Designing the

Human-Scale Scan Car



unsense x AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS



Source: NOS Niewsuur

The rise of the Scan Car

Scan cars are increasingly becoming the eyes and ears of the municipality. Used for a variety of needs – from enforcing parking policy to registering waste to be picked up on the street – these vehicles bring major advantages. In cities across the Netherlands, scan cars being employed for a variety of municipal tasks. In Amsterdam, the city is executing a pilot with machine-learning equipped cameras mounted on garbage trucks, which automatically geo-locate and classify garbage on the streets. This information will then be made available to garbage collection trucks, allowing them to plan their routes efficiently. Rotterdam is experimenting with scan cars equipped with visual cameras and LIDAR to capture both images and 3D point clouds. With these vehicles increasingly relying on data collected in public space, now is the time to guide this future in a more ethical direction and prevent the creation of a 'big brother' city.

This three-part design sprint was designed such that interesting, creative ideas could be developed within a short time-frame. We invited representatives from the Municipality of Amsterdam, Rotterdam, CTO of Amsterdam, TADA, and researchers from TU Delft to participate, share insights and collectively work towards a more human scan car.

This booklet presents the outcomes of this process. From reevaluating sensing technology used in registering parking violations to further exploring forms of human interactions with the scan car, each concept focuses on adding different human perspectives to the existing model of urban data collection.

Responsible Urban Digitisation

As digital technologies enable us to complete tasks quicker and cheaper than ever before, it is no surprise that municipalities across the world are adopting them to streamline operations and reduce costs. Low-cost, internet-connected sensors create new ways of measuring, monitoring, and modifying the built environment that were not even possible10 years ago.

Whilst the automation of civic processes using sensor technologies can bring certain benefits (cleaner streets, reduction in fraud, etc…), they also threaten to erode the organic relationship between people and the cities they live in. Often overly focused on efficiency and "seamlessness," these systems can become opaque, confusing, or outright threatening to residents of the city. Designing for seamlessness can obscure the mechanisms behind a technology, making it difficult for citizens to understand and have agency within these systems.

In order to ensure that the benefits afforded by these systems are achieved without sacrificing the privacy of citizens, we believe that design must play an increasingly central role.



