their respective circumstances and surroundings (Van Regenmortel, 2009). It conveys an affective state whereby individuals or groups perceive a heightened sense of control, comprehension, and active involvement (Harrison & Waite, 2015, p503). Emancipation aims to create an inclusive and egalitarian society free from inequalities and oppression (Fraser, 2005, p305). The authors argue that supporting citizens' 'Right to the Smart City' requires carefully designed, facilitated, inclusive, curated, and managed processes that address these three aspects

systematically and structurally, with the active involvement of 'empowering intermediaries' (Baack, 2015). Additionally, Sennett (2013) emphasizes the importance of open, flexible, and transparent governance in fostering participatory endeavors, contributing to a more inclusive, dynamic, and sustainable approach to urban planning and design known as the 'open city.'

Characteristics of the Right of the Smart City	Aspects	Related Questions
Engagement	Involvement	*How does the project/process allow for active and meaningful participation?*
	Openness	*How is the project/process open to anyone? Does it support open-endedness?*
	Inclusivity	*Who is invited to participate?*
Empowerment	Agency	*How does a process contribute to stakeholders' individual and/or collective ability to act*
	Decision-making power	*How does a process contribute to stakeholders'' individual and/or collective opportunity to generate value according to their needs and concerns?*
	Empowering intermediaries	*Are there any experts/professionals involved to support stakeholders' involvement?*
Emancipation	Representation	*Do all stakeholders have an equal opportunity to be represented?*
	Recognition	*Are all stakeholders equally recognized and valued for their efforts?*
	Redistribution	*Are means equally distributed to allow citizens to participate?*

Table 2, adjusted from Leclercq & Rijshouwer, 2022, p8.

Taking these insights into account, the objective of this research is to combine the perspectives from both frameworks, thereby achieving a more comprehensive understanding of the socio-political conditions and implications associated with the utilization of UDTs to augment citizen participation in urban planning processes. The limitation of the Cardullo & Kitchin (2019) model includes inadequate coverage of essential elements like citizen selection, engagement design, and information provision, resulting in a neglect of other political spaces (Chantry, 2022). While effective in highlighting proposal formation, the model falls short in capturing the broader realm of political participation. Moreover, at the upper echelons of the Cardullo & Kitchin (2019) model, there emerges a discourse centered around citizen co-creation and autonomy, which also resonates within the municipality of Rotterdam (Gemeente Rotterdam, 2022). In contrast, the model proposed by Leclercq and Rijshouwer surpasses the limitations of the Scaffold model by focusing on the underlying conditions that enable the realization of this Right to the (Smart) City. When combined with the discourse emanating from the municipality, the model of Leclercq and Rijshouwer (2022) becomes a suitable framework for analyzing these specific forms of civic participation.

3. Methodology

The primary objective of this research was to undertake a critical examination of the application of UDTs in the context of enhancing citizen participation within urban development processes in Rotterdam. To accomplish this goal, a qualitative case study approach employing semi-structured interviews was chosen as the most appropriate research method, owing to its capacity to foster an open-minded perspective toward the subject matter (Yin, 2004). By employing an inductive approach to theory-building and conceptualization, these interviews facilitated the emergence of concepts and theories derived directly from the gathered data (Bryman, 2016, p12). Adopting a theory-driven approach, this study aimed to generate knowledge that could apply to diverse urban contexts (Van Thiel, 2015). Prominent literature recognizes case study methodologies as valuable tools for investigating the interplay between UDTs and their physical counterparts, as they provide a comprehensive understanding of the communication and information flows among administrators, planners, and citizens within the realm of (digital) urban planning and design (Dembski et al., 2019).

3.1 Case selection

In 2021, a participation project was launched in Rotterdam to redevelop Slotboomplein in Oud-Charlois. This project was chosen for this study as it was the municipality's first pilot project to use a UDT for participatory purposes, and no new projects were taking place at the start of the research. The project invited residents to register via a QR code and submit their designs to the municipality using the 3D design tool 'Future Urban' (Furban) replacing the physical model with a digital one. The input collected from this process was used by city designers to inform their work. This participation project was a pilot initiative within the *'Digitale Stad'* [Digital City] -project, which aims to explore the opportunities and challenges of a UDT. While the project was internally evaluated, a citizen experience evaluation was not yet conducted.

3.2 Data collection methods

For this research, a triangulation of data collection methods was used. This involved comparing and contrasting the results obtained from different data sources and methods, such as document analysis, interviews, observations, and focus groups. The underlying premise is that diverse data collection methods should yield consistent findings, and examining a given subject from multiple perspectives can contribute to a comprehensive understanding of the phenomenon (Leung, 2015).

Document analysis were undertaken on available materials, such as internal UDT project reports, technical reports on the technology, online publications, presentations, and news articles. Given that these documents reflect the deliberations of governments and experts, a thorough discursive analysis was conducted to explore the role of citizen representation in the case study.[3]

In-depth analysis was facilitated with semi-structured expert interviews of UDT developers, municipal actors, and citizens. The advantage of a semi-structured interview lies in its ability

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[3] See Annex 1

to gather more in-depth information by posing follow-up questions and probing for deeper meanings (Van Thiel, 2015). A pilot interview was already conducted with the project manager of *'Digitale Stad'* [Digital City] before conducting the research to understand the context of the developments. By conducting expert interviews, a more profound understanding of the practical application of citizen participation in UDTs was gained (Hochschild, 2009; Van Thiel, 2015). The identification of potential interviewees in this study involved two primary methods: document analysis and soliciting referrals from respondents. Through document analysis, relevant municipal users involved in the development of UDTs were initially identified. Additionally, referrals from respondents were sought to expand the pool of potential interviewees. This iterative process of seeking referrals from existing interviewees is commonly referred to as the snowballing method (Wohlin, 2014; Bryman, 2016).

In total, interviews were conducted with seven respondents who played a supportive role in the participation process. The study employed focus group methods and ethnographic observation to collect the experiences of residents of the Slotenboomplein regarding the participation process. Three focus groups, consisting of a total of 9 participants, were organized to delve into the experiences and expectations related to participation processes, encompassing both physical and digital aspects. In addition, ethnographic field research was conducted on two occasions, which involved interviewing 12 residents of the neighborhood. These observations were conducted through unplanned visits to the neighborhood surrounding the square and engaging with residents to inquire about their participation or non-participation.[4]

3.3 Data analysis

The interview data underwent coding utilizing an inductive approach, facilitating open coding and subsequent reclassification of codes into primary codes through axial coding, with the assistance of the Atlas.ti software. This process facilitated the establishment of connections based on the theoretical frameworks (Van Thiel, 2015). The methodology was well-suited for a qualitative and inductive study, where the research objectives were not predetermined. During open coding, labels were assigned to potentially relevant segments, while axial coding involved comparing codes to create overarching categories (Van Thiel, 2015). Finally, selective coding was employed to develop concepts into a theory (Bleijenbergh, 2015).

