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Your neighbourhood, your data

Outcomes of a research game about the knowledge, attitude and behaviour of citizens in the smart city

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Introduction

What do citizens know about the so-called 'smart city' and the data technologies that are part of it? What are their privacy concerns? How do they handle their personal data? And which lessons should smart cities developers and officials draw from this? During the past year, the Leiden-Delft-Erasmus Centre for BOLD (Big, Open & Linked Data) Cities has studied these questions extensively, in collaboration with the Knowledge Workshop on Urban Big Data in Rotterdam.[1]

We developed a survey in the form of an online game. In this game, people take a virtual walk through a smart city. At several locations they have to to answer a question or carry out an assignment. At an event a security guard will ask you, for instance, whether he may scan your identity document for security reasons; at another location, you can get a discount when you fill in your email address. Thus, we ask in various ways if people in the smart city are willing to share their personal data for security goals, for financial gain, for convenience or for social reasons. At two locations in our smart city, we have made a puzzle that challenges the players to identify and click on techniques and sites for data collection, the so-called 'data points'. The game thus gives us an idea about existing knowledge (*what do people know?*) and behaviour (*what do people share?*).

We designed the game with the Rotterdam-based design firm WARP[2] and launched it the context of the Dutch National Science Weekend[3] in October 2018. During this weekend, thousands of people, among whom minister Van Engelshoven of Education, Culture and Science[4], played the game: alone, with their children, with friends and partners.

In addition, we asked research agency Motivaction[5] to draw a representative sample of the Dutch population for us. By means of such a sample we make sure that a sound representation of the Dutch population has been included in the study. Motivaction also provided us with additional data about the mentality and digital lifestyles of the respondents.

In this publication, we will report about the data from the sample and our discussions during the Science Weekend and other (scientific) events where we have played the game. Not only will we discuss what people know and share in the smart city, but also on which factors this depends.

Background

Numerous cities in the Netherlands have joined the 'smart city' movement. Not only the four big cities in the Randstad are involved. The municipality of Helmond, in the south of The Netherlands, will build a completely smart neighbourhood (by its own claim as the first city in the Netherlands), where the municipality, enterprises and knowledge institutes will experiment with new digital and data technologies to make the neighbourhood energy-neutral and safe.[6] Likewise, the municipality of Renkum, in Gelderland, has gained access to the 'smart future' with the purchase of 9,000 pieces of smart lighting.[7] Furthermore, recently a European network of smart villages has been set up, in which the possibilities of digital and data technologies are explored for rural areas.[8]

There is great optimism within the smart cities and villages movement. Whether the issue is traffic jams, pollution and overcrowding or the containment of fraud, crime and street nuisance: for each challenge in the city or village there seems to exist a smart digital or data-driven approach.

An overview made by consulting agency Berenschot in 2018 for the Association of Dutch Municipalities (VNG) shows, however, that 'smart' is barely embedded systematically in the municipal organizations, and that there are considerable risks with regard to, - among other things -, privacy, information security and freedom of choice.[9]

Besides the technological optimism, there is also an ongoing discussion between municipalities and their economic and social partners about the public values and ethical frameworks for the smart city. This permanent discussion has resulted in an entire range of principles and rules for the responsible

development of smart cities and villages, in which public values are central instead of technological or economic values.

Already in 2017, Geonovum published guidelines for the use of sensors[10]; an ever-increasing number of cities embraces the six so-called TADA principles for responsible data use[11]; and the Association of Universities in the Netherlands (VSNU) use the acronym SHARED to indicate that smart cities and villages should be there for all of us, not just for the local government or the big commercial platforms[12]. The Association of Dutch Municipalities has brought this entire range together in five principles for the digital society which all Dutch municipalities subscribe to.[13]

Where is the citizen in all of these developments? On the one hand, residents fully participate in the many new forms of participation that are being tried out in the smart city: we run into each other in 'living labs', 'hackathons', 'govjams' or 'data bootcamps'. These often involve highly educated citizens with good digital skills and a strong belief in the power of technique and innovation.

Sometimes we also encounter other citizens: more than a year ago, the municipality of Utrechtse Heuvelrug saw its plans for smart lighting run aground because of the interference of a civic action group. The group was concerned about the radiation generated by the 5G connectors fixed on top of the lamps, and they also feared their privacy would be invaded by the Wi-Fi trackers and cameras hanging from the lampposts. [14]

Articulate, active citizens who speak out in favour of or against the smart developments in their city: they are still rare. As we shall see, most people have little idea of what a smart city is and which technologies it entails. Very slowly, data and technologies get through to the agendas of municipal councils, yet a truly democratically rooted smart development of cities or villages is still a long way off. Nevertheless, we walk, cycle or drive daily through our urban or small-town environment and hand over our data, consciously or unconsciously. For this reason, we, as a research group and knowledge network, think it important to further develop the knowledge and debate about this, both scientifically and socially. Our game is, therefore, more than just a way to collect anonymous research data; the aim of the game also is to stimulate the awareness and the debate about the smart city as well.