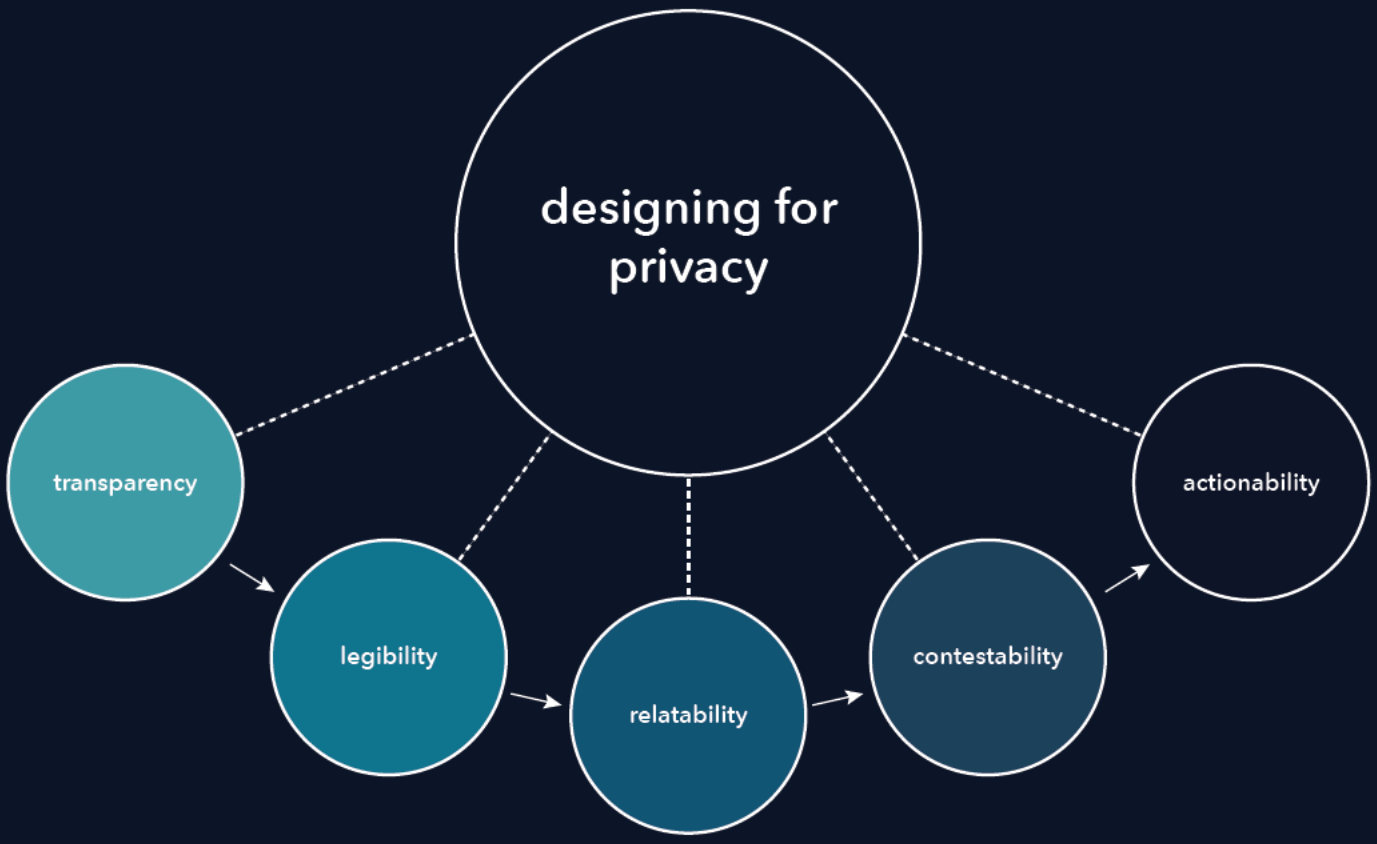
Mapping + Optimising Routes



Parking Control



Public Security



design principles

In discussions surrounding responsible digitization in cities, privacy and security often materialize as the primary concerns. While we believe that these concerns are well-founded and crucial, we believe that improving privacy alone does not go far enough. In order for digital systems to be designed responsibly, it is also crucial to consider and enhance a system's transparency, legibility, relatability, contestability and actionability.

With this in mind, we developed a spectrum of five design principles, ranging from simple interventions (improving transparency) to more involved ones (making data actionable). All of the concepts proposed in this booklet fall somewhere along this spectrum, which acts as a tool for differentiating between the various proposals.

Assembling a team

To tackle this challenge, we assembled a diverse team of experts from around the Netherlands. The sprint attendees came from different backgrounds, working in academia, design, and for municipalities. Uniting all attendees, however, was an interest and experience in the ethical use of technology in citites. Co-hosted by the Amsterdam Institute for Advanced Metropolitan Solutions (AMS) and UNSense, we worked together to create potential futures for a more human-scale scan car.

organizers

AMS
AMSTERDAM INSTITUTE FOR
ADVANCED METROPOLITAN SOLUTIONS

AMS Institute is the joint initiative by TU Delft (TUD), Massachusetts Institute of Technology (MIT) and Wageningen University (WUR) in Amsterdam, the Netherlands. AMS is an internationally leading research institute that applies scientific knowledge to actual urban projects in Amsterdam and beyond.

UNSENSE

UNSense is an arch tech company that applies design thinking, data, and technology to the built environment. Rooted in UNStudio and built upon 30 years of architectural practice, UNSense combines the ability to design great buildings, spaces and places with a deep understanding of the potentials of integrated technology.

participants

TU Delft

City of Rotterdam

tada

Universiteit van Amsterdam

City of Amsterdam



The Design Sprint

Oct. 29



Session 1
Framing the Problem

The first session focused on framing problems of data collection through automated sensing systems by explicitly pinpointing the perspectives of different major actors and looking through the lense of data ethics.

How might we combine the human scale of our older, manual processes with the efficiency and utility of automated, robotic systems?

Session 2
Developing Solutions

The second session focused on ideating and developing solutions in response to the problems identified in the first session. To better communicate and visualise the outcomes of the sprint, we further developed and consolidated the design ideas in between the sessions and reworked them into four concepts.



Oct. 30



view the concepts

Nov.
5



Session 3
Presenting Concepts

We presented the four concepts in the final session, each focused on improving on the current methods of urban data collection. In this session, we gathered useful feedback from the workshop participants and discussed potential opportunities and roadblocks in realizing the concepts in practice.