3.4 Validity & Reliability

To enhance research reliability and ensure reproducibility, this study aimed to provide transparency in data sources (Verschuren & Doorewaard, 2007; Van Thiel, 2015). The interviews were recorded and transcribed, which benefits the research's reliability and data quality (Bryman, 2016). Additionally, a topic list was used to ensure consistent coverage of themes across all interviews, promoting uniformity in responses (Van Thiel, 2015).[5] Given the emphasis on capturing the first-hand experiences of respondents, the likelihood of bias, distortion, or validity concerns is minimal. It is unlikely for respondents to influence or alter

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[4] An overview of the interviewed respondents and conducted documents can be found in Annex 1.

[5] The topic list can be found in Annex 2.

what they subjectively express during the interview process (Talmy, 2010). Moreover, the interviews can be seen as separate cases, as they reveal different perspectives and experiences related to the problem (Small, 2009). To further strengthen internal validity, theoretical insights were used to pre-draft interview questions, and concepts from document analysis were incorporated (Gibbert et al., 2008). While the study focused on the pilot case of Rotterdam, limiting its generalizability, the findings still provided valuable insights that could be beneficial to similar municipalities.

3.5 Ethical considerations

To maintain ethical standards during the research process, various measures were taken to ensure the privacy and informed consent of the participants. Before conducting the interviews with residents, a checklist for ethical and privacy aspects of the research was created, which included an informed consent form. Participants were also given the option to discontinue or decline the use of their data during the interview, without the need to provide a reason. Moreover, the anonymity of all participants was ensured by altering the names of citizens, while the positions of government respondents were included only if deemed relevant (Creswell, 2013). To further safeguard the privacy of participants, audio recordings were stored in a secure online drive with restricted access and deleted from the researcher's phone after uploading. Field notes were also stored on a secure external hard drive. The collected data was only shared with the supervisor, the second reader, and members of the TWIRL research project, and will be deleted after the project's completion.[6]

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[6] The "Checklist Ethical and Privacy Aspects of the Research" can be found in Annex 3.

4. Results

This chapter presents findings from a case study on citizen participation in a UDT project in Rotterdam. It examines the interaction between people, local government, and technology, shaping the experiences of the UDT pilot project. The first section explores the municipality's motivations, purpose, and intended level of citizen involvement. The second section assesses the actual degree of citizen participation and identifies internal and external barriers in implementation. Lastly, it describes how the aforementioned challenges affect the experiences and expectations of participating citizens to realize the 'Right to the Smart City'. Table 3 below summarizes these results:

Characteristics of the Right of the Smart City	Aspects	Internal Challenges	External Challenges
Engagement	Involvement	Experimental stage; lack of internal guidelines for participation projects.	High threshold for plan development and design for the square; Mistrust towards the government.
	Openness	Rotterdam House Style, lacking an open-ended approach.	Lack of admission requirements for participation.
	Inclusivity	Lack of clear strategy for recruiting diverse audience of residence	Lacking diversity among respondents.
Empowerment	Agency	Primary goal focused on 'pacifying' and de-escalating conflicts.	Residents hindered from collective action due to non-sharing of designs and lack of adequate training.
	Decision-making power	Final decisions made by technocrats, lack of transparency.	Absence of negotiated rules and transparent communication regarding the decision-making process.
	Empowering intermediaries	Not the customary practice of the municipality to engage in dialogue with citizens.	Citizens desire more process guidance rather than process control.
Emancipation	Representation	Predefined single shared reality of UDT determined solely by experts without citizen input.	Digital divide, with the presence of "usual suspects" and absence of older residents for digital participation.
	Recognition	Emphasis placed on technical knowledge and plans.	Minimal consideration given to the emotional and lived experiences of residents.
	Redistribution	/	Justification of design decisions.

Table 3, summary Results Right to the Smart City. Source: Adapted from Leclercq & Rijhouwer, 2021, p8.

4.1 Motivations for experimenting with citizen participation in the UDT

The urban development of Rotterdam's UDT is being curated as an integral component of the municipal project called *'Digitale Stad'* [Digital City] in collaboration with various scientific and non-scientific partners. At the heart of this initiative lies the ambition to establish the city as a pioneering data-driven organization, facilitated by a digital Open Urban Platform that encompasses a three-dimensional replica of the urban environment (Respondent 1; Gemeente Rotterdam, 2022). Utilizing pilot projects, the initiative seeks to explore citizen participation as an essential facet within the Digital City Rotterdam program (Respondent 1; Gemeente Rotterdam, 2022).

The primary goal of the UDT in urban planning processes is to use it as a tool for facilitating decision-making. Respondent 2 emphasizes that the UDT is meant to support, not replace, participation processes. This viewpoint is supported by Respondents 3, 4, and 7 who recognize the potential of the digital twin city in assisting with these processes. Specifically, the UDT aims to depict the entire urban domain by converting intricate challenges and 'invisible social data' into a comprehensible and visually appealing format. Respondent 1 argues that this would foster integrated efforts and eliminate bureaucratic silos, resulting in swift and effective resolutions to urban development challenges. The potential applications of the UDT are vast, such as expediting permit processes by enabling reviewers to align aspirations with legal requirements more efficiently, as stated by Gemeente Rotterdam (2022).

The UDT will function as a translational tool, facilitating the visualization and communication of complex urban information and potential future scenarios to a wide-ranging audience. This will be achieved by establishing a shared (visual) language, as indicated by Respondent 1. According to the project developers (Respondents 1 & 2), this approach aims to level the playing field by enabling individuals who are unfamiliar with the technical jargon used by urban planners to actively engage in democratic decision-making and planning processes. This is accomplished through the utilization of 3D plans, which offer a more comprehensive visualization compared to 2D plans that necessitate interpretation through a legend. The user-friendly representation of planning processes not only enhances citizens' understanding of urban developments but also provides the added advantage of digital accessibility, as corroborated by Respondents 1-5.

> *"Participation begins by speaking the language of those you seek to engage. [...] To achieve this, digital tools, such as 3D, can play a crucial role. 3D is not just a dataset; it is also a universal language. In a city with 179 nationalities, 3D provides an opportunity to explain everything uniformly, eliminating the need for complex legends. Unlike a 2D map, it conveys information quickly and without abstraction. In 3D, you see more details, such as the size and height of objects, without any translation required."* – Project Manager Digital City, Respondent 1.

The motivations for organizing a pilot participation track at Slotboomplein, situated in Oud-Charlois Rotterdam, were multi-faceted, as explained by Internal Document 2 and Respondents 2, 3, 4, and 6. Firstly, the square has been a paved public space for many years where flooding and heat stress frequently occur, motivating the municipality to reduce heat and water nuisance. This extrinsic motivation aligns with the policy ambitions of sustainability in the National Program Rotterdam-Zuid (2021, p7), which emphasizes climate adaptation not only in housing but also in area development.[7] Also, the project was seen as "complex nor controversial, which is a good fit for a pilot project" (Internal Document 2). Additionally, according to the residents, the numerous benches and lighting on the square create a nuisance for young people, further motivating the desire to address the square. Notably, the motivations to improve the square did not stem from a digital perspective, but digital tools were used to facilitate the participation process, as highlighted by Respondent 3.