In the following chapters, we will use the results of the game to answer three questions:

1. Which smart technologies do people recognize in the city? On which factors does this knowledge depend?
2. Which attitudes and behaviour do they display in the city with respect to their personal data? On which factors do that attitude and behaviour depend?
3. Which types of 'data sharers' are present in the smart city and what are their personal characteristics and ideas?

We will illustrate the outcomes with our notes made at the various festivals and meetings where visitors were able to play the game, and where we have talked with people one-on-one about the game and the smart city. In the final chapter, we will translate our findings into concrete recommendations for the smart city. We will call for the necessity of a digital environmental vision in which citizens, officials and the industry collectively determine the digital and data layout of their city or village. The methods of the game and the analyses will be presented in the appendix. This appendix also contains an overview of our researchers, commercial partners and sponsors.

Knowledge: What do people know about the smart city?

When you ask an average urbanite for her or his opinion about the smart city, you will most often get little more response than a glazed look. When in 2016, the British IET asked a sample of the population of the United Kingdom whether they were familiar with the concept of the 'smart city', only a meagre 18% turned out to know the term.[15] Subsequently, respondents could hardly explain what a smart city involves, with answers that varied from "something to do with technology" to "a clean city", "an interesting city" or "a city where the people are smart".

A year later, inspired by this study, two BOLD Cities researchers visited the Blaak in Rotterdam to pose the same question to passing Rotterdam residents.[16] The response was similar to that of the British study. A few people recognized the term 'smart city' and knew how to link it to infrastructure and smart devices. The majority of the people in the street got stuck in generalities that did not directly relate to the subject. One of the respondents called Rotterdam "a smart city for sure" because "we have elected a good mayor".

Our other research contexts also suggest that the smart city only seldom captures the imagination of city dwellers. In recent years, we have regularly organized seminars, interviews and an ample number of 'data walks' in the four big cities in the Randstad area.[17]

During the data walks people frequently point out security cameras; with respect to the collection of personal data, they talk about Facebook and Albert Heijn, yet they seldom speak about the data that government bodies (may) gather. The people who shout the loudest that "they have nothing to hide", may indicate during the same conversation that they are fearful of a 'Chinese situation' in the Netherlands, with which they mean the possible introduction of a social credit system.

In these conversations, the concept of (big) data proves to be a phenomenon that our participants have difficulty grasping. The examples they offer are often based on extreme media attention (for instance about scandals surrounding Facebook) or manifestations in popular culture; they frequently mentioned the Dutch reality programme *Hunted*, for example, in which people try as long as possible to remain undetected by a police search team.

Because their knowledge about data collection in the city and the related privacy issues is often limited, respondents found it hard to formulate an opinion. In this they are not alone: during the 2018 municipal elections and 2019 provincial elections, digital and data technologies were scarcely the subject of the political debate. [18]

Thus, besides this study, our mission with the Centre for BOLD Cities also is to increase the 'data awareness' of citizens. This is an important reason why we have given our study the shape of a game. The involvement of players increases when they are presented with questions and dilemmas in a playful and beautiful form.[19] In this way, the game can function as an instrument to think more about digital and data technologies in the city. With this method, we hope to contribute to the data literacy in the Netherlands.

What was our approach?

We put together a list of twenty often occurring data points in public space and distributed these over two picture puzzles in the game, one of a park and the other of a square. The players are assigned the task of selecting these data points in the picture puzzles amidst other, 'non-smart' objects. After each picture puzzle, the players are asked to answer a number of questions, to find out whether they really know what they have clicked on. This way we could score each player, indicating the extent of her or his knowledge.

How did this turn out?

Most people recognize nine to ten of the twenty data points in the picture puzzles. From this we deduce that people usually do have a basic idea about the locations in the city where data are collected, but do not recognize most of the types of data points. The three data points most often found are free Wi-Fi, the rain sensor at the traffic light and the check-in gates at a public transport station. The least frequently recognized data points are the traffic detection loop that registers the presence of cars and/or bicycles at a traffic light, the sensor for the groundwater level, and city hall (see the table at the bottom of this page). Because of our special relationship with the city of Rotterdam and its Knowledge Workshop Urban Big Data (which, among others, made this study possible), we have made a separate analysis about the Rotterdam respondents. Much more often than others, they recognize the rain sensors, which may be explained by the fact that, in Rotterdam, they have been abundantly promoted.