What if you could talk back?

The ability to contest or refute a decision made by an automated system is crucial in ensuring that our technical systems adhere to the same standards we hold our civic institutions to. Currently, after being fined by scan car for a supposed parking violation, one receives a letter in the mail with the fine and instructions on how to pay. Given the time gap and the analog format that the fine is delivered in, it is difficult to effectively contest such an action.

An instant fine notification, built into the existing parking payment app, would reduce the time gap between a fine and notification, making it easier to understand exactly when and why a particular decision was made. The ability to tag one's license plate with information that could be communicated to the scan car (i.e. temporary parking or disability status), could eliminate the need to contest by ensuring that fewer errors were made in the first place.

There is, of course, a tension here between the need to make a system "human friendly" and the strictness that is required of a punitive fining system. These conditions are not mutually exclusive, but will require extra consideration when developing this concept further.



1


"[redacted] my Car:
Back in 5 Minutes!"
Pay Parking
Leave an e-note:
View Bills
Leave an e-note:
Temporary Parking
Leave an e-note:
Unloading my car; back in 5 minutes!
123

What if you could talk back?

Design Elements



Making the System Visible

A well-designed landing page describing scanning methodology (i.e. grace period, decisionmaking process, actors involved). Images and/or video are attached to penalty notification, showing exactly what the scan car "saw."



Diversifying Functions of App

Fine payment can be made entirely in-app, with users able to add images and video if contesting a fine.



Instant Fine Notification

Instantly get notified of a fine via push notification, if using the payment app. Have the ability to directly engage with the municipality representative.



Digital License Plate Tagging

Users can tag their license plate with additional information to be read by the scan car. A five-minute "loading/unloading" tag, for example, would trigger a countdown that would be seen by the enforcement organization.

1

“We like the concept of leaving notes both to the public and to the scancar; how could we motivate people to use this app’s new features?”

- design panel feedback

What if you could see what it sees?



When we see a car driving around with a camera mounted on top, we get the feeling that we are being watched. But what exactly is the car "seeing"? In this concept, we explored various ways in which the design of the scan car can better communicate what the car is seeing. Mounting license plate scanners at license plate height, rather than eye level communicates that the car is not looking at humans, but at license plates. An icon- and color-based signage system mounted atop the car communicates when the scanner is active and what it is scanning for at the moment.

In Rotterdam, scan cars collect and discard image data instantly, leaving behind only the metadata of identified waste to be picked up on the street. It is important to communicate this process clearly to the public. Direct communication on the object or in its surroundings, rather than through a website or app, should be prioritized here. One potential concern raised by this concept would be the difficulty of ever truly being able to see what the scan car sees, as in reality the computer is seeing in a series of 0s and 1s. As designers, we should continuously search for new metaphors that allow us to communicate this accurately.

2


Live Stream
Scancar Data
Object Type
Geotag Coordinates
Timestamp
Notifications
A refrigerator on the curb is available for pickup 1.2km away
Gemeente Amsterdam
AR
What you see
What I see

What if you could see what it sees?

Design Elements



Function Icons

Standardized icons and colors communicate the scanning function(s) of each vehicle. Icons are illuminated when actively scanning, and turned off when inactive.



Data Circularity

An app or web page displays "data circularity:" what is thrown out, what is reused, and for what purpose?



Form Communicates Function

The physical design of the sensors should communicate function. Low-mounted sensors, for example, would make clear the camera is looking at ground level and not at humans.



See Like the Scan Car

AR tool lets users understand how the scan car algorithm "sees". Users point their phone camera at objects on the street and see how it is identified and converted to metadata. Users can report mistakes to improve the algorithm.



Live Online Data Stream

Stream of realtime data is displayed online in a running list. This is a dynamic database showing metadata, rather than image data.



A Tool for Action

A tool notifies residents of large objects waiting to be thrown out. This way, residents can take the objects themselves, saving money and avoiding a trip to the landfill.

2

“It would be great if there were more physical ways of ‘seeing what the car sees,’ such as a screen on the car.”

- design panel feedback

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What if the car was like a neighbour?

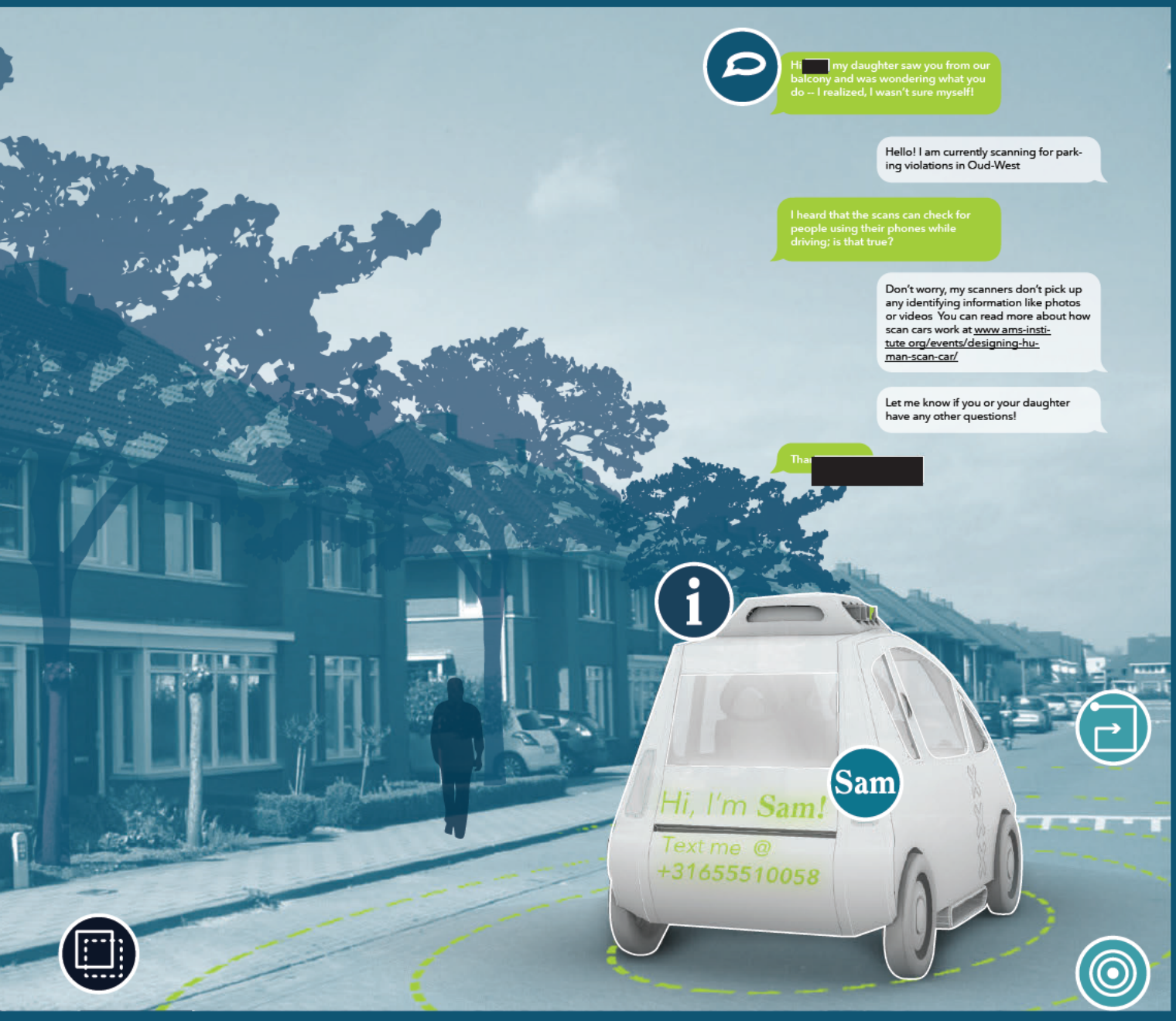
Seeing the same people performing a task regularly in your neighborhood (such as waste collection or law enforcement) creates a sense of familiarity with these systems and the people behind them. As these tasks increasingly are taken over by automated systems, how will our relationships with them change?

Here, we reimagine the scan car as a neighbor: both a familiar entity and source of useful local information. Giving the cars familiar names serves both to make the cars identifiable and to give a better understanding of how many of these vehicles are circulating at once. One could send a text to a car that they see driving around the neighborhood, asking questions about the type of data it's collecting, privacy concerns, or what the data is being used for. The car could utilize an external screen that could dynamically display information relevant to the neighborhood that it is passing through (road closures, restaurant openings, etc.).

As more and more scanning functions are conducted by the same vehicle, our relationship to these vehicles may become complicated. We have a very different relationship to and expectations of a police officer than we do a fireman. We believe understandability and relatability are a foundation of trust in a system, and therefore think functions should be separated as much as possible. Upon seeing a vehicle, one should be able to understand what the function is. To even further increase ownership of these systems, residents could collectively participate in creating scanning schedules for the neighborhood.



3


Hi [redacted] my daughter saw you from our balcony and was wondering what you do -- I realized, I wasn't sure myself!
Hello! I am currently scanning for parking violations in Oud-West
I heard that the scans can check for people using their phones while driving; is that true?
Don't worry, my scanners don't pick up any identifying information like photos or videos You can read more about how scan cars work at www ams-institute org/events/designing-human-scan-car/
Let me know if you or your daughter have any other questions!
Tha[redacted]
Sam
Hi, I'm Sam!
Text me @
+31655510058

What if the car was like a neighbour?

Design Elements



Radius-Based Visibility

Residents can see the cars located within a ~300 meter radius via an Uber-like interface. Tap on the car to ask a question.



Localized Routes

Scan car routes keep within a few neighborhoods so that residents see the same vehicle with frequency, Making the system more legible.



Naming the Cars

Each car has a name, which makes the car both identifiable and easily relatable. Beyond naming, the individual cars could have a distinct appearance.



Conversational Interaction

Natural language chat interaction allows residents to ask the car for information like they would a neighbor, via chat bot or real person.



Local Information Board

The car can display helpful local information (road closures, restaurant openings, etc…), catered to the neighborhood it drives through.



Decentralized Digital Twin

Data related to air quality, traffic, or weather can build up a digital twin of the city in a decentralized manner.

3

“We like the ‘friendly neighbor’ analogy; how might we give the car even more identity and a more meaningful neighbor role?”

- design panel feedback

-

What if the car becomes a tool for residents?

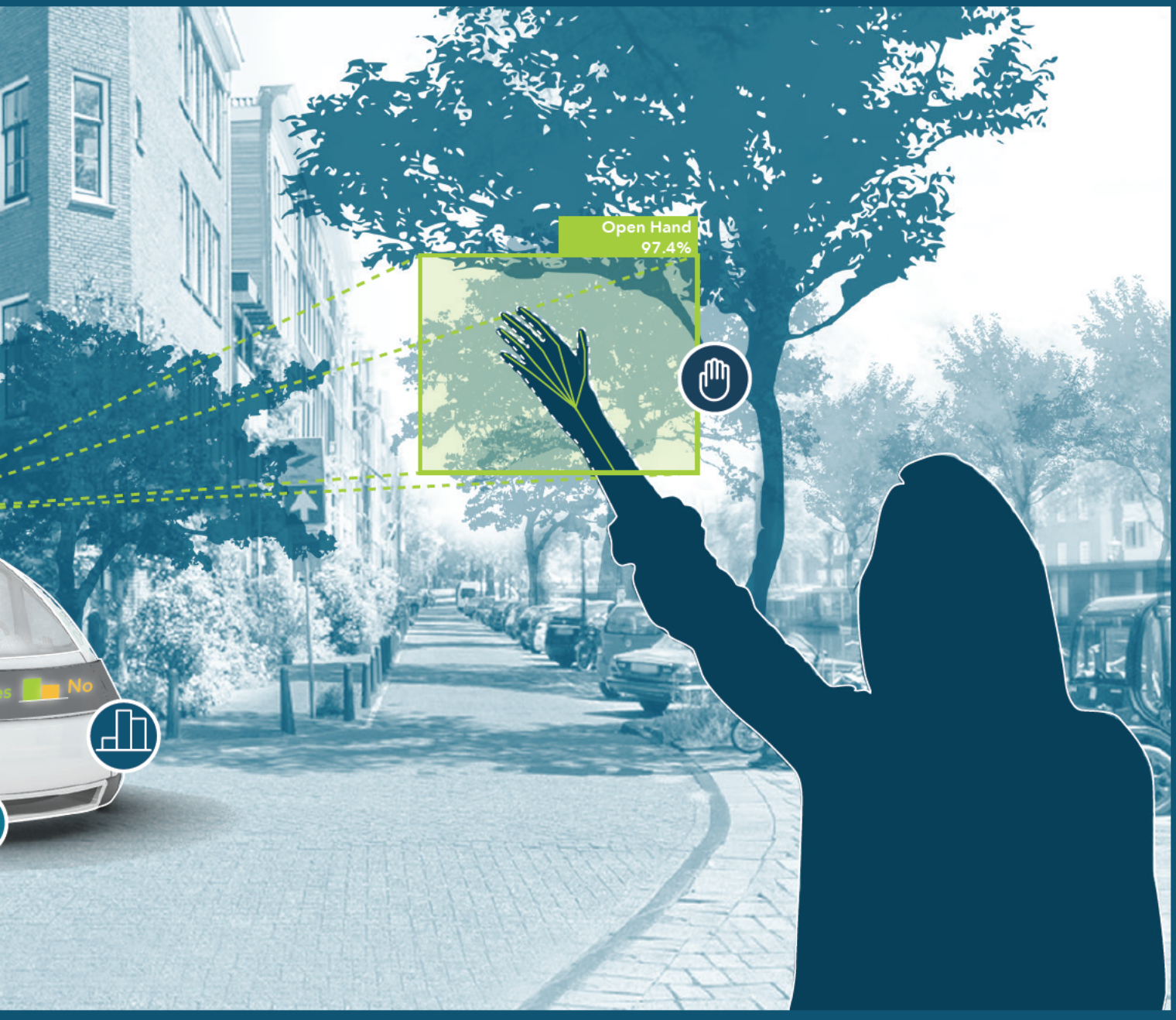
While interviewing residents of Amsterdam about what they believed the scanning cars were used for, all responded with "I don't know", or "parking violations." As demonstrated by the use cases of Amsterdam and Rotterdam, however, these cars are being used for an increasingly wide array of applications. The problem remains that people don't feel the data being collected by the cars is useful or relevant to their everyday lives. Here, we explored potential future uses of the scan car that look beyond punishing for parking violations towards positive civic ends.

The fact that these vehicles are moving around all parts of the city on a regular basis presents new opportunities for gathering highly granular geotagged information about the city. Information about air quality, traffic, crowd management, etc... could be made available to local residents. Via a gesture-based interaction system, people on the street could interact with the vehicle, perhaps responding to questions presented on the vehicle's external screen via a series of simple gestures. Object recognition could be used to notify residents of furniture on the street, encouraging hyper-local reuse of objects rather than being sent to the landfill.

Private car manufacturers are beginning to explore the possibility of using personal vehicles as distributed sensing city sensing systems. While this is certainly effective in terms of collecting large sets of data, the sensing mechanisms become increasingly opaque and hard to comprehend. By delegating these functions to governmentally-owned vehicles, these systems can operate while remaining legible, contestable, and understandable.



4



What if the car becomes a tool for residents?

Design Elements



Spatial Opinion Mapping

All votes are geotagged and made accessible online, providing granular insights into differences in opinions across neighborhoods.



Graphics on Vehicle

Instructions for interaction are printed directly on the car. One understands the process immediately and intuitively.



Immediate Feedback

After receiving a vote, poll results are displayed directly on the car via a screen.



Gesture-Based Interaction

Gestures allow residents to interact with a moving vehicle. Three standardized gestures eventually become common knowledge; interaction is simple and easy.



DIY Submissions

Residents, local businesses, and organizations can text in their own questions to be asked, making the platform useful for all.

4

“The playful, gamified interactions here resonate much more strongly with us than the idea of polling. I want my children to be able to gesture to the car to honk, like they do with the waste truck drivers”

- design panel feedback

What's Next?

The concepts developed in the design sprint show there are many possibilities to make scan car interactions more 'human'. As sensing cars will become an increasingly common element of smart cities in coming years, we believe it is vital to keep working on the questions of how we want them to be experienced.

We will be investigating which of these elements resonate most with people, and are most promising to start working on first. As we believe the only way to figure out what the smart city should look like is through hands-on prototyping, we will be working towards a prototype and gauging peoples' responses.

To do this, we will be building a consortium of organisations that want to join in this research.

Do you want to engage?


UNSENSE
AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS

UNSense
Plantage Middenlaan 62
1018 DH Amsterdam
The Netherlands

info@unsense.com
www.unsense.com

AMS Institute
Kattenburgerstraat 5
Building 027W
1018 JA Amsterdam
The Netherlands

office@ams-institute.org
www.ams-institute.org