> *"Slotboomplein is very paved, and the trees are not doing well. So, it gets incredibly hot in the summer, so you have heat stress there and also flooding as the water doesn't really have anywhere to go. So, the designer drew up a design with these elements and the residents' ideas. Given the design freedom made available through the tool."*
> – Project Manager Co-Creation Digital City, Respondent 2.

In addition, by increasing the accessibility of participation, the municipality wishes to strengthen the position of citizens and their involvement. As Respondent 2 highlights, it is often overlooked "how much knowledge is present in such a neighborhood", while the residents are intimately familiar with the area's minutiae through their daily use, as stated by Respondent 4. Multiple respondents noted that historically, the focus has often been on *discussing* citizens rather than actively *engaging with* residents. The municipality characterizes Rotterdam-Zuid as an area where interactions with local authorities frequently become contentious due to communication challenges, resource limitations, and conflicting interests stemming from various redevelopment projects, resulting in a notable "competition for space" (Respondent 3). However, respondent 6 asserted that the municipality aims to diverge from this pattern, driven in part by the forthcoming implementation of the Omgevingswet.[8]

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[7] Gemeente Rotterdam (2021). Kansen voor verduurzaming [Opportunities for sustainability]. *Duurzaamheid in het Nationaal Programma Rotterdam-Zuid.* p7.

[8] [Environmental Act] "The Environment Act requires all municipalities and provinces to prepare an environmental vision that reflects how the municipality deals with developments in the physical environment now and in the future. [...] The basis for the environmental plan is the environmental vision. This describes the wishes and needs of the residents and entrepreneurs in our city. On this basis we work on an environmental plan that determines what rules apply to your environment" (Municipality of Rotterdam, 2023, par. 3). For an environmental vision, a Municipality Administration is thus forced to include citizens in the redevelopment of a new area. As also confirmed by respondent 5.

"People currently have other things on their minds or lack trust in the municipality. They don't feel like their input is being considered, and now we're trying to convince them that it can indeed be possible. Also, the project leader of such a project must be willing and ready to go the extra mile, to extract more than just a simple note through the door or organize an evening. In this case, a digital tool was also utilized, which made it more enjoyable. It was somewhat of an experiment, especially because the pandemic encouraged everything to be done digitally." – Neighbourhood Manager, Respondent 6.

In conclusion, the pilot participation track at Slotboomplein in Oud-Charlois, Rotterdam served as an exemplar of the diverse motivations for citizen involvement encompassing experimenting, climate adaptation, and the enhancement of citizen positions by fostering greater accessibility and engagement. However, despite the ambitious goals and potential benefits of citizen participation in the Rotterdam UDT pilot, the next chapter describes the internal and external obstacles of the process that need to be addressed.

4.2 Internal and external challenges to citizen participation in the Rotterdam UDT pilot

The official purpose of the Slotboomplein UDT Pilot was twofold. First, to improve democratic participation by promoting the involvement and innovative contributions of diverse citizens through intuitive experience. And second, to facilitate the understanding of complex information for leveled discussion among stakeholders (Internal Document 2; Respondent 6).

The participation process for the Slotboomplein project was initiated amidst the Covid-19 pandemic, employing a combination of online and physical meetings to gather ideas and inform residents. To minimize process delays caused by the health crisis, online meetings were conducted via Microsoft Teams, involving approximately 15 to 20 individuals actively seeking citizen input and sharing information about the project plan. Subsequently, to enhance citizen participation and improve communication of urban plans to residents, the municipality utilized augmented reality (AR) technology, accessible through QR codes, to provide a more comprehensible and universally understandable depiction of the designers' proposals (Respondent 1-5). Additionally, citizens were allowed to submit their proposals through Furban's application. The QR codes were scanned 40 times, resulting in the creation of four to five designs.[9] The physical information session was organized by erecting a tent on the square where several officials, such as the digital participation project manager, the Slotboomplein participation project manager, the neighborhood manager, the neighborhood networker, the traffic expert, and the designer were present. During this session, citizens had the chance to engage by asking questions and offering feedback on the presented plans and proposals. This

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[9] The stated participation rate is based on internal policy documents and interviews with relevant officials. There is no clarity on whether 4 (Internal document 2) or 5 (Respondent 2 & 3) drafts were made. Indeed, the internal information differs significantly from the information from the company facilitating the application: "What we know about Slotboom Square is that 100 people registered and created 20 designs. This means that one in five people made a design, which we think is acceptable" (Respondent 5).

event provided a valuable platform for direct interaction between citizens and officials, ensuring their voices were heard and incorporated into the ongoing participation process (Respondent 3).[10] The participation process included consultation, information-sharing, and placation, within the realm of tokenism (Cardullo & Kitchin, 2019). Although citizens played roles as recipients of information, participants and testers, proposers, and deliberators of alternatives, their input was not binding (Respondent 1-7).

> *"Five designs were proposed by the residents, which were discussed and from which ideas were collected for the final design. The outcome of the process was a redesigned Slotboomplein that considered the desires and ideas of the residents and has now been realized."* – Project Manager Participation, Respondent 3.

Despite the extensive efforts made through a combination of online and physical meetings, the UDT Pilot project encountered multiple challenges that impede effective citizen participation. These obstacles arose from internal organizational challenges within the municipality, as well as external challenges faced by the residents, collectively contributing to the hindrances encountered during the process.

Internally, challenges stemmed from incomplete integration of the pilot project within the organization, designers' limited experience in citizen communication, difficulties in engaging and reaching citizens, and limited consultation and feedback mechanisms. These factors indirectly impacted citizens' meaningful participation in the project. While citizens participated as testers and provided feedback, their experiences with the participatory process and UDT have not been thoroughly evaluated. On the residents' side, they encountered tangible barriers, including insufficient training, limited availability of the Furban's application on older mobile devices, fading QR-code stickers for AR visualization, unclear European legal boundaries for design-related applications, and restrictions imposed by the "Rotterdamse Huisstijl" (Internal Document 2, Respondent 5). This institutional arrangement allows municipal actors to decide which elements are open for consideration in the planning process. [11] For instance, certain features like benches or playground equipment were already pre-selected and non-negotiable, while residents could only choose their locations. According to the urban planner (Respondent 7), this framework provides a better internal control for designers, and safeguards their autonomy, but can be challenging to explain in the participation process.

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[10] Notably, citizens disagreed with some ideas, including the proposed number of benches and a collective barbecue and picnic tables. Further details regarding citizens' experiences are provided in the subsequent section.

[11] The Rotterdamse Huisstijl [House Style] is operationalized by the handbook The Toolkit, Handboek Openbare Ruimte [Public Space] and "provides designers and managers with a selection of materials for the design of public space. The handbook represents a clear, unambiguous, and high-quality family of street furniture and paving materials that enhance the identity and recognizability of Rotterdam's outdoor space (2012, p.4). Respondent 7 also provided a narrative description of the Rotterdam House Style: "It is an analysis of the city, of how the city is put together, what types of neighborhoods, streets, as well as lines there all, are. We have the same set of agreements across the whole city in terms of layout, history, design of certain neighborhoods and streets, and which materials we use. So, across the whole city, whether you are in the West or South, the same materials are used and there is the same layout, albeit focused on the specific location. We draw a line and have looked at sustainability and replacement of materials, for example. We have a store from which we can take stuff and replace it properly so that the city has a uniform look."