Notable for the most often recognized data points is that they require some action from people, or that people directly and palpably benefit from them. They get, in other words, a physical experience from them. You personally log in to a free Wi-Fi network; at a check-in gate, you hold up your card to the scanner. Although a rain sensor does not require interference from a city dweller, it does have direct physical consequences (when it rains, the traffic light for cyclists changes to green more quickly, making the wait for cyclists shorter[20]). Highschool students, by the way, have a lot of fun 'hacking' the system by emptying bottles of water over the sensor.[21] Yet, to two barely recognized data points, - the traffic detection loop (28%) and the measuring point for groundwater (20%) -, the opposite applies. Those data are collected without any action from the citizen, which possibly makes many city dwellers feel that it has nothing to do with them personally.

For us, it is hard to imagine why our players clicked the least frequently on city hall as a data point. The municipality is an heavy data collector, for instance for the civil registry, benefits or licences. Maybe the set-up of our game makes people think that only hypermodern services are involved. Yet, the low percentage (18%) has also made us suspect that people really are unaware that municipalities do gather quite a lot of data.

Which city dwellers have much or little knowledge?

Knowledge about the data points turned out to depend on age, gender, income, mentality and digital lifestyle. People who recognize many data points are more often than others young and male (although the 'top-scoring group' mainly consisted of women – see the box below). Furthermore, the 'connoisseurs' in the game more often have a high income.

With the help of the additional data provided by research agency Motivaction, we can also find out whether the 'mentality' and the 'digital profile' of respondents make a difference for the number of data points recognized[22]. The people who recognize many data points, more often have a so-called 'postmodern mentality'. Motivaction describes this group as "pioneers of the adventure culture, in which the experiment and breaking through moral and social conventions have become goals in themselves". The group who knows much does not distinguish itself by any specific form of digital behaviour. As the knowledge and mentality of this group already suggest, people who are using social media without much technical knowledge, simply because "everybody does it" (the so-called 'Digital Interactors' in the Motivaction profile) are rare here.

Is knowledge still connected to concerns about privacy?

Do people who recognize a lot of data points and thus are aware of how many data are collected in their environment, have more concerns about their privacy as a result? And the other way around: are there fewer concerns when people know little? Our common sense about 'blissful ignorance' suggests this to be true. After our data walks, participants often sighed that they were ignorant about the many data collected in the city and that they would take more notice. Our study indeed shows this mechanism. In the next chapter we will discuss it in more detail.

Attitude: How do people behave in the smart city?

In the past year, during our meetings with different people and public groups, we have encountered a wide variety of ideas about privacy. One of us gave a so-called 'silent disco' lecture at a science festival in Nijmegen and invited people to vote on privacy with their feet: the public could step into the box 'concerned' or the box 'unconcerned'. Both boxes were well visited, as was the case at another festival in the Maassilo, were we repeated this exercise. Of course, some people said they had nothing to hide, while others were seriously worried, and still others took up a position in the middle, saying their position depended on the situation.

Concerns about privacy

In the game, we have made a systematic analysis of these attitudes, based on the work of the American privacy researcher Alan Westin.[23] In the Nineties of the past century, he presented people with propositions about their trust in the way in which enterprises and organizations handle their personal data[24]. We have rewritten his propositions into three statements about the government and the way it handles the data gathered from citizens.

For our propositions we focused on the government, since the development of the smart city in the Netherlands is mainly driven by local governments. In the game we have asked people to what extent they agreed or disagreed with these statements:

I think that the government handles the personal data of people in a proper and trustworthy way;
I think that people do not have control over the personal data the government collects about them;
I think that the laws and rules in our country guarantee that the privacy of citizens is protected.

We gave the label 'unconcerned' to those people who gave three answers indicating great trust in the government and few concerns about privacy. Whoever expressed worries three times, received the label 'concerned', and everybody in-between we called 'variable'.

Just like Westin observed with his respondents, the majority of our players proved to be positioned in-between concerned and unconcerned; their answers to the statements suggest that they are concerned about some things but not about others. Rotterdam inhabitants seem to be a little more outspoken than the rest of the Netherlands; slightly more Rotterdam residents are outspokenly concerned or unconcerned than is shown in the nation-wide results.

China

During lectures and events and in the focus groups, people often tell us that they are not so much concerned about the way their data are dealt with in the Netherlands, but that they do fear 'Chinese affairs'.

With this they mean the 'social credits' system, used for the surveillance of Chinese citizens by means of cameras equipped with facial recognition. Violations result in a lower credit score, which may have consequences for a citizen's opportunities on the labour market, opportunities to travel or get a mortgage, and where the children are allowed to go to school. This has been covered extensively by the news and everybody has at some time heard about it.

People use 'China' this way to indicate that, even though they are quite unconcerned, they nevertheless do have clear limits.

Privacy concerns also depend on the situation

One critique of Westin's work is that concerns of people about their privacy is not a static given. Worries about privacy are also thought to depend on the type of data being collected (for instance: personal or non-personal data) and the goal of the collection (for example: service provision or surveillance). In addition, the assumption is that in each situation in which people share their personal data, they also take into consideration what is in it for them. Well-known considerations involved in this process are those concerning security, covenience, financial gain and social benefit.

For this reason, we designed eight situations for our game in which people have to decide whether they are willing to share their data to attain a specific goal. In the game, we presented the players with the following choices:

1. Do you check in with a personalized or an anonymous public transport chip card?

2. Do you trade in your email address for a discount pass?

3. Do you share your location data with the government, enabling it to carry out crowd management?

4. Are you willing to evaluate your visit to the city and share it online?

5. Do you choose a short route past surveillance cameras or do you go around?

6. Do you want the deposit money from a smart wastebasket to be deposited on your bank card?

7. Do you allow scanning of your identity document to visit an event?

8. Would you like to receive a video of your visit to the smart city, to share it via social media? In return, video images with your facial characteristics will be stored in the municipal archives.

The players who left their personal data behind in all eight situations were scored an 8; those who did not share anything were scored a 0; people who shared something once were scored a 1, and so on. On average, our respondents traded in their personal data four to five times for something in return. This outcome is not very different for Rotterdam residents.

It is remarkable that a vast majority of respondents is willing to share their data for the purpose of security and convenience. In Rotterdam, this happens even more often than in the rest of the Netherlands, but the differences are not big or remarkable (except for the greater willingness among Rotterdam citizens to choose a personal public transport card).

The group of players was divided approximately fifty-fifty where trading in personal data for financial gain was concerned, yet sharing personal data for social purposes was not easily done, at least not in this game. An overview of game situations and the accompanying percentages of people willing to share data can be found on the next page.

Complex considerations

We will discuss one situation in more detail because we have deliberately designed it to be more extreme. To gain access to an event, players were asked to have their identity document scanned for security reasons. According to the General Data Protection Regulation (AGV) this is prohibited.

At the site of the Dutch Data Protection Authority, one can read that an organization is only allowed to make a copy or scan of someone's identity document if it has a legal obligation to do so.[25] The government, banks, notaries, casinos and caregivers are allowed, but rental companies, hotels and telecom providers are not. ("They can ask to see your document to determine who you are and are allowed to note some of your data down, but making a copy is prohibited.") In the game, many of our respondents (61%) gave permission to scan their identity document. The considerations we heard during the festivals and events where people played the game, show what kind of thoughts they entertained:

"I just think it's good for security. I've got nothing to hide."

"I trust the man in that uniform. If he asks for it, I assume it's okay."

"I just want to know what's going on there."

"I've got no choice. How else can I get into that event?"

"I do value my privacy, but I know that we don't have privacy. It doesn't matter. They already know everything about me."

"I'm completely like: 'Everybody may know everything there is to know about me…'"

"I can't be concerned with that all the time, can I?"

Here, we see a whole range of attitudes pass by, - resignation, innocence, trust, curiosity, exasperation -, that we have heard in other conversations and that are not unique to this specific situation. In the game, these people all acted alike (they delivered their data), but in doing so, their considerations and feelings differed. The other situations in the game, too, gave rise to many questions and sighs. In the game, for instance, players could choose to go around in order to avoid security cameras, whereupon someone said:

"Why would you take the long route anyway [without security cameras and drones]? I just take the shortest route; I don't care how many cameras are hanging there. Why would you explicitly choose […] the route without cameras? Does that mean… does that make you the guy who has also done bad things or… Yes, what do you have to hide, anyway?"

Differences between people

Which factors can explain why people are concerned to a greater of lesser extent about their privacy? Our analysis shows that respondents have more worries about their privacy when they possess more data knowledge (which means that they recognized more data points in the game) and have less income. When the possible causes of privacy concerns were weighed against each other, less income proved to cohere most comprehensively with more privacy concerns. Why, in this case, income plays such an important role, is not directly explained by our analyses and should be studied in future research.