"People require a certain skill to form a clear understanding of a digital presentation. The project, in fact, was rather roughly developed, and some individuals found it too abstract. They also had limited variables to work with. [...] You cannot separate the physical aspect from participation. It was an interesting experiment with definite potential, but it needs to become more user-friendly and facilitate the discussion about people's desires, problems, and potential solutions." – Project Manager Participation, Respondent 3.

Internal Document 2 revealed designers' reluctance to implement the tool, resulting in a default inclination to design sandboxes to avoid creating unrealistic promises for residents. Respondent 4 emphasized that residents may perceive themselves as having better ideas, leading to a binary mindset when making choices like prioritizing parking or greenery. In response, municipal actors aim to make collective choices benefiting the entire city, although addressing these issues primarily rests with the central government rather than the UDT developers. Nonetheless, these factors significantly impacted citizen participation by limiting residents' agency in the design process, from object selection to their placement. Furthermore, residents were not provided with the option to view designs submitted by others on the application website (Respondent 2).

"That is also true because many residents are very outspoken and especially know very well what they don't want. For residents, it's often a matter of what happens on their doorstep, and they don't look further into what their neighbors think or what other residents might think. [...] We need to be strict about this together with the municipality and say, "This is the input we have gathered, this is the design, and this is how it will be." " – Urban Planner, Respondent 7.

Figure 1, Preliminary design and final design following a participatory event. The image was obtained subsequent to an in-depth discussion with an Urban Planner, specifically respondent 7.

In conclusion, the UDT pilot project in Rotterdam encountered both internal and external challenges that hindered citizen participation. Internal challenges encompassed incomplete

integration within the municipality and limited communication experiences among designers. On the other hand, external challenges compromised technological limitations and restrictive design frameworks. Despite these hindrances, the project successfully led to a redesigned Slotboomplein that incorporated input from residents. The following chapter delves into the residents' experiences within the participation project, aiming to investigate the extent to which a 'Right to the Smart City' was achieved.

4.3 Exploring citizen engagement-emancipation-empowerment in participatory UDT projects.

Building upon the case discussed in this research and guided by the principles of engagement, empowerment, and emancipation, we aimed to address the question of how to support citizens' 'Right to the Smart City,' taking into account the external and internal obstacles described in the previous chapter.

Regarding engagement, participants in this participatory process were primarily recruited through traditional methods, including postal and digital mail invitation letters and word of mouth. However, it remains unclear which citizens participated in the digital design submission process, limiting the ability to describe this group. Nevertheless, in the subsequent phases of the process, there was a stronger focus on creating greater inclusiveness by directly addressing a variety of citizen groups in the invitation to participate and by physically being present at the square with all relevant municipal actors.

A significant number of individuals were informed about the process through associations in the building at Slotboomplein, primarily catering to individuals aged 55 years and older.[12] Multiple motivations for participation were observed, including practical concerns regarding window views, home accessibility, and noise disturbances. Emotional motivations were also evident, with one long-term resident perceiving the participatory event as a crucial opportunity to effect change on the square. Expressing frustration, she highlighted years of unsuccessful attempts to address bench-related nuisances, emphasizing the municipality's obligation to listen now that they sought citizen input.

> *"For years, I have tried to make the municipality aware of the nuisance caused by the benches; for years, my children have slept with earplugs. Not once was anything done with my complaints, but now the municipality asks for our input, and they have to listen."* – Rita

During neighborhood observations, it became apparent that many residents near the square did not actively participate in the events. Several factors contribute to this, including a general distrust in the municipality, limited digital skills, language barriers, high turnover in certain rental properties, and lack of personal interest. These residents believed their input would not be genuinely considered, leading to limited openness in the project. It's important to note that

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[12] The longest side of the building that borders the square is occupied by residents aged 55 years and older.

some residents perceived this research as primarily benefiting the municipality, further reducing their engagement during the interviews. Notably, absent residents also displayed limited trust in the municipality and skepticism regarding the credibility of their input, partly due to civil servants' decisive role in determining agenda topics.

Regarding empowerment, stakeholders had limited opportunities to express their ideas and aspirations for alternative urban scenarios and actively contribute to their realization through co-creation. Although the projects aimed to enhance citizen agency, decision-making power, and local value creation, they only achieved a partial success. Participants' ability to act and the decision-making power of stakeholders were relatively restricted, as evident from the divergent perspectives between citizens and municipal stakeholders on the participatory process. Some participants perceived the design as predetermined, reducing the process to a formality, while a minority felt genuinely involved in decision-making. Residents expressed widespread concerns about water overflow, yet a disagreement emerged regarding the appropriate quantity of park benches due to apprehensions surrounding the potential for undesired behaviors they may facilitate. The final design incorporated citizens' requests for a playground and fewer benches. However, the municipality emphasized the residents' limited collective perspective (Respondent 4) and their tendency to express desires by highlighting what they do not want (Respondent 7). Therefore, driven by time and budget constraints, as well as technocratic beliefs, the project initiators adopted a top-down approach, with the municipality maintaining control and defined boundaries during participation processes. However, within the resident community, disagreements emerged, with respondents emphasizing that unrestricted freedom during participation processes could result in chaos and conflict.

> *"We don't always agree, there was already a conflict over a picnic table and later on over a mural painting."* – Wendy

> *"Well, that's how participation processes are, it's a bit of a 'tragedy of the commons,' isn't it? *laughs*"* – Willem

Despite initial skepticism, participating residents acknowledged the municipality's role as a facilitator in gathering and reconciling expectations to reach compromises, thereby positioning the municipality as a process manager and intermediary.

> *"We do need the municipality, it's important that they provide some guidance and connect all the ideas. After all, it's their job. It's also difficult and chaotic to navigate through those discussions (cf. picnic tables and mural paintings) on our own."* – Rita

In terms of emancipation, uncertainty exists regarding the valuation of citizens' input in the decision-making process. Respondent 7, the square designer, claimed adequate attention was given to citizens' primary interests, but deviations can arise due to design freedom and the legal framework. The extent and conditions under which citizen input was considered remain unclear but during the interaction with the square's designer, access was granted to the designs submitted for the project. This provided the researcher with insights into the preliminary design by the municipality, the citizen-submitted projects, the final project and wthe emancipation aspect. Residents described physical participation events marked by strong protests, advocating for a reduction in the number of benches. Some respondents expressed that without such protests, the municipality would not have addressed their concerns. Limited digital skills were cited as a reason for non-participation, but the impact of this on their perceived influence remains inconclusive, as no respondents were found who had submitted a self-developed design. [13] Redistribution was not evident, with the only potential form being the outcome of the square.

> *"Now you have an idea of everything that has been compromised. And then you can see that if you go completely outside those boundaries, it is difficult to accept that design. [14] But you can say that I see swings popping up everywhere, apparently they like that. Well, also quite a lot of benches, but in the end, only two benches were installed because they quickly received criticism from residents. Because then we would get loitering youths and nuisance, so that won."* – Urban Planner, Respondent 7.