Sharing personal data can be explained based on the extent to which people worry about their privacy; people share their data more when they worry less. No wonder, we are inclined to think, yet in many other studies a so-called 'privacy paradox' has been found. This paradox means that, although people say they are worried about their data, they subsequently share it many times.[26] In our study,

however, we have not found this paradoxical phenomenon. Furthermore, the lesser their data knowledge, the more people share their personal data.

Profiles: Which types of data sharers do we see in the smart city?

When people reach the end of the game, they receive feedback from the game which tells them what type of 'data sharer' they are. There are four possible outcomes: generous data sharer, thrifty data sharer, unsuspecting data sharer and aloof data sharer (see the picture). The outcome is determined by the individual score for recognition of data points (varying between 0 and 20) and the number of times players have shared their personal data (between 0 and 8).

Our goal with this feedback in the game is to encourage people to think some more about their behaviour regarding data in the smart city. During the various events and meetings, too, we observed that the feedback produced a lot of topics for conversation.

Heated discussion

During Expedition Next in Rotterdam, a young couple playing the game together get into a heated discussion: while the girl is an unsuspecting data sharer who does not see any danger in sharing her personal data (on the contrary, she only sees its benefits), her boyfriend is a thrifty data sharer. He is astonished that his girlfriend expresses a blind trust in organizations and authorities that collect her data. As far as he is concerned, the Dutch government is "totally incapable" when it comes to the protection of his personal data.

The study shows that more than a third of the people can be classified as 'unsuspecting data sharers'. This means that they recognize few data points and share many personal data. The opposite profile, which applies to people who recognize many data points and share very little (the 'thrifty data sharer') occurs least frequently. The diagrams on this page show the precise data and distribution per category for the entire sample and for the Rotterdam subgroup.[2]

In our study, we have assessed if the four types of data sharers depend on socio-demographic background data, the attitude with respect to privacy (concerned, varying and unconcerned), their mentality and their digital lifestyle. Of all of these variables, only 'place of residence' proves not to be important. The four types of data sharers have clearly different profiles for all other variables (social, mental and digital).

The unsuspecting data sharer

More than a third of our respondents fall in this group of people, who recognize only few data points in the city and share many personal data. More often than might be expected based on chance, this involves low educated, older women with an income below average. They are not overly worried about their personal data and are very active with their social media. With respect to mentality, the unsuspecting data sharer belongs to the 'modern citizenry'[29] and the 'upwardly mobile'. At the same time, he or she cannot be classified as 'post-materialist', since the citizens involved are concerned about their status and are uncritical about social developments.

Visible cameras?

In 2017, during a walk with employees of the Rotterdam municipality, we were walking through an area full of security cameras. The group, which consisted of a mix of women and one man, were engaged in an enthusiastic conversation about the way in which they use Instagram and Facebook to keep in contact with family and friends. The BOLD Cities researcher who escorted the group, wanting to shift the focus of the conversation back to the data points, said: "Of course, we all see the cameras here, but what else do we see?" The group looked around and one person asked: "Where do you see cameras, then?" She had never before recognized the 360 degrees camera that looks like a ceiling light for what it really is.

The generous data sharer

A quarter of our respondents fall in this category. Like the unsuspecting data sharers, they hand over many of their personal data, but they do recognize many more data points than the unsuspecting respondents do. More often, these respondents are young men with a high income. Their digital profile also differs from that of the unsuspecting data sharers. Instead of being enthusiastically digitally interactive, they are "pragmatic, cautious and unsure towards the digital world, yet keep up with the developments."[30] With respect to mentality, they belong to the 'upwardly mobile', the career-oriented individualists who have an outspoken fascination for social status, new technology, risk and a thrill."[31]

I don't own a car

During one of the data walks, international bachelor students from a Rotterdam degree programme clearly let us know that they link questions about data in the city mostly to themselves. They, too, indicated more than once that they "had nothing to hide". When the data were about car traffic and parking in the city, the participants showed little interest. "I don't own a car," several people piped, 'so this doesn't matter that much to me."

What the municipal refuse collection might do or should be allowed to do with various data applications, could not interest them either. After all, they said, they just threw their garbage away in the student housing complex where they lived.

The use of data for security purposes was such a self-evident phenomenon for the participants that they have stopped thinking of being critical about it. As the students said: "That's just how it is, isn't it?

The aloof data sharer

This is someone who shares few data and also recognizes few data points. Of our respondents, 20% are aloof data sharers. With respect to their socio-demographic profile, they resemble the unsuspecting data sharer: aloof data sharers more often are older, relatively low educated women with an income below average. The aloof data sharer is only online when necessary, has little affinity with technology and is clearly worried about both her or his personal privacy and the privacy of others.

Data secret

"No, look, I remember the Second World War. Not that I lived through it, but I did hear the stories people told. Also about the… those Germans simply seized all data at the Civil Registry and the Jews, of course, and Roma … Gypsies and everything, and in general, people thought it a disgrace. And now, the same thing happens again, much more sophisticated, and almost no-one speaks up and I think that's very remarkable. And I fear those data aren't safe. Not at the hospitals, because they find garbage bags in the street, with the data of all these people inside, just like that. And not with the government, either, the Tax Administration… one failure after another. We used to have the secrecy of correspondence. I truly am an old fart. Why is there no secrecy of data?"

(From an interview with seniors in a community centre. Speaking is a community development worker)

The thrifty data sharer

Almost 20% of the respondents belong to the people who recognize many data points but share their data only frugally. Thrifty data sharers are more often men than women, they are relatively young and earn a relatively high income. In terms of mentality, this group contains people with cosmopolitan, post-materialist and hedonistic values[32]. People in this group share several characteristics: they are eager to gain new experiences and have a strong penchant for self-realization. Furthermore, they have a tolerant attitude. They keep up with digital developments without much enthusiasm and are concerned about their personal data.

> **No Internet**
>
> "I had a colleague who wasn't connected to the Internet. As a matter of principle. That's already twenty years ago, I think. The more you know about it, the more scared you get. Because they might be parked at your front door with a little car and a laptop and then they can register every keystroke you type on a keyboard…"
>
> *(From a conversation with seniors in a community centre. Speaking is a retired ICT professional)*

Outside the boxes

The quantitative data yielded by the game, which enabled us to compile these four possible profiles for data sharing, show several clear and understandable tendencies. We see that the knowledge part of the profile is clearly connected to socio-demographic characteristics: education, age, gender and income. Beside the amount of knowledge they possess, whether or not people share their data seems to be explained primarily by people's attitude to life and the extent to which they are worried about privacy. We also know from conversations with players, however, that some of them are not so easily placed into quantitative boxes at all. We encountered the following group, for instance, at a community college where we let students play the game. In view of the small amount of data points they recognized and the amount of data they shared, the players emerged from the game as 'unsuspecting data sharers'. Yet, their behaviour cannot be easily classified as such (see the box).

> **Unsuspecting or clever?**
>
> "You won't be able to find anything about me on the Internet." The students following an IT training use fake IDs, fictitious names and special email addresses whenever they go online. They have been doing this from a young age, which has almost entirely prevented them from appearing when they google themselves.
> "Big companies like bol.com and H&M may have my real data. Those I trust. Not those small companies…" They want their online orders to be delivered at a pick-up point.

Recommendations: Which steps can the municipalities take?

In the previous chapters, we have presented the results of the research game *Your neighbourhood, your data* (in Dutch: *Jouw buurt, jouw data*). The goal of this game was twofold: first, we wanted to gain insight into the knowledge level and data behaviour of citizens. We were curious to find out whether they recognize data points in public space and know what these devices do. We also wanted to examine in which situation a citizen is willing to share personal data. This resulted in a data profile that indicates whether the player is an unsuspecting, generous, aloof or thrifty data sharer. Secondly, through the game we wanted to make citizens more aware of these data points in public space and of the privacy dilemmas one encounters every day.

At some points, the results show the gap between high and low educated people that also manifests itself in many other social areas. In the game, highly educated people on average recognize more data points than low educated people do. Those who recognize more data points are less often willing to hand over their data. Those who are more concerned also share less quickly. Yet, in our sample, how worried you are about privacy is not related to the level of education.

Either way, most people have a varying attitude towards privacy issues and let their behaviour depend on the situation. In this context, we saw that they share their data most easily in situations where they receive safety or convenience in return. A large part of the people who played the game emerged from it as unsuspecting data sharers. That means that they recognized a small number of data points and shared their data often. The people who recognized many data points in the city and kept their data to themselves, - the thrifty data sharers -, made up the smallest group.

So what do the outcomes of the research game mean for citizens and officials in the smart city? Should something change or improve and, if so, who can we address to initiate that? In other words: what is the agency and responsibility of citizens and officials? Our study points in four directions.

Data wisdom: greater knowledge is a necessity

The outcomes seem to lead directly to a recommendation about data literacy, and we have indeed already advocated such an element in various contexts, as a part of education and training courses.[33] To make citizens, and in particular vulnerable groups, more aware of the fact that they have a say in the extent to which, and the form in which, digitalization and datafication take place, most of all requires knowledge about data points and streams, about ownership and the goal of these data (just like people also need knowledge about infrastructure such as trains and buses in order to understand and use them). In our view, the form should facilitate citizens to find out together which data and digital technologies are present in their environment and how they want to handle these. There are many forms to consider for this: we already saw, for instance, how low educated adolescents have found ways to protect themselves from which their teachers could learn a lot. This data literacy should also urgently extend to the representatives of citizens in political parties.

The necessity of a vision about the smart city, technology and privacy has hardly reached the local political agendas. As long as a party leader of a big Amsterdam party can publicly state that big data is no more than a "hype of hipsters"[34], there is still much work to be done. Yet, at the same time, a recommendation about data literacy places the responsibility too simply on the shoulders of individual citizens and representatives, while the greatest challenges of the smart city do not solely, and maybe not at all, unfold on that individual level.

A first step to increase data literacy among the younger generation might be, for example, to offer the game *Your neighbourhood, your data* as part of teaching packages for the subject media literacy (for groups 7 and 8 of primary school and/or classes 1 and 2 of secondary school). Besides awareness, the

game also provides an occasion for discussion and the exchange of knowledge between students as well as between teacher and students.

More transparency and recognizability of the digital infrastructure

We have to conclude that, for many, the digital infrastructure is hard to recognize in public space. Although some data points are visible, data cables run underground, and data signals fly through the air: smart space is not quite eye-catching. For this reason, the second recommendation resulting from our study is to make technologies and data collection (more) visible. Several cities have already begun to set up a register for sensors and smart devices, which describes the location, type, ownership of data points, and the goal of the use of data.[35]

To increase the visibility and transparency of data for citizens, at a number of data points in public space information and an explanation could be provided, for example by means of accessible, artistic interventions, in a style appealing to all citizens (and in particular vulnerable groups).

To conclude, the design itself of digital and data technologies can be changed. Under the heading of 'adversarial', 'contestable' or 'reflexive' design, it would be possible to design these technologies in such a way that the users, - in this case citizens -, can immediately see what happens with their data. This enables them to determine what they think about it and how they would like to deal with it; as the Amsterdam technology centre Waag Society states: "We code for digital sovereignty."[36]

Make use of the Environment and Planning Act as a chance to achieve a collectively supported digital vision

During the conversations we had around the game, we often heard statements such as "there's no way of escaping it", "I don't have an alternative" or "I can't be alert about privacy all the time, can I?". This suggests that people lack agency to do something about their own privacy and data environment. And that perspective is, indeed, missing, since the smart city confronts one with visible and invisible data points that leave only two options: to share or not to share. The new Environment and Planning Act requires that cities and developers involve all parties, including citizens, in the furnishing of new areas (and in the renovation of old areas as well). Slowly, digital and data technologies now start to become part of the meetings about such an environmental vision, but often only in an instrumental role, to improve the moulding of that vision and to realize the goals more easily.[37]

One step further is the acknowledgement that those technologies, too, might in themselves be a subject for ideas and, - never to be forgotten -, feelings; consequently, they should be designed collectively, with input arising from everybody's interests and wishes. This means that the input of citizens should take place much earlier in the process of developing the smart city than is usual now, both digitally and physically. Elsewhere, we have already argued for the development of smart cities, based on a 'digital environmental vision', and we repeat this argument here.[38]

A digital environmental vision requires that the design of smart applications is always developed in cooperation with citizens and other involved parties. This includes the question which issue exactly you mean to solve, and in which broader vision on the city the smart technique fits; another necessary question should be whether instead of smart solutions, there may be simpler alternatives. The existing process for the physical environmental vision can be copied quite easily into the development of a digital environmental vision.

Work towards a 'SHARED' city instead of a smart city

We noticed during our conversations with the game's players that they almost always speak about 'them': they collect, they know everything, they can … In this, we detect a feeling of distance between citizens and their digital environment that is exactly what is undesirable in a city or village. Not without reason, many mayors frequently utter the statement that the city or village "belongs to us all". Therefore, we should assess the municipalities' smart city initiatives on the question whether and how they keep the city or village as something, or make it into something, "belonging to all of us". Is that smart city also becoming a SHARED city, where citizens, the government and local stakeholders determine collectively the 'why', 'how', 'of whom' and 'in order to' of the smart applications?

SHARED values constitute the ethical framework used by the Association of Universities in the Netherlands (VSNU) to test its research agenda for a human-oriented digital society, and we can apply them in more detail to the development of a shared smart city.[39] A smart city is SHARED when:

- Its digital vision and policy are both implementable and useful in the long term *(Sustainable)*;
- Its digital vision and policy are open and inclusive, respect legal, moral frameworks and etiquette; they do not sharpen existing differences, nor create new ones *(Harmonious)*;
- It acknowledges and consders that more is involved in digital and data technologies than only purely rational arguments; it can also evoke a range of positive and negative feelings in people and groups, such as high-tech excitement or fear of 5G radiation *(Affective)*;
- It involves exactly those groups and interests that will have to deal the most with the effects of data and digital technologies *(Relevant)*;
- The digital and data solutions also make it possible that all those involved can see, understand and assess the technology in question and, as much as possible, will be able to use the technology themselves as well *(Empowering)*;
- The diversity is recognized and acknowledged, not just with respect to the socio-economic, cultural and ethnic differences in the city, but also with respect to the use and appreciation of digital technology and data *(Diverse)*.

To close, we conclude that the research game has yielded interesting results. Yet, it also shows that, for many, the datafication of public space still is a complex issue. Another remark we must make regarding the outcomes of the research game is that people do not act unambiguously when their privacy is at stake. There are big differences between people, but it also happens, for instance, that people at one moment decide not to share their data but do share them at another time. For this reason, conversations with individuals to get an idea of their action perspectives are indispensable to do justice to the complexity of the smart city. Consequently, a next step for our study will be to organize focus groups, where we will engage specific groups of people (high school students, the elderly, et cetera) in conversation about data awareness and the effect of datafication on their actions.

Colophon, sources and methods

Colophon

De game had been devised and designed by the researchers of the Leiden-Delft-Erasmus Centre for BOLD Cities presented below. They have analysed the data and attended to this publication.

Liesbet van Zoonen is professor of Sociology at the Erasmus University Rotterdam. She is science director of the Leiden-Delft-Erasmus Centre for BOLD Cities, and co-founder of the Knowledge Workshop on Urban Big Data in Rotterdam. She also leads the programme line Digital Cities and Communities in the research agenda Digital Societies of the VSNU.

Emiel Rijshouwer is industrial designer and urban sociologist. He works as a researcher for Erasmus University Rotterdam and the municipality of Rotterdam on a project about 'data empowerment' in public space. He received his doctorate with a thesis on the evolution of Wikipedia and the Wikimedia Foundation.

Els Leclercq is city planner and works as a research fellow for the TU Delft and the AMS Institute. She studies new organizational structures for urban processes. Els received her doctorate with a thesis on the privatization of public space.

Luuk Schokker works as programme coordinator for the Leiden-Delft-Erasmus Centre for BOLD Cities. In this role, he sets up and coordinates research projects and (public) activities.

Fadi Hirzalla is assistant professor at Erasmus Universiteit Rotterdam. His research focuses on the question how digital media and technology influence citizenship. He is coordinator of the Rotterdam Knowledge Lab Urban Big Data.

Sarah Giest is assistant professor at Leiden University. Her research focuses on the analysis of policy instruments and the capacity for innovation, technology and sustainability, for instance during the use of big data for urban policy.

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Sample and additional background variables
Motivaction

Used methods

Sample date
Data collection by Motivaction took place between the 23th and 26th of May 2019.

Sample size
2039

List of variables

Knowledge (Chapter 1)
Two picture puzzles and explanatory questions

Attitude (Chapter 2)
Three 'Westin propositions'

Behaviour (Chapter 3)
Eight questions about data sharing

Socio-economic status
Gender
Age
Education
Income
Place of residence

Mentality
Eight mentality profiles from Motivaction

Digitality
Five digital lifestyles from Motivaction

Analysis techniques

Knowledge (Chapter 1)
Frequency tables, bivariate correlation analysis, linear regression analysis

Privacy concerns (Chapter 2)
Frequency tables, bivariate correlation analysis, linear regression

Data profiles (Chapter 3)
 Frequency tables, ANOVA, Chi Quadrat Test, bivariate correlation analysis

Want to know more?
The complete data set can be retrieved via the Centre for BOLD Cities and will be published online at the Centre's website.

The original SPSS output (with analyses and results) on which this report and accompanying factsheets are based, and also a description of all individual variables, can be retrieved via the Centre for BOLD Cities and will be published online.