The three value chains related to the Right to the Smart City consistently emphasized transparency and trust in this study. The uncertainty in the decision-making process affected their engagement, empowerment, and emancipation. As a result, respondents expressed mistrust due to past experiences, leading to a diminished belief in their ability to make a meaningful impact.

> *"The plans had already been firmly established; the tent was merely a beautiful prop for the show!"* – Patrick

Following Leclercq and Rijshouwer's suggestion to reflect on participation processes, this study aimed to identify improvements. Despite limited knowledge of digital 3D planning, some residents showed enthusiasm for providing input through a physical 3D model. Besides, a significant number of residents expressed doubts or mistrust towards digitalization and preferred in-person meetings. Nonetheless, for active participants, the inclusion of a digital 3D model enhanced the visualization during physical meetings, although no models were

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[13] Partly enabled by the neighborhood manager, and due to privacy reasons, an email was sent to residents of the neighborhood. In this email, the neighborhood manager not only introduced herself but also indicated that people who submitted a draft could contact the researcher for an interview. The email was sent on April 19 but there were no responses during the survey period.

[14] The "boundaries" refer to the design space allocated by the municipality to the residents. The design space was limited to the developed area of the square.

submitted by them. Last, municipal officials recommended using polls to incorporate democratic input into future design processes (Respondents 2 & 3).

This chapter examined the results of the participation project and the experiences of the residents, highlighting challenges in citizen engagement, empowerment, and emancipation. While efforts were made to promote inclusivity, limitations in recruiting participants for digital design submission and factors like distrust and limited digital skills hindered full participation. Uncertainty in decision-making processes affected residents' trust and belief in their ability to influence outcomes, emphasizing the importance of transparency and addressing the complexities of the participatory process.

5. Conclusion

Urban Digital Twins (UDTs) have emerged as a promising tool to enhance citizen participation in urban planning processes and decision-making. However, concerns have been raised regarding the extent to which UDTs can truly fulfill their promise of inclusivity and democratic governance. Specifically, there are concerns regarding the actual implementation of citizen engagement, as UDT development primarily emphasizes technical aspects while neglecting socio-political considerations. Power imbalances among stakeholders and the presence of a digital divide in cities may undermine democratic representation and participation within UDTs. Kitchin et al. (2019) explicitly highlight that the question of how citizen-centric smart cities can be fostered, supported, and facilitated is still not answered with satisfaction. Similarly, White et al. (2021) acknowledge the lack of satisfactory answers regarding the question of whether UDT can enhance citizen participation. This thesis critically examines the potential of Urban Digital Twins (UDTs) in augmenting citizen participation in urban planning processes within the context of Rotterdam. It assesses a pilot project that involves residents' designs for Slotboomplein, utilizing a 3D application. Three sub-questions have been formulated and will guide the subsequent conclusion.

> **Research question:** *What are the municipality's motivations to use UDTs to stimulate citizen participation?*

The motivations for utilizing an Urban Digital Twin (UDT) in the participation process of Slotboomplein were multifaceted. Firstly, it aimed to enhance the public decision-making process by empowering residents to create simulations. The municipal authority intended to engage a greater number of citizens in decision-making, seeking outcomes that align with citizens' expectations and promote democratic urban governance (Holland, 2008; Cardullo & Kitchin, 2019). Additionally, impending legal requirements and the local commitment to involving citizens further acted as driving factors for learning from citizen participation. Furthermore, the pilot project is part of a broader institutional UDT initiative, which concurrently explores various opportunities, including this participation project. Consistent with previous research, the UDT pilot project served as an experimental endeavor, incorporating evaluative challenges to inform future participation projects.

> **Research question:** *How do citizens participate in existing UDT pilots?*

This case study diverges from previous studies conducted by Demski et al. (2020) and White et al. (2021) in terms of the role of the Urban Digital Twin (UDT). Rather than serving as a tool for problem identification, the UDT in this study aimed to stimulate and support citizen participation projects, providing inspiration and information. While literature suggests that smart city technologies have the potential to enhance public decision-making (De Waal, 2011; Kandt & Batty, 2021), the impact of the UDT tool, in this case, remained limited due to its implementation and management by administrative actors using a top-down approach. Although the 3D visualization was perceived as valuable, ultimate decision-making authority resided with municipal authorities and corporations.

The results indicate a hybrid level of participation, encompassing consultation, information-sharing, placation, and elements of tokenism, where citizens may act as recipients of information, participants and testers, proposers, and deliberators of alternatives (Cardullo & Kitchin, 2019). However, despite their active role in discussions and deliberations, the initiation and final decisions remain in the hands of municipal authorities and even corporations (Cardullo & Kitchin, 2019). The design space was delineated based on two factors: the designated area for design and the constraints imposed by the Rotterdam House style and Furban, which dictated the permissible objects to be incorporated. Similarly, White et al. (2021) and Shahat et al. (2021), femphasized the significance of inclusivity and exclusivity within the digital infrastructure. Besides, the UDT in this context was shaped by the municipality's value-based considerations regarding public objects (Nochta et al., 2020; Charitonidou, 2022). The UDT pilot project aimed to strengthen citizen participation but encountered constraints and difficulties during its implementation and integration into local government structures.

> **Research question:** *How can UDTs make existing urban processes more participatory?*

This research aimed to examine the support for citizens' 'Right to the Smart City' through exploring engagement, empowerment, and emancipation. The findings underscore those digital applications were utilized to a moderate extent and perceived as supplementary to the overarching 'Smart City' concept. However, it is vital to avoid disregarding or underestimating their role and contribution. Therefore, contextualizing and qualifying the relevance of the 'Right to the Smart City' becomes crucial in this case.

Regarding citizen engagement, the initial phase of the participatory process relied mostly on traditional methods, and there was uncertainty surrounding the participation of citizens in the digital submission process. Citizens groups and relevant municipal actors promote inclusiveness and motivations for participation by citizens varied, including practical concerns and a desire for positive change. However, a significant number of residents living near the square did not actively participate due to factors such as distrust in the local government, limited digital skills, language barriers, high resident turnover, and concerns about the credibility of the process. Besides, physical participation was favored for engagement (Luo et al., 2022), and personal interests influenced the level and meaningfulness of participation.

The research findings reveal limited stakeholder empowerment, with varying perceptions of involvement and predetermined decision-making. This insufficiency in developing a sense of entitlement hinders feelings of empowerment, encompassing self-confidence, autonomy, and the capacity for positive action (Harrison & Waite, 2015; Zimmerman, 2000). Diverse resident concerns and desires highlight the challenge of achieving collective understanding, while skepticism towards the process is evident.

Assessing the level of emancipation in this study posed challenges. While the project's low participation requirements theoretically ensured equal opportunities, digital literacy issues

hindered some citizens' involvement. Furthermore, the active role of administrative initiators and facilitators in safeguarding the decision-making process complicated the analysis of the value attributed to citizens' input. Lastly, residents did not receive any compensation or benefits for their participation, except for the outcome of the park. However, due to limited agreement among residents themselves and with the municipality, the project presents challenges when it comes to justifying the design decisions.

Strong protests by residents played a crucial role in capturing the municipality's attention, emphasizing the importance of activism. In this context, citizens' involvement in digital affairs is prone to power imbalances, and a lack of openness, inclusivity, transparency, and agency, which are akin to the characteristics observed in governmental processes (Iveson 2007; Harvey 2008). Nonetheless, some residents emphasized the need for the municipality to act as a process manager to prevent potential chaos or conflicts that may arise from granting participants complete freedom. Although the findings demonstrate an increased level of creative agency among citizens in these processes, residents do not expect a form of *autogestion* as advocated by Lefebvre (1976, 2001).

Last, transparency and trust were prominent themes, with uncertainty in decision-making affecting engagement, empowerment, and emancipation. Respondents expressed distrust in their relationship with the municipality due to past negative experiences, leading to doubts about their influence despite their attachment to the square. This aligns with Sennett's (2013) emphasis on open governance, as transparency plays a crucial role in building trust between the community and the governing body. When decision-making processes are transparent and accessible, residents would feel more likely empowered and engaged. In contrast, a lack of transparency and trust can thus hinder meaningful participation and collaboration.

During this research, the decision was made to enhance the existing model proposed by Cardullo and Kitchin (2019) by combining it with the model developed by Leclercq and Rijshouwer (2021). This decision can be justified from the perspective that incorporating the Leclercq and Rijshouwer model allows for an analysis of citizen agency and engagement that goes beyond the mere categorization of a participatory process, as seen in the Cardullo and Kitchin model. Also, the combination with the Cardullo and Kitchin model enables a more reflective examination of the process, as it shows the variety of ways in which citizens are construed in a smart city. By employing an inductive approach and deriving results from it, this research extends the theoretical framework proposed by Leclercq and Rijshouwer (2021), particularly by incorporating an additional internal and external dimension. As indicated, it became apparent that engagement, empowerment, and emancipation are interrelated and cannot be strictly separated as distinct values. This was demonstrated by factors such as trust and transparency, which had an impact on all these values for the residents. Furthermore, this research contributes to theoretical innovation due to the limited literature on participation in UDTs, with the additional contribution of combining the two aforementioned models within this context.

Not only does this research hold significance from a theoretical standpoint, but it also holds practical value for both citizens and the government. The experimental nature of the project

presents an opportunity for the municipality to glean insights from the pilot project's experiences and apply them to future implementations of participatory processes utilizing UDTs. However, rather than providing citizens with tools for comprehensive and creative participation, they often perceived their influence and involvement as limited. Consequently, this research not only sheds light on the technical limitations but also reveals underlying barriers. Furthermore, an analysis of this experimental trajectory offers valuable insights for governments beyond national borders, given the substantial growth of UDT development in Western Europe (ABI, 2021).

Finally, previous research has suggested that digital participation methods could engage marginalized groups (Dembski et al., 2020) or inadvertently exclude certain individuals (Engelbert et al., 2019). However, in the current study, no respondents were found who had submitted a design, thereby highlighting a limitation of this research as it prevented the affirmation or negation of either proposition. This underscores the need for further research on the user-centricity of digital applications to conduct a thorough analysis of citizen inclusion in such projects. It is crucial to acknowledge that the research possibilities in this field, akin to the practical applications of Urban Digital Twins (UDTs), are vast. Key areas for further investigation include privacy, participation, data protection, security, and inclusivity, as these issues will continue to be significant in ongoing discussions on UDTs (Yang & Kim, 2021; Ferré-Bigorra et al., 2022). By addressing these areas, future research can contribute to a more comprehensive understanding of the potential benefits and challenges of UDTs in promoting citizen participation and shaping the development of smart cities. Alternatively, comparative studies could be conducted on multiple urban digital twin projects in diverse cities or countries to explore variations in citizen inclusion, participation processes, and outcomes. Finally, conducting further research on alternative models and forms of citizen participation in smart cities, for example through urban living labs, can contribute to the quest to achieve the Right to the Smart City.

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Function Respondent	Number Respondent
Program Manager Digital City Rotterdam	Respondent 1
Program Manager Co-creation Digital City	Respondent 2
Participation Program Manager, BMC	Respondent 3
Traffic expert	Respondent 4
Co-founder Furban	Respondent 5
Neighbourhood Manager	Respondent 6
Urban Planner	Respondent 7
Citizens	Focus group 1
Citizens	Focus group 2
Citizens	Focus group 3
Citizens	Ethnographic Observation
"Evaluatie vragenlijst Co-Creatie in de Digitale Stad (Slotboomplein)"	Internal Document 1
"Co-creatie Lessons Learned (Slotboomplein)"	Internal Document 2

Annex 2: Topiclist

1. Administratie

Introductie onderzoeker & onderzoek
- Naam
- Doel van het interview

Rechten en plichten van de respondent.
- Vraag naar de mogelijkheid dit interview op te nemen.
- Wijs op de rechten van uittredingen en resultaat opvraging.
- Ondertekenen ethische overwegingen

Introductie respondent
- Kan u iets meer vertellen over de functie die je hebt binnen de gemeente?
- Wat is uw achtergrond/ervaring m.b.t. de UDT?
- Hoe bent u betrokken geraakt in de UDT (Rotterdam)?

Urban digital twins
- DT zullen ook gebruikt worden om burgerparticipatie te verhogen. Hoe zal dit gebeuren?
- Wat kan u mij vertellen over het pilootproject dat hiervoor ontwikkeld werd?

Stakeholders
- Wie zijn hiervan de belangrijkste stakeholders?
    - Welke bedrijven waren hierbij betrokken?
    - Zijn er burgers of actoren uit het middenveld betrokken bij de ontwikkeling van deze UDT's? Of enkel bij de uitvoering?
- Wie coördineerde dit project?
- Is dit project formeel of informeel tot stand gekomen?

Input
- Hoe werd de locatie van het project bepaalt?
    - Vraag/proef vanuit ambtenarij, politiek, burgers of bedrijven?
- Hoe werden de burgers benaderd?
- Hoe werden de burgers bevraagd?
- Werden burgers hierin ondersteund of was enige digitale kennis vereist?
    - Hoe autonoom waren de burgers in het proces?
- Wat is de tijdlijn van het project? Waar zit het project nu in het proces en wat zijn de volgende stappen?
- Welke data werd gebruikt?
- Hoe werd de kwaliteit beoordeeld van het model?
- Ook al probeer je een model zo omvattend mogelijk te maken, het blijft een weergave van de werkelijkheid en daarmee op een bepaalde manier een simplificatie. Hoe maak jij of jullie als team besluiten over wat wel wordt opgenomen/ wat wel zichtbaar is in het model en wat niet?
- Gebeurt het wel eens dat er discussie is tussen ambtenaren/ politieke actoren/ stakeholders over de (kwaliteit van de) visualisatie? Beschouwen deze personen de input van het model als correct? Vertrouwen zij het model?

Output
- Waar wordt het momenteel toegepast? Waar zal het op toegepast worden?
- Wie zijn potentiële gebruikers?
    - Welke doelgroep(en) hopen jullie te bereiken (die misschien nu niet zijn bereikt)?
- Wat zijn de voordelen van dit model?
- Wat zijn de uitdagingen?

Besluitvorming
- Hoe is het geïntegreerd in bestaand besluitvormingsprocessen?
- Wat zijn de uitdagingen van het project? Waar kan verbetering plaatsvinden?
- Worden UDTs gebruikt worden om samen met burgers besluiten te nemen of deze naar burgers te communiceren?

Toekomst
- Welke plannen of ambities heeft de gemeente voor de ontwikkeling van UDTs?
- Is er nog iets dat we niet hebben besproken, maar wat wel relevant is wanneer het gaat over het ontwikkelen/ toepassen van UDTs?

Voor verdere gesprekken
- Welke contactpersonen zou ik kunnen bereiken zodat ik meer over het project te weten kan komen?

2. Burger

Introductie

Introductie onderzoeker & onderzoek
- Naam
- Probleemstelling onderzoek
- Doel van het interview

Rechten en plichten van de respondent.
- Vraag naar de mogelijkheid dit interview op te nemen.
- Wijs op de rechten van uittredingen en resultaat opvraging.
- Ondertekenen ethische overwegingen.

Introductie respondent
- Wat is uw achtergrond/ervaring m.b.t. de UDT?
- Hoe bent u betrokken geraakt in het participatieproces?

Urban Digital Twins
- Heeft u al eerder gebruik gemaakt van een Urban Digital Twin/3D-tool?
    - Was het gebruik van de tool intuïtief, toegankelijk en gebruiksvriendelijk voor u? Of waren er eventuele obstakels die u hebt ervaren?
- Wat zijn volgens u de voordelen van het gebruik van een UDT als participatietool ten opzichte van traditionele participatieprocessen?
- In hoeverre voelde u zich betrokken bij het proces van stadsplanning?
- Hoe effectief vond u de UDT als middel om uw mening en ideeën over de stad en de leefomgeving te uiten? /In welke mate heeft het gebruik van de UDT uw inzicht in de planningsprocessen van de stad vergroot?
- Was er voldoende mogelijkheid te communiceren met andere gebruikers en feedback te geven op elkaars ideeën?
- Zou u de UDT aanbevelen als participatietool en waarom?
- Zijn er nog andere suggesties of feedback die u zou willen geven over uw ervaringen met de UDT als participatietool?

Annex 3: Checklist Ethical and Privacy Aspects of the Research

CHECKLIST ETHICAL AND PRIVACY ASPECTS OF THE RESEARCH

INSTRUCTION

This checklist should be completed for every research study that is conducted at the Department of Public Administration and Sociology (DPAS). This checklist should be completed *before* commencing with data collection or approaching participants. Students can complete this checklist with help of their supervisor.

This checklist is a mandatory part of the empirical master's thesis and has to be uploaded along with the research proposal.

The guideline for ethical aspects of research of the Dutch Sociological Association (NSV) can be found on their website (http://www.nsv-sociologie.nl/?page_id=17). If you have doubts about ethical or privacy aspects of your research study, discuss and resolve the matter with your EUR supervisor. If needed and if advised to do so by your supervisor, you can also consult Dr. Bonnie French, coordinator of the Sociology Master's Thesis program.

PART I: GENERAL INFORMATION

Project title: Towards a Right to the Smart City? Citizen Participation in Rotterdam's Urban Digital Twin

Name, email of student: Arthur De Jaeger, 668107ad@eur.nl

Name, email of supervisor: Swerts, Thomas

Start date and duration: 14-02-2023 UTAI 25-06-2023

Is the research study conducted within DPAS   YES - NO

If 'NO': at or for what institute or organization will the study be conducted?
(e.g. internship organization)

PART II: HUMAN SUBJECTS

1. Does your research involve human participants. <mark>YES</mark> - NO

    If 'NO': skip to part V.

    If 'YES': does the study involve medical or physical research? YES -
<mark>NO</mark>

    Research that falls under the Medical Research Involving Human Subjects Act (WMO) must first be submitted to an accredited medical research ethics committee or the Central Committee on Research Involving Human Subjects (CCMO).

2. Does your research involve field observations without manipulations
    that will not involve identification of participants. <mark>YES</mark> -
    NO

    If 'YES': skip to part IV.

3. Research involving completely anonymous data files (secondary
    data that has been anonymized by someone else). YES - <mark>NO</mark>

    If 'YES': skip to part IV.

PART III: PARTICIPANTS

1.   Will information about the nature of the study and about what
        participants can expect during the study be withheld from them?   YES -
        NO

2.   Will any of the participants not be asked for verbal or written
        'informed consent,' whereby they agree to participate in the study?   YES -
        NO

3.   Will information about the possibility to discontinue the participation
        at any time be withheld from participants?   YES - NO

4.   Will the study involve actively deceiving the participants?   YES -
        NO
        *Note: almost all research studies involve some kind of deception of participants. Try to
        think about what types of deception are ethical or non-ethical (e.g. purpose of the study
        is not told, coercion is exerted on participants, giving participants the feeling that they
        harm other people by making certain decisions, etc.).*

5.   Does the study involve the risk of causing psychological stress or
        negative emotions beyond those normally encountered by
        participants?   `   YES -
        NO

6.   Will information be collected about special categories of data, as
        defined by the GDPR (e.g. racial or ethnic origin, political opinions,
        religious or philosophical beliefs, trade union membership, genetic
        data, biometric data for the purpose of uniquely identifying a person,
        data concerning mental or physical health, data concerning a person's
        sex life or sexual orientation)?   YES - NO

7.   Will the study involve the participation of minors (<18 years old) or
        other groups that cannot give consent?   YES - NO

8.   Is the health and/or safety of participants at risk during the study?   YES -
        NO

9.   Can participants be identified by the study results or can the
        confidentiality of the participants' identity not be ensured?   YES -
        NO

10.   Are there any other possible ethical issues with regard to this study?   YES -
        NO

If you have answered 'YES' to any of the previous questions, please indicate below why
this issue is unavoidable in this study.

To conduct a socio-political analysis of the project and its process, the political choices of the municipality will be asked.

Several respondents perform a unique position in the Municipality of Rotterdam. Their names will not be mentioned but their anonymity can only be partially guaranteed as their function will be mentioned.

What safeguards are taken to relieve possible adverse consequences of these issues (e.g., informing participants about the study afterwards, extra safety regulations, etc.).

Respondents will be anonymized in this study. In addition, they will be given access to their part in the results, the opportunity to give feedback herein, or be allowed to withdraw themselves from the study. Data will be saved in an external hard drive, which is only accessible by a password.

Are there any unintended circumstances in the study that can cause harm or have negative (emotional) consequences to the participants? Indicate what possible circumstances this could be.

It is not the intention of the study to obtain sensitive information.

Please attach your informed consent form in Appendix I, if applicable.

Continue to part IV.

PART IV: SAMPLE

Where will you collect or obtain your data?

> In Rotterdam. Both citizens and employees of the municipality.

Note: indicate for separate data sources.

What is the (anticipated) size of your sample?

> 12-14 respondents
> Finally: 21 Citizens, 7 public administrators of the municipality

Note: indicate for separate data sources.

What is the size of the population from which you will sample?

> Citizens living around Slotboomplein and the surrounding neighbourhood.
> Public administration of the Municipality of Rotterdam.

Note: indicate for separate data sources.

Continue to part V.

Part V: Data storage and backup

Where and when will you store your data in the short term, after acquisition?

Data will be stored in a secured external drive.

Note: indicate for separate data sources, for instance for paper-and pencil test data, and for digital data files.

Who is responsible for the immediate day-to-day management, storage and backup of the data arising from your research?

Arthur De Jaeger

How (frequently) will you back-up your research data for short-term data security?

Weekly basis

In case of collecting personal data how will you anonymize the data?

Respondents will be anonymized, and transcripts of the interview will only be shared with the supervisor, second reader and researchers of the TWIRL research project.

Note: It is advisable to keep directly identifying personal details separated from the rest of the data. Personal details are then replaced by a key/ code. Only the code is part of the database with data and the list of respondents/research subjects is kept separate.

PART VI: SIGNATURE

Please note that it is your responsibility to follow the ethical guidelines in the conduct of your study. This includes providing information to participants about the study and ensuring confidentiality in storage and use of personal data. Treat participants respectfully, be on time at appointments, call participants when they have signed up for your study and fulfil promises made to participants.

Furthermore, it is your responsibility that data are authentic, of high quality and properly stored. The principle is always that the supervisor (or strictly speaking the Erasmus University Rotterdam) remains owner of the data, and that the student should therefore hand over all data to the supervisor.

Hereby I declare that the study will be conducted in accordance with the ethical guidelines of the Department of Public Administration and Sociology at Erasmus University Rotterdam. I have answered the questions truthfully.

Name student: Arthur De Jaeger

Name (EUR) supervisor: Thomas Swerts
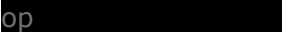
Date: 21-03-2023

Date: 20-03-2023

APPENDIX I: Informed Consent Form

Informatieblad voor scriptieonderzoek: Towards a Right to the Smart City? Citizen Participation in Rotterdam's Urban Digital Twin.

Onder begeleiding van Thomas Swerts onderzoekt Arthur De Jaeger burgerparticpatie in de context van een Urban Digital Twin. Met behulp van uw deelname kan dit onderzoek worden gerealiseerd. Wij zijn benieuwd naar *uw mening* over dit onderwerp. Er zijn geen goede of foute antwoorden.

Waarom dit onderzoek?	Het onderzoek focust op hoe burgerparticipatie wordt ingericht en ervaren in de context van een digitale twin van de stad. Dit is interessant te onderzoeken aangezien Rotterdam zijn eigen digitale twin van de stad ontwikkeld en deze in de nabije toekomst zal implementeren. De analyse van een pilootproject geeft zowel op academisch als professioneel vlak inzichten over de *lessons learned* van het project. Dit onderzoek wordt uitgevoerd vanuit de Erasmus Universiteit Rotterdam.
Verloop	U neemt deel aan een onderzoek waarbij we informatie zullen vergaren door:
	U te interviewen en uw antwoorden te noteren / op te nemen via audio- of video-opname. Er wordt een transcript uitgewerkt van het interview. Hierin blijft u anoniem.
Vertrouwelijkheid	Wij doen er alles aan uw privacy zo goed mogelijk te beschermen. Naast de student zal alleen de scriptiebegeleider, tweede lezer en medewerkers van het onderzoeksproject TWIRL, toegang krijgen tot alle door u verstrekte gegevens. Het onderzoeksproject TWIRL wordt uitgevoerd door vijf onderzoekers verbonden aan de Universiteit Leiden, TU Delft en de Erasmus Universiteit Rotterdam. Het is een interdisciplinair onderzoek, waarbij we kennis vanuit bestuurskunde, urban sociology en critical design samenbrengen. Het onderzoek wordt gefinancierd vanuit het BOLD Cities Center dat een samenwerkingsverband is van de bovengenoemde universiteiten (een zogenoemd LDE-samenwerkingsverband).[15]
	Er wordt op geen enkele wijze vertrouwelijke informatie of persoonsgegevens van of over u naar buiten gebracht, waardoor iemand u zal kunnen herkennen.
	In het onderzoek wordt u aangeduid met een verzonnen naam (pseudoniem).
Vrijwilligheid	U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. Mocht u iets niet in een groep willen vertellen, maar wel privé, dan kunt u achteraf e-mailen of bellen. Uw deelname is vrijwillig en u kunt stoppen wanneer u wilt.
	Als u tijdens het onderzoek besluit om uw medewerking te staken, zullen de gegevens die u reeds hebt verstrekt tot het moment van intrekking van de toestemming in het onderzoek gebruikt worden.
	Wilt u stoppen met dit onderzoek? Neem dan contact op
Dataopslag	In de scriptie zullen anonieme gegevens of pseudoniemen worden gebruikt. De audio-opnamen, formulieren en/of andere documenten die in het kader van deze scriptie worden gemaakt of verzameld, worden beveiligd opgeslagen.
	De onderzoeksgegevens worden bewaard voor een periode van maximaal tien jaar. Uiterlijk na het verstrijken van deze termijn zullen de gegevens worden verwijderd of worden geanonimiseerd zodat ze niet meer te herleiden zijn tot een persoon.

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[15] Voor meer informatie: https://www.centre-for-bold-cities.nl/projects/urban-digital-twins

Indienen van een vraag of klacht

Indien u specifieke vragen heeft over hoe er met uw persoonsgegevens wordt omgegaan, kunt u deze stellen aan ██████████████████████████████ U kunt daarnaast een klacht indienen bij de Autoriteit Persoonsgegevens indien u vermoedt dat uw gegevens verkeerd zijn verwerkt.

Door dit toestemmingsformulier te ondertekenen erken ik het volgende:

		JA	NEE
1	Ik ben voldoende geïnformeerd over het onderzoek. Ik heb het informatieblad gelezen en heb daarna de mogelijkheid gehad vragen te kunnen stellen. Deze vragen zijn voldoende beantwoord en ik heb voldoende tijd gehad om over mijn deelname te beslissen.	☐	☐
2	Ik neem vrijwillig deel aan dit onderzoek. Het is mij duidelijk dat ik deelname aan het onderzoek op elk moment, zonder opgaaf van reden, kan beëindigen. Ik hoef een vraag niet te beantwoorden als ik dat niet wil.	☐	☐

Voor deelname aan het onderzoek is het bovendien nodig dat u voor verschillende onderdelen specifiek toestemming geeft.

3	Ik geef toestemming om de gegevens die tijdens dit onderzoek over mij worden verzameld te verwerken zoals is uitgelegd in het bijgevoegde informatieblad	☐	☐
4	Ik geef toestemming om tijdens het gesprek geluid-opnames te maken en mijn antwoorden uit te werken in een transcript.	☐	☐
5	Ik geef toestemming om mijn antwoorden te gebruiken voor quotes in de scriptie van de student.	☐	☐
6	Ik geef toestemming om de bij mij verzamelde gegevens te bewaren en in gepseudonimiseerde vorm te gebruiken voor al het verdere onderzoek dat er later mee gedaan kan worden.	☐	☐

Naam deelnemer: Naam student:
                                          Arthur De Jaeger

Handtekening: Handtekening:

Datum: Datum: