The→
Incredible
→Machine

mm-Wave user experience design project

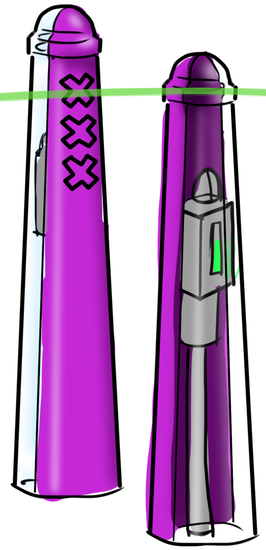


Concept November 19th, 2020

concept directions









Simple Sensors

+ Attainable
+ Recognizable
+ Matches ambitions
- Design needs elaboration
- Lack of affordances

Democratic Sensors

+ Involving citizens is laudable
- Other project explore this more in-depth
- Out of scope for this project

The New Amsterdammer

+ The public-ness is interesting features
- Unpractical form factor for a lot of sensors
- Gimmick-y

Playful sensors

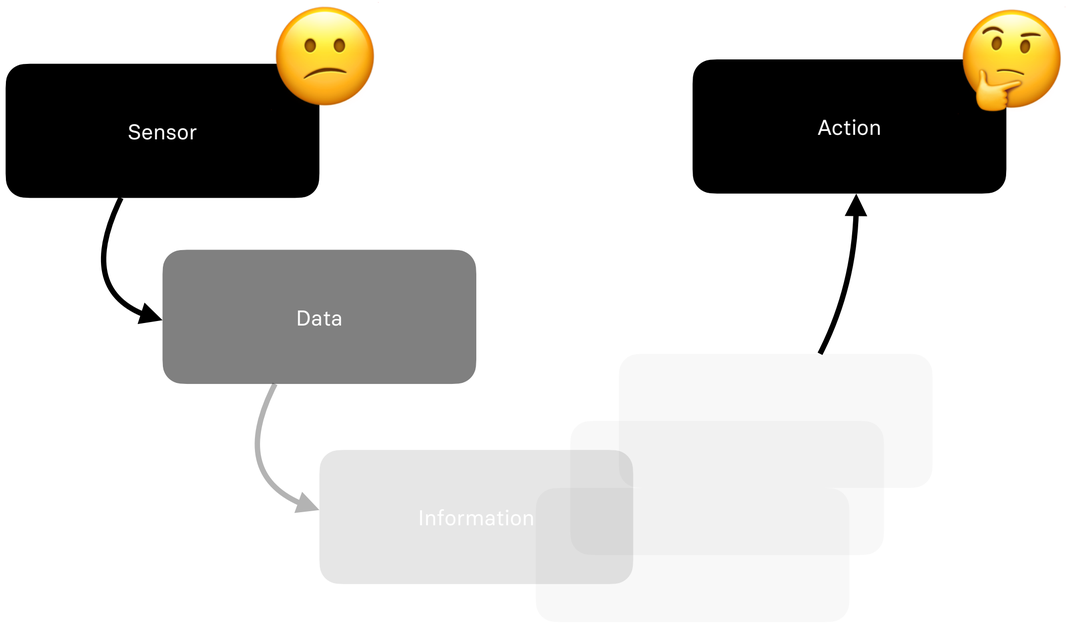
+ Engagement with audience is desirable.
+ It's fun
- Should we take the smart city this lightly?

Simple Sensors +

Note In this narrative, we use *citizens* as the stakeholder having the user-experience. This could also be read as *local businesses*, *visitors*, or other stakeholders in the public space.

key insights

On the boundary of trust and transparency

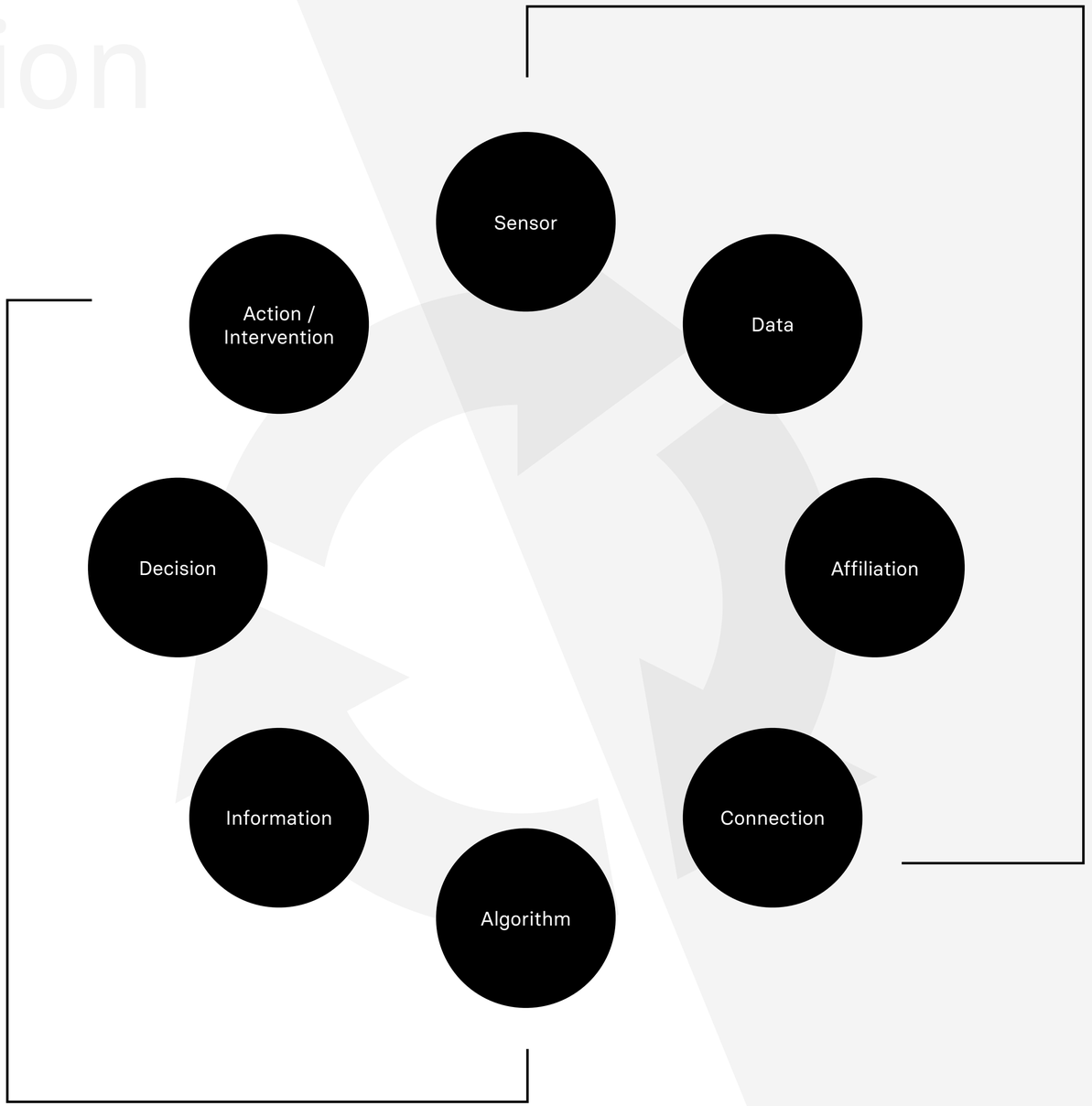


City officials require sensor data to optimize operations, plan projects, or measure effects of interventions. Most often, there is no immediate benefit for citizens of a sensor collecting data. It's after data is processed, that it informs an action that affects citizens. Concerns about a sensor are often connected to concerns about potential action, and that the action has negative implications.

In an ideal world, every citizen is able to scrutinize the relationship between a sensor and subsequent steps leading up to an action. But in practice, when engaging with a sensor in public space, only partial transparency is attainable. For the translation from data into decision, trust in the institutions deploying the sensor and handling the data is key.

Organisation

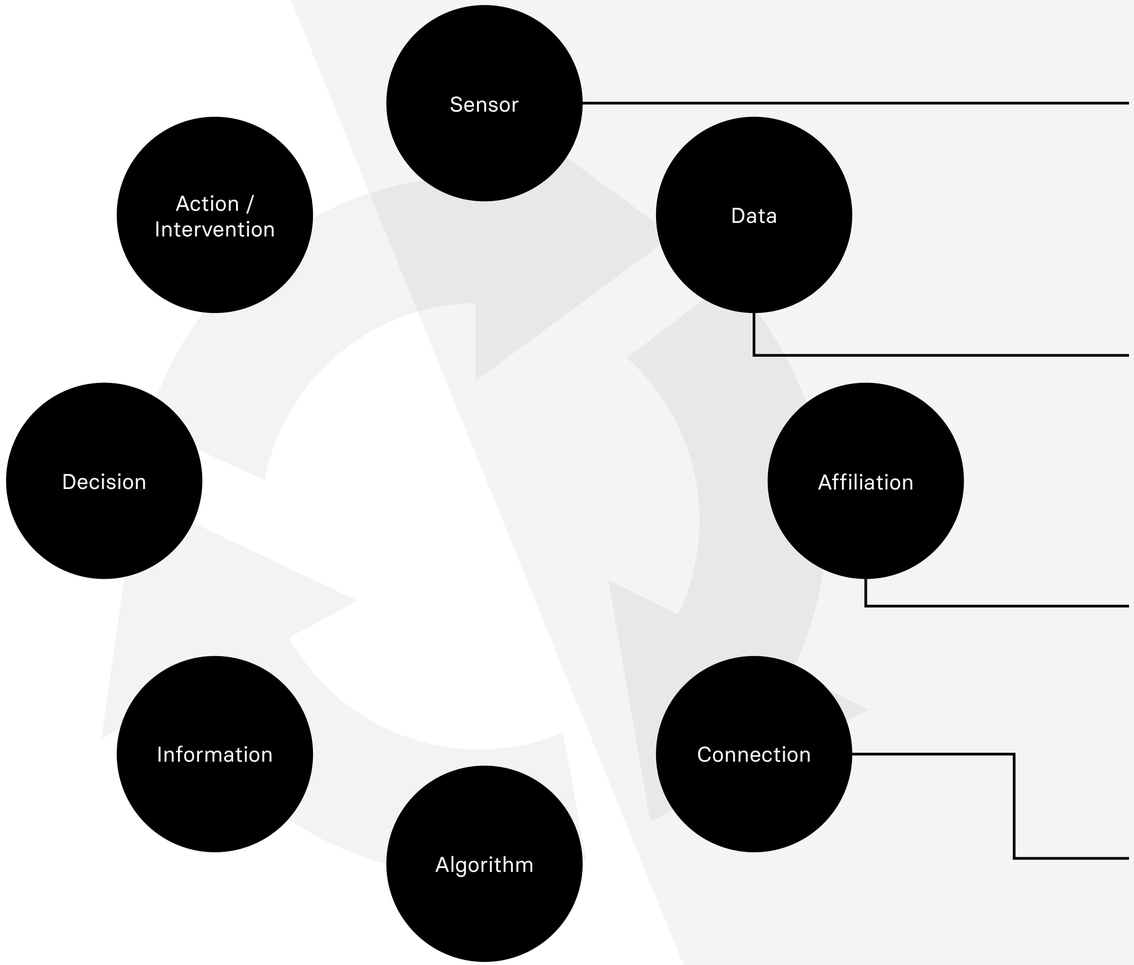
Can designing a transparent user experience here...



... help people trust what happens here?

Public s

A sensor as proxy for a system

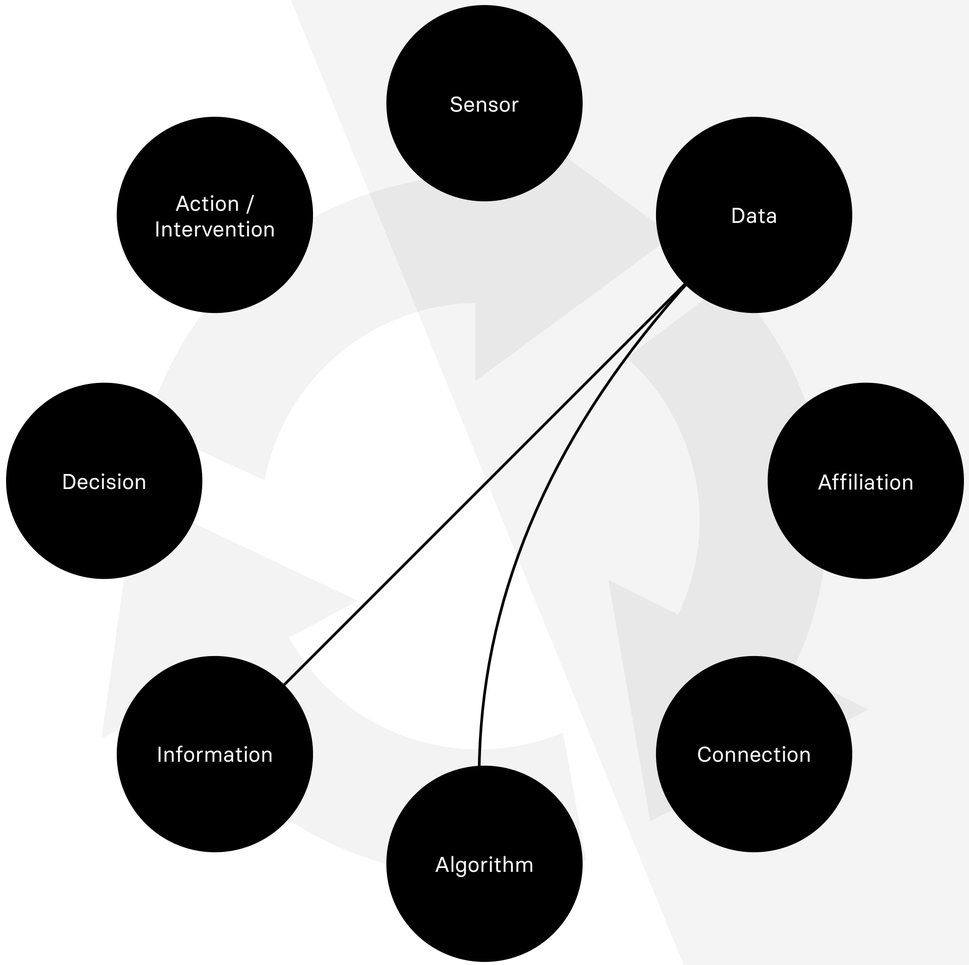


I understand what this sensor is measuring.

I have the impression the data reflects reality.

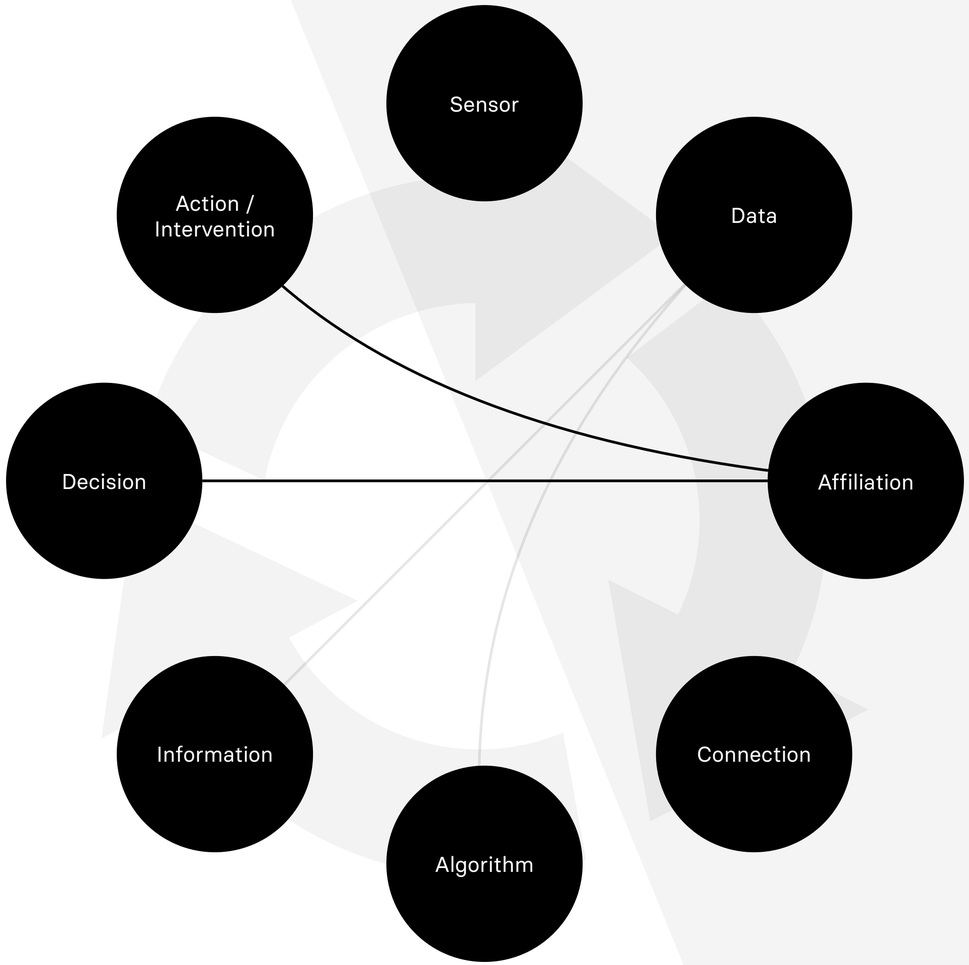
I can see who has access to the data and why.

I can see how the data is being accessed.



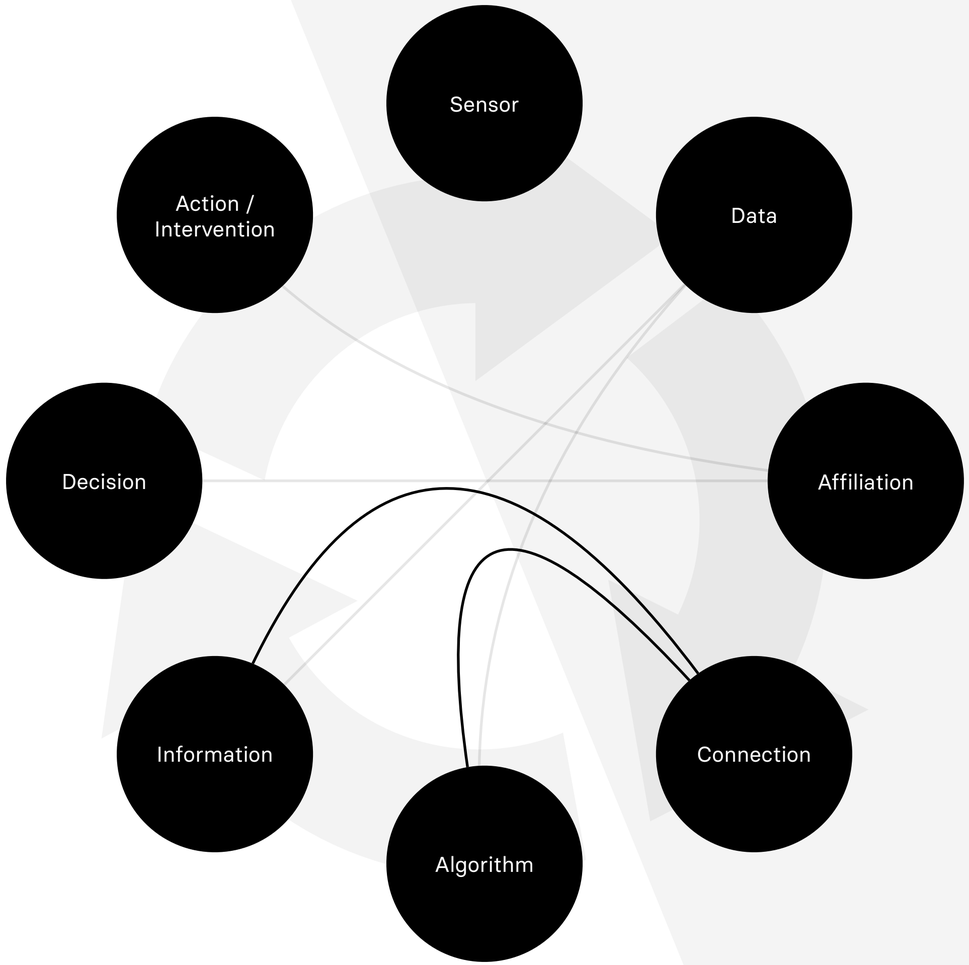
Data

- Does this data reflect the reality as I’m experiencing it?
- Is the data accurate, complete, unbiased?



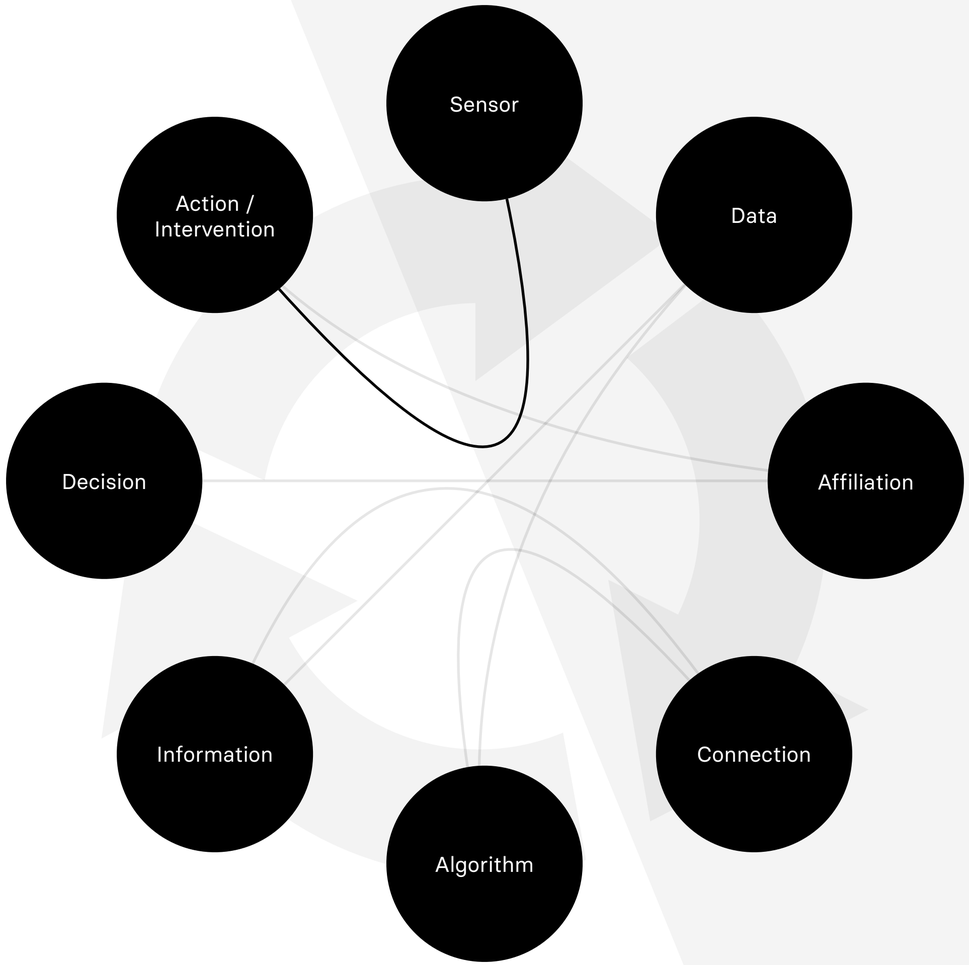
Affiliation

- Who has access to the data of this sensor...
- ... and for what purpose?
- What are possible decisions based on this data?



Connection

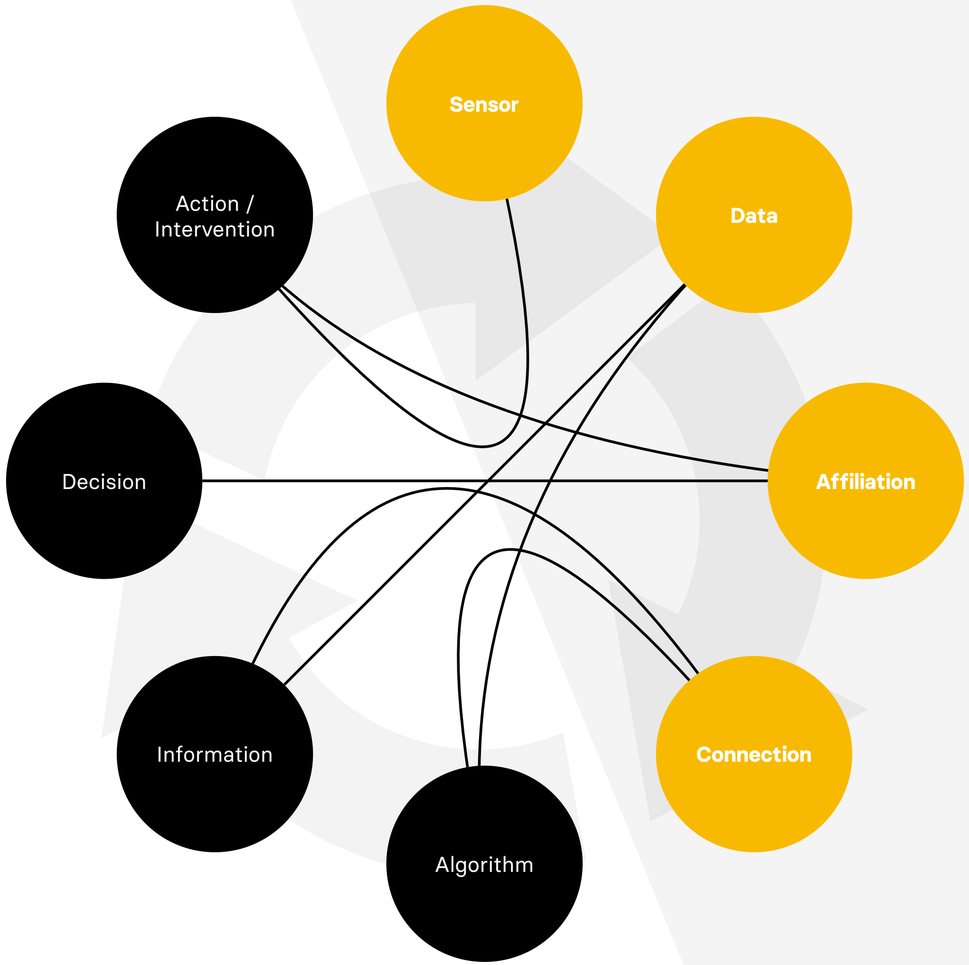
- Is this sensor connected to a system...
- ... or is data processed on the device?
- Is the data shared in real time, or with an interval...
- ... and how long is that interval (minutes, an hour, a week?)



Sensor

- Does this sensor produce the right metrics to base any decision and subsequent action or intervention on?

Simple Sensors offer a window into the networked systems that inform the management of urban resources.



1. Clear **affordances** that indicate what is measured
2. Real-time **insight** in how measurements are converted into data.
3. Show **who is using** data and for what **purposes**.
4. Indicate the **intervals** with which data is shared

Interfaces between systems and public space.

Public space



Banking services



Postal service



Telecom networks

Systems



Emergency services



Traffic lights





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6. Invite people to **verify** if the sensor is working as intended.

Playfulness







Simple sensors invite citizens to engage through playful or thought-provoking features.

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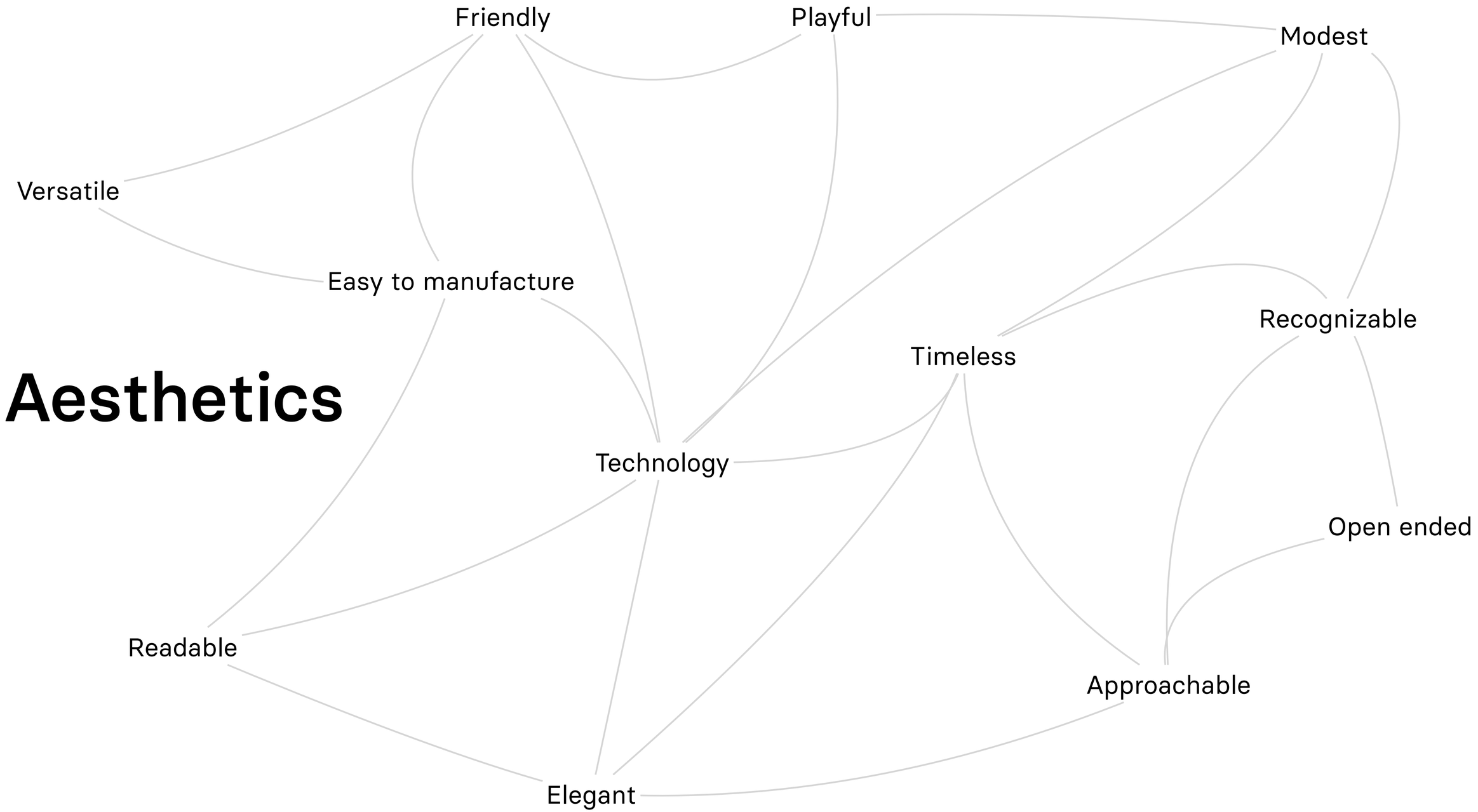
Aesthetics


Friendly
Playful
Modest
Versatile
Easy to manufacture
Recognizable
Timeless
Technology
Open ended
Readable
Approachable
Elegant



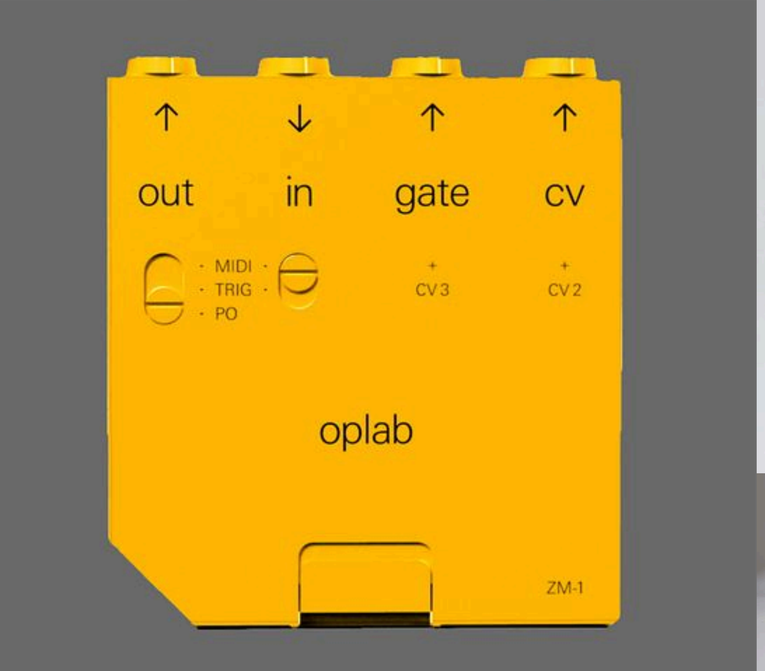







15
ARMOUT ONOFF
PINKCHO
STEREO
AUDIO UNIT

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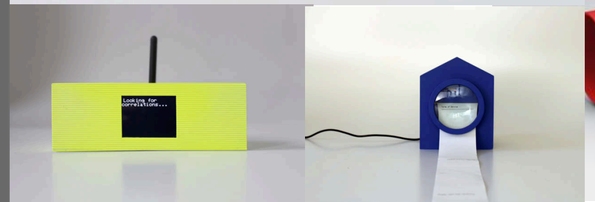

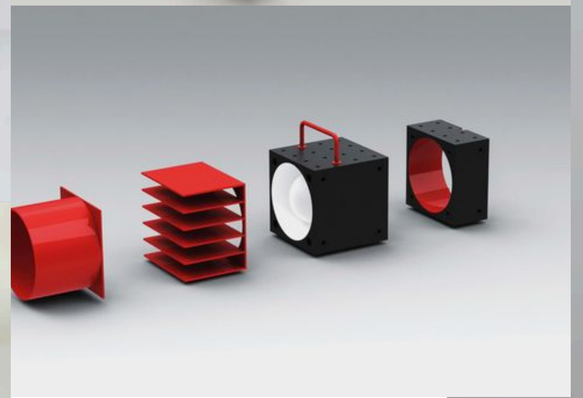



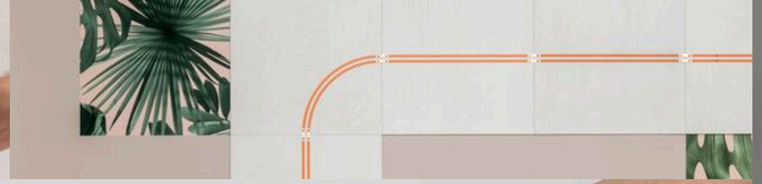







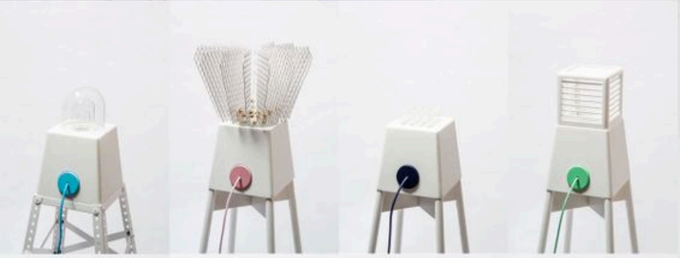
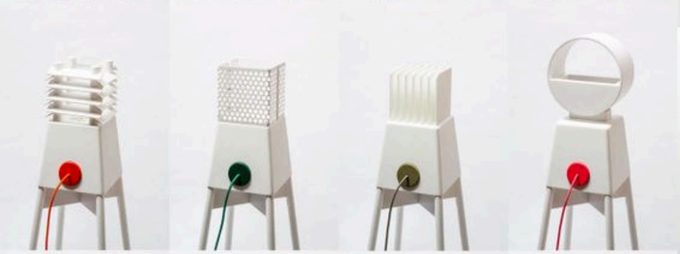
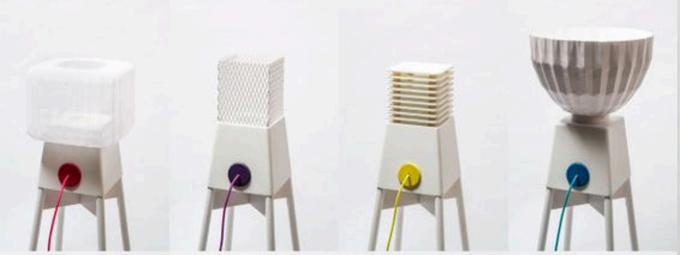


BRAUN
2
1
0
volume

Design

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simple sensor system

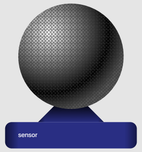




mm-wave sensor



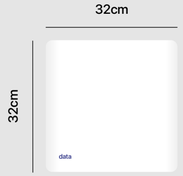
mm-wave sensor
(sideview)



environmental noise sensor

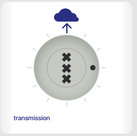


air quality sensor

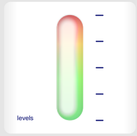




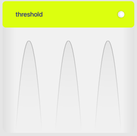
real-time data



transmission interval



real-time data

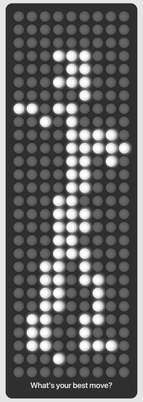


threshold indicator





Press to play



Dance moves



Download data



On / Off switch





Citizen adjust threshold



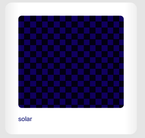
Suggestions



Periscope



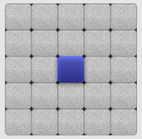
Seat



Solar power



Street dot



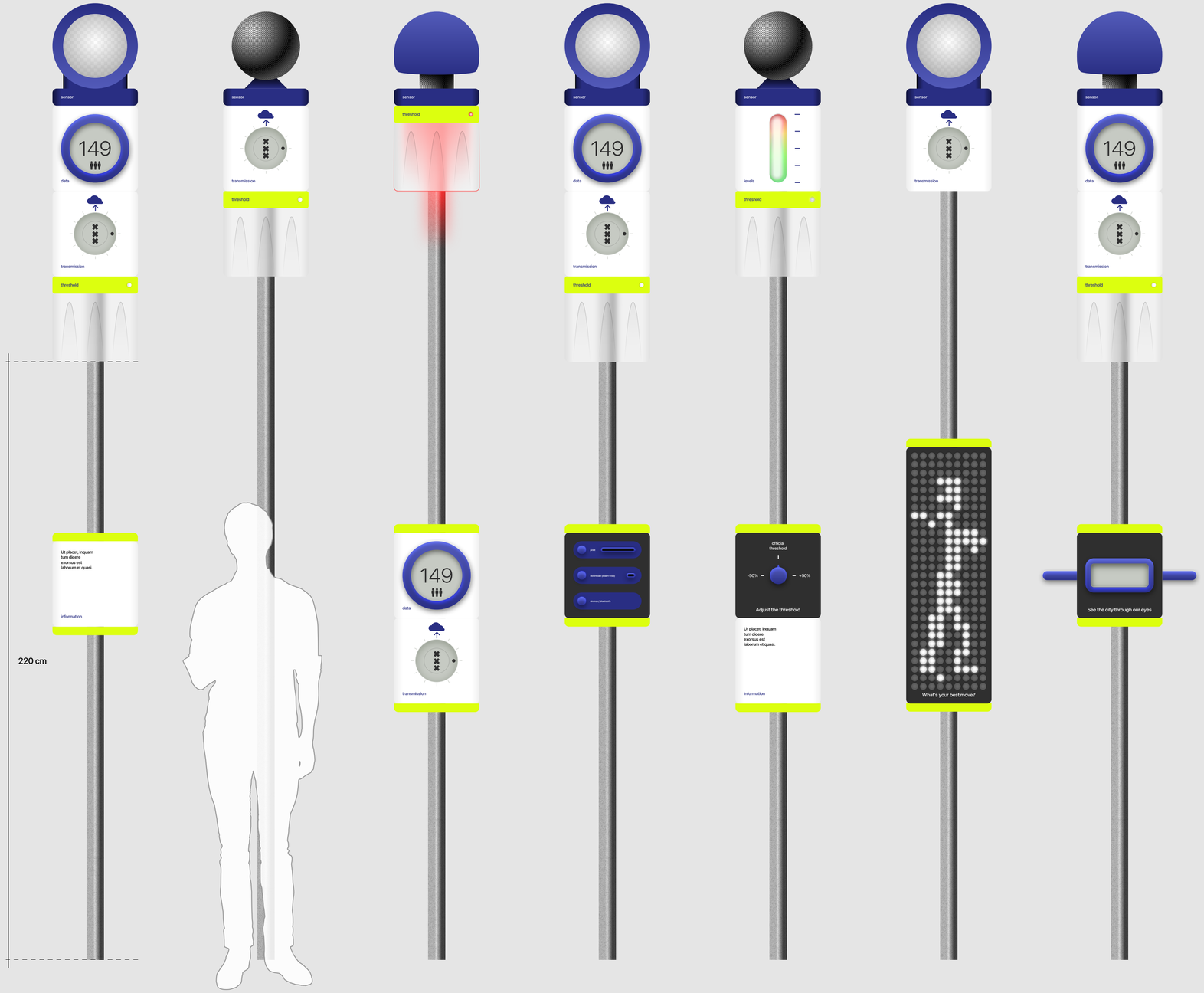
Sample demarkation

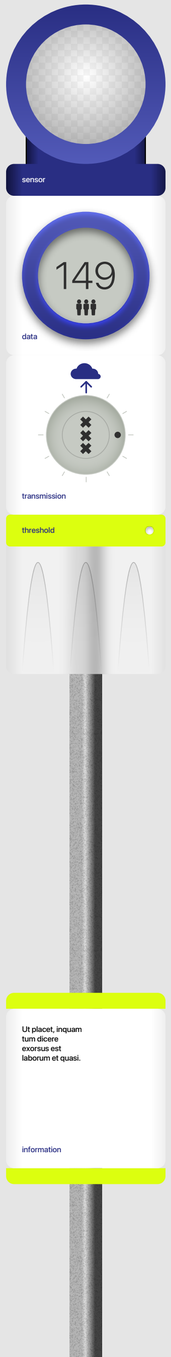


Information surface

Simple Sensors is a family of modules that interact with their environment, citizens, and urban management systems.

Each module opens opens a different perspective on the practice of data collection in the city. And with each composition, citizens can be engaged in a new way, relevant to the context.





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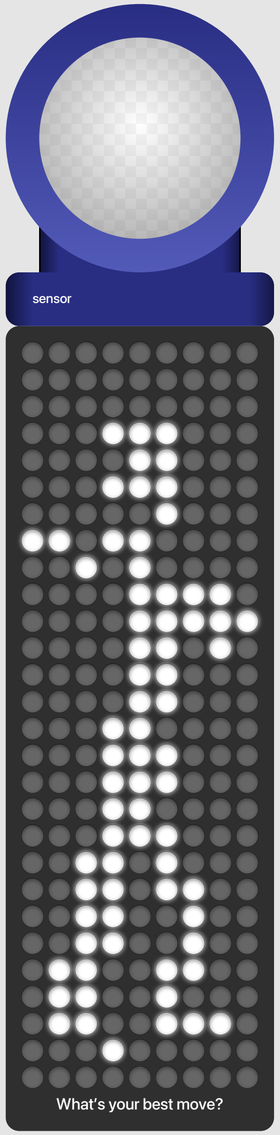

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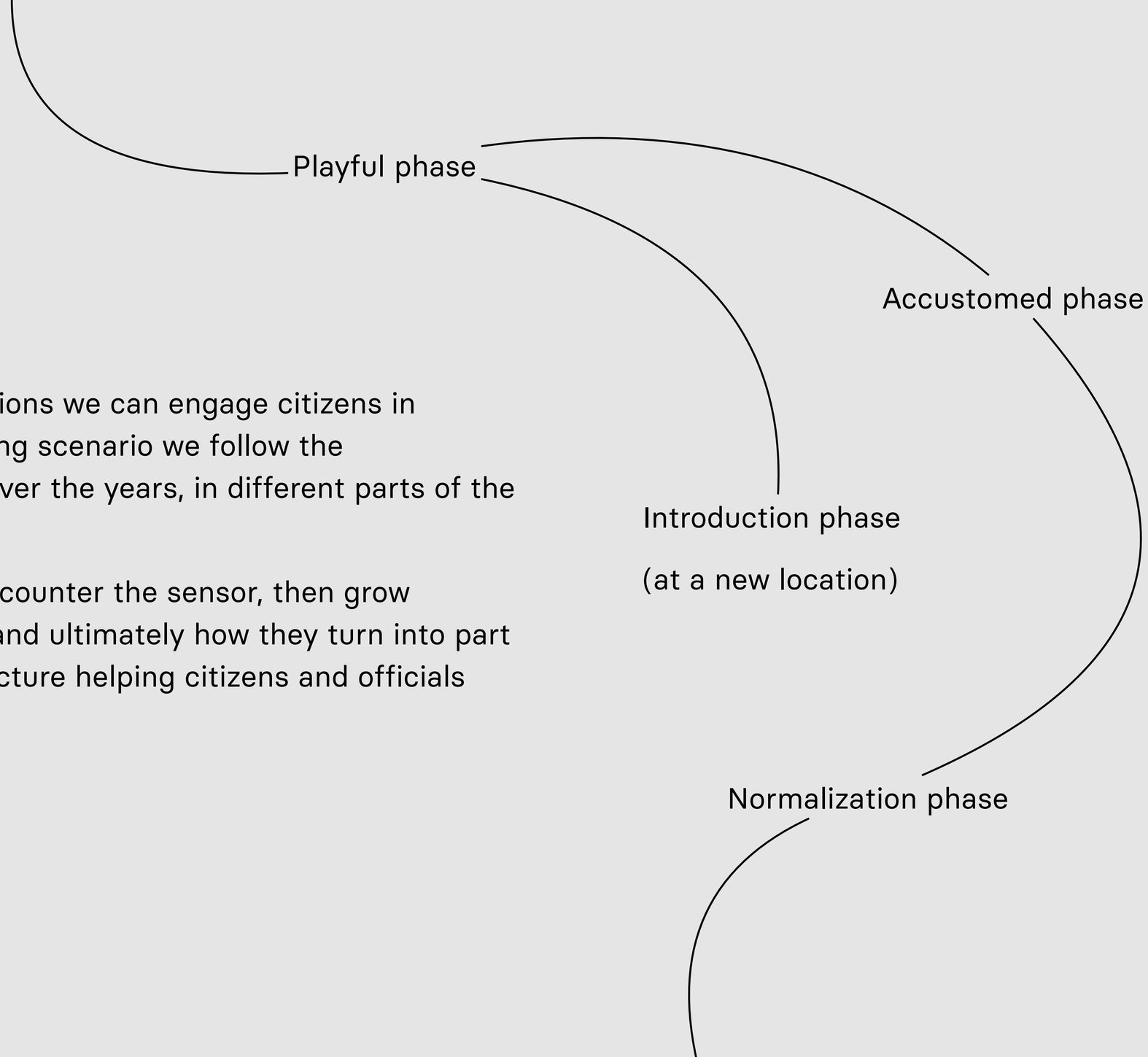


User experience

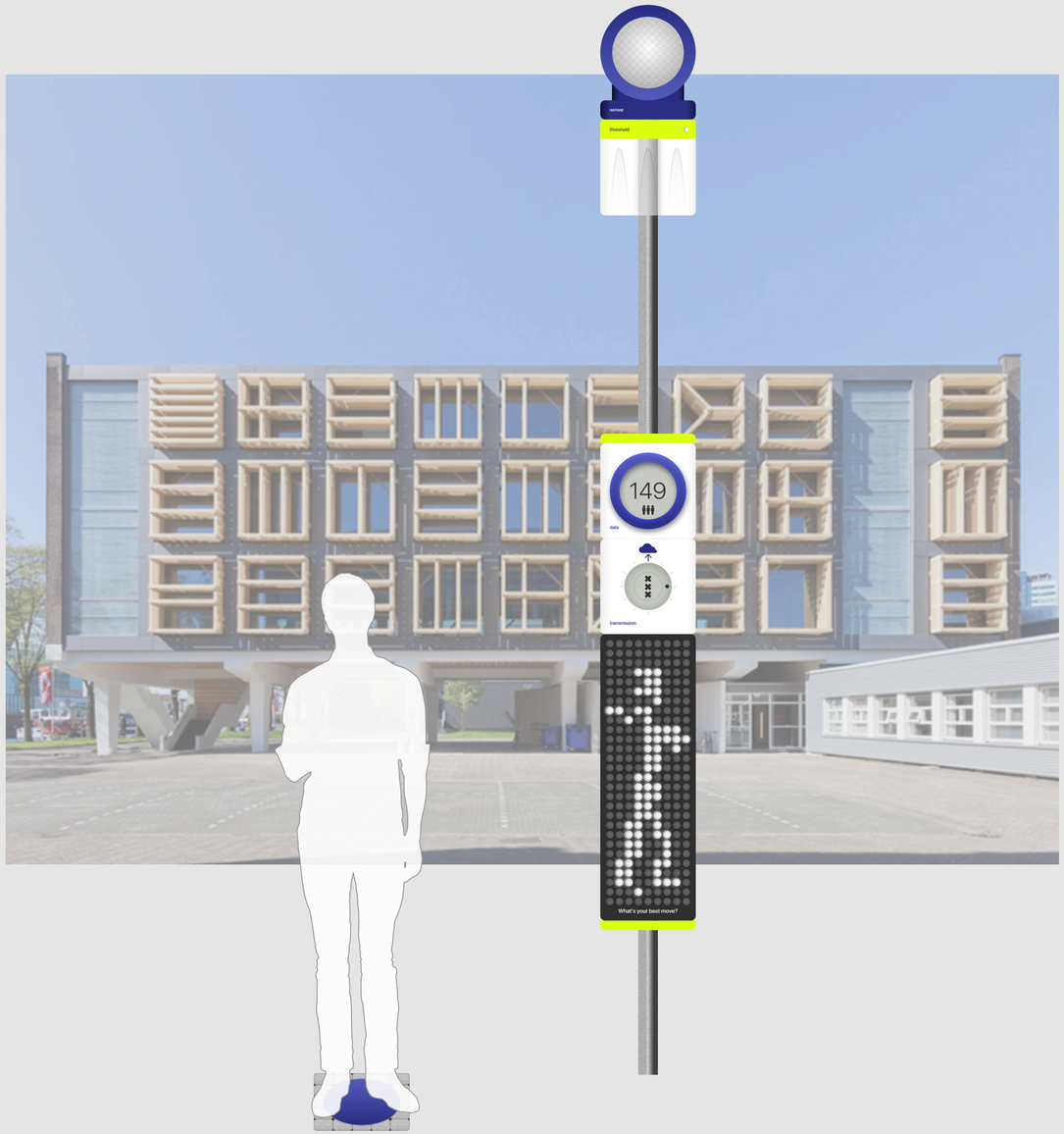
Through different configurations we can engage citizens in different ways. In the following scenario we follow the implementation of sensors over the years, in different parts of the city.

We learn how people first encounter the sensor, then grow accustomed to the sensors and ultimately how they turn into part of the urban public infrastructure helping citizens and officials manage public space.

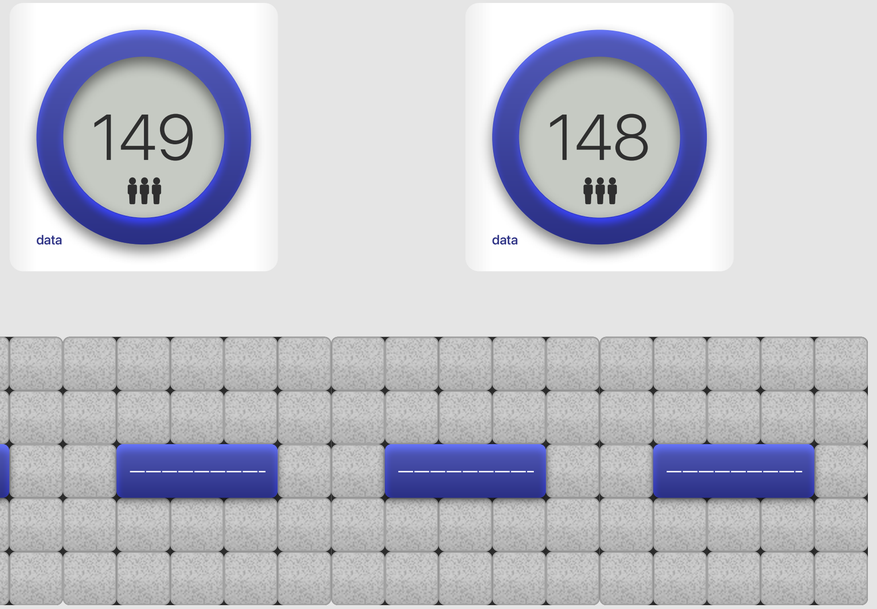
Playful phase

The mm-wave sensor at the Marineterrein is the first simple sensor to be introduced in Amsterdam.

To invite people to engage with the sensor, a bright purple dot is marked on the sidewalk. Walking over the dot, you see a point cloud of your silhouette pass over a low resolution display on the pole.



You decide to investigate. And when you approach the sensor, and cross a purple demarkation, you notice the number on the station changes from 149, to 148.



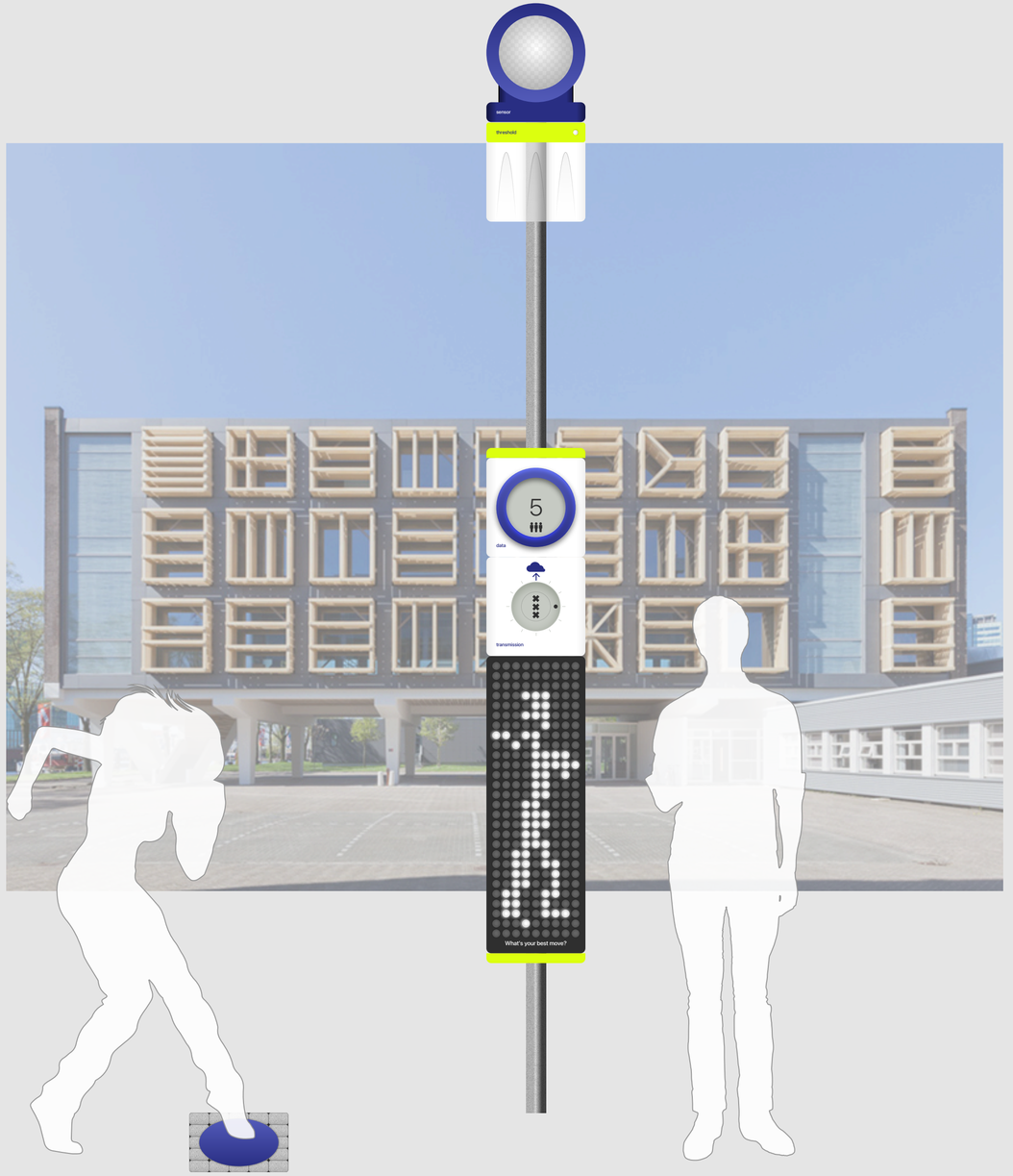
From up close, you quickly learn this thing counts people. You notice a clock, marking when data is uploaded to the cloud. A cloud bearing the three x’s of Amsterdam.

Now you understand. The city is counting people. But apparently very slowly. So it must be for research purposes, I suppose. O, wait, it says so on the side here of that clock thing; yes the city wants to learn about crowds.



In the weekend, the Marineterrein looks deserted. While your girlfriends decides to give the thing a spin, you read some more about this sensor on the side.

You still feel a little ambiguous about the fact that the city has installed a camera here. But upon further reading, you learn that this thing only counts people, nothing else.



Accustomed phase

It’s April, 2020. Covid is still sweeping the city, but since regulations become less strict, people are throwing little outdoor performances.

You decide to go the Marineterrein where a band is performing.

But upon approaching, you already see the crowd counter signaling the area has reached maximum capacity. The threshold indicator is red.

You continue your way. Maybe some other time.



Without a clear goal, you cycle through the city, looking for a place to sit down. You decide to head to the Hortus, but in no hurry, you decide to avoid streets where the air quality sensors flashing red. If you want to damage your lungs, there are more pleasant ways to do that in Amsterdam.



That night, you try to relax, but the noise from the street is just too much.

The residents have been complaining to the city council for years, and now they have finally installed a sensor to help us measure the nuisance.

This sensor can tell when it’s too noisy, and give an indication. Maybe police would act for once! But even at this noise level, no indication the critical threshold is crossed.



Time to get a report. You go outside and print the data of that evening.

For good measure you tune down the threshold until it the indicator mounted below the sensor turns red. It’s only a matter of time before some drunk turns it back to max, but you hope the city registers the action.

The fourth data print in a week, time to reach out the city council again.



You need a drink yourself. You call a friend and decide to meet up. Even in the dark, you recognize the clear silhouette of a simple sensor, in this case an air quality sensor.



Introduction in a new area

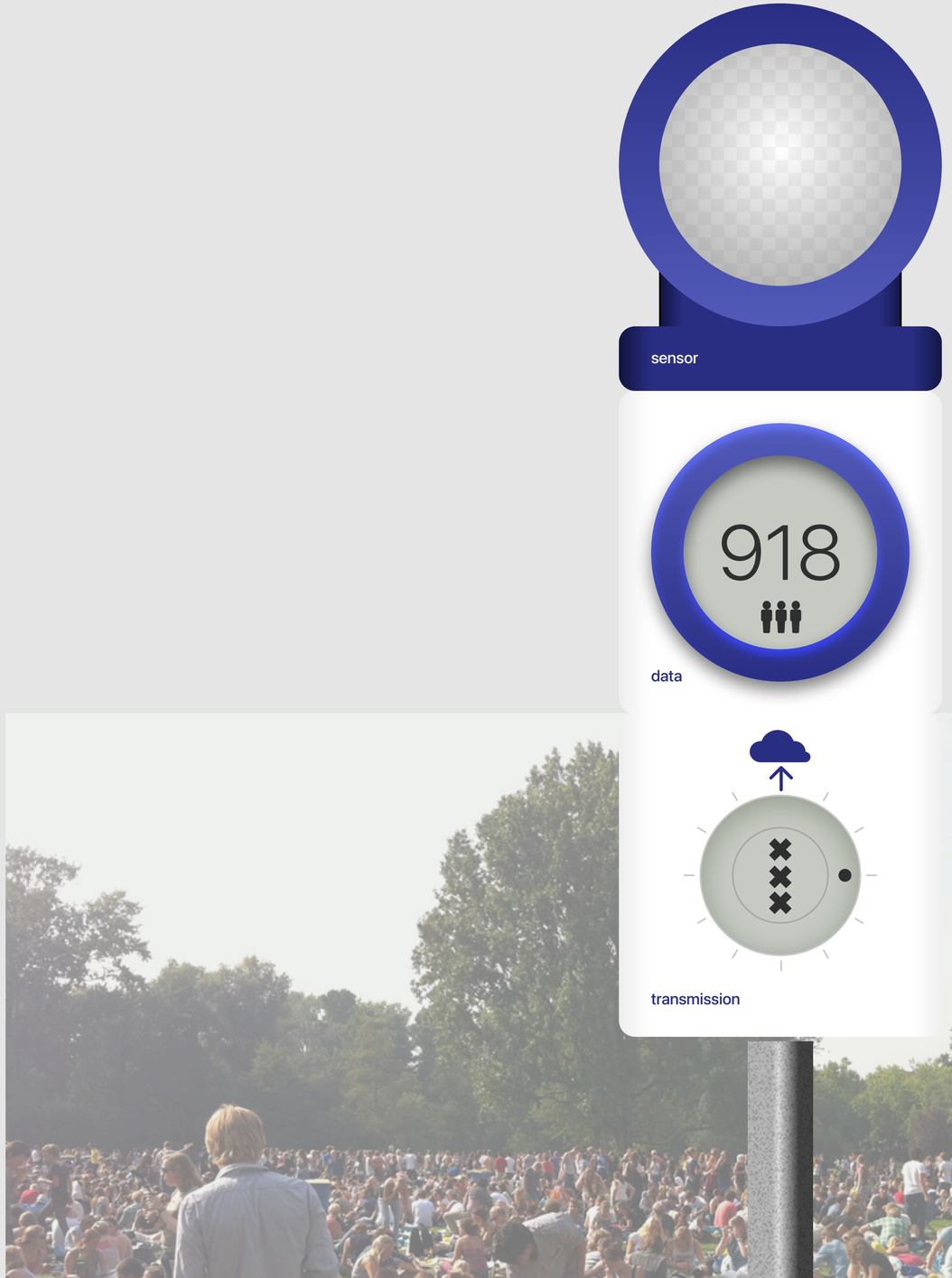
Amsterdam is trying to monitor crowds in the Vondelpark. Multiple fights have been breaking out over limited recreational space.

Earlier police interventions hasn’t been met with great enthusiasm. There’s an idea for a soft approach, but there is no data on the effectiveness of those measures.

A simple sensor to monitor the crowd is installed, and Amsterdam tries to make it as friendly as possible.



The sensor that is installed has no threshold indication; this should be a measuring device. The data transmission is tuned to very slow. Only once an hour data is uploaded.



To inform people about the research that’s going on, a little sign explains the research setup. Looking through the periscope, visitors can see how the current data compares to the data of a few weeks ago, when police monitoring was the norm.



Normalization

The Knowledge Mile is booming. Several smart city experiments are ongoing, and students are coming up with unprecedented ways to see the city.

Also happening at that location: taxi’s driving into students crossing the road.

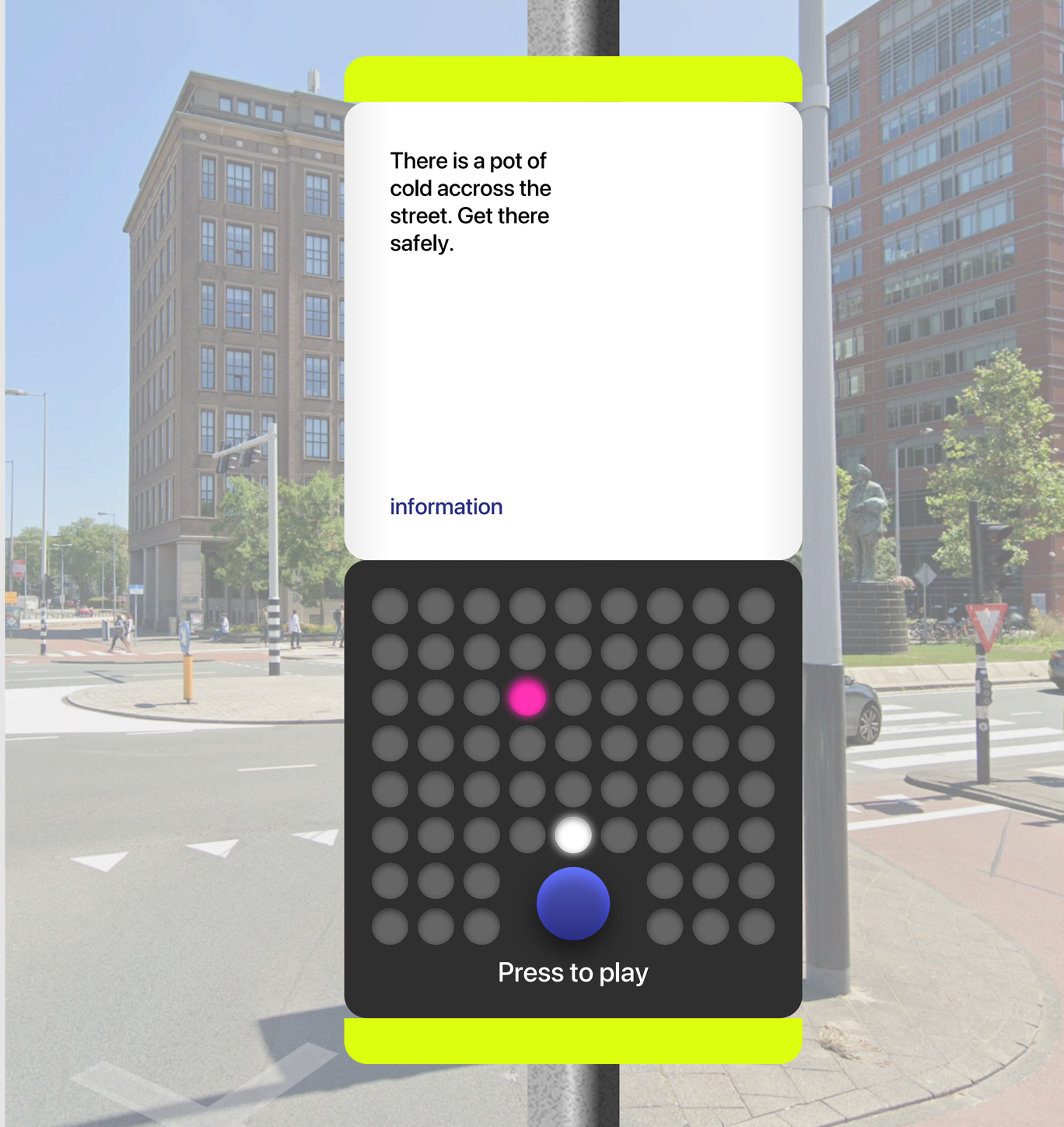
AMS and the CTO office team up, and invite a students Creative Media Technologies to design a game on a smart sensor that help students cross streets more safely.



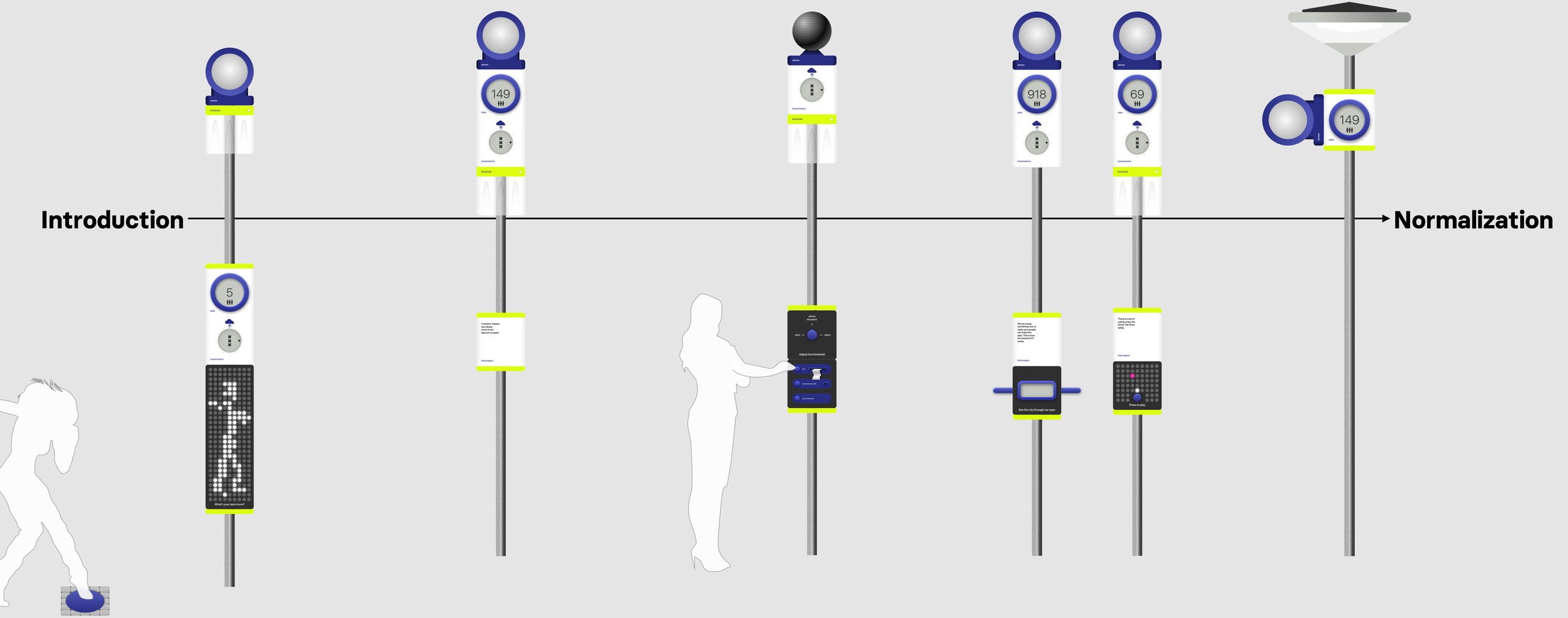
The students get busy and program small games that run on the grid display.

The simple sensor was then configured to collect data to compare crowds on the street between red and green light at the crossing.

The research showed clear improvements, many more students wait for green light while playing the game.



Introduction → **Normalization**



Heavy on playful experiences, interfaces are mounted low to read carefully.

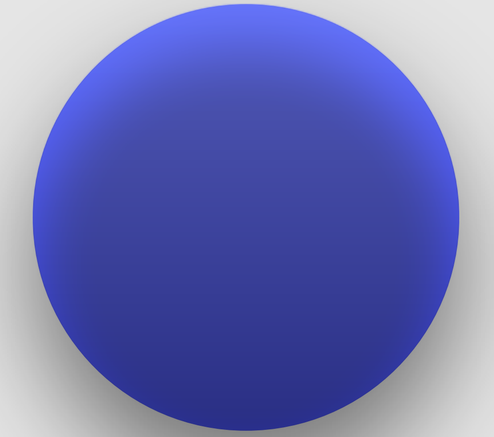
Feedback moves to top of the pole for easier reading for afar. More focus on information

Introduce more complex interactions with the sensors. Real time feedback moves to digital channels.

Scientist, artists, and citizens can start to work with sensors and data through new interfaces.

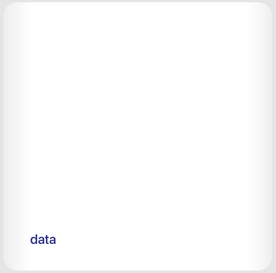
Simple sensors become a part of the city and require fewer touchpoints to communicate.

Design language



White surface

Share information



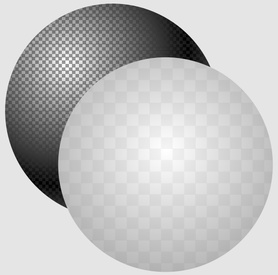


Dark gray surface

Invitation to interact

Sensor filter material

A buffer covering a sensor hinting what can penetrate and be measured.



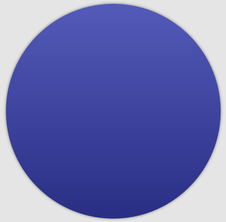


Frosted glass

Indicate possibility of light for long distance indication of important issues.

Purple blue

Emphasis for important aspects of modules and smart city identity.



Fluorescent yellow

Framings to attract focus on particular feature.

Monochromatic displays

E-ink displays to emphasize the slowness of data flowing





Typo- & iconography

Simple icons and lowercase letters to emphasize a humble demeanor

Sideview

Every module has a description on the side explaining in layman terms what this module is, and what it does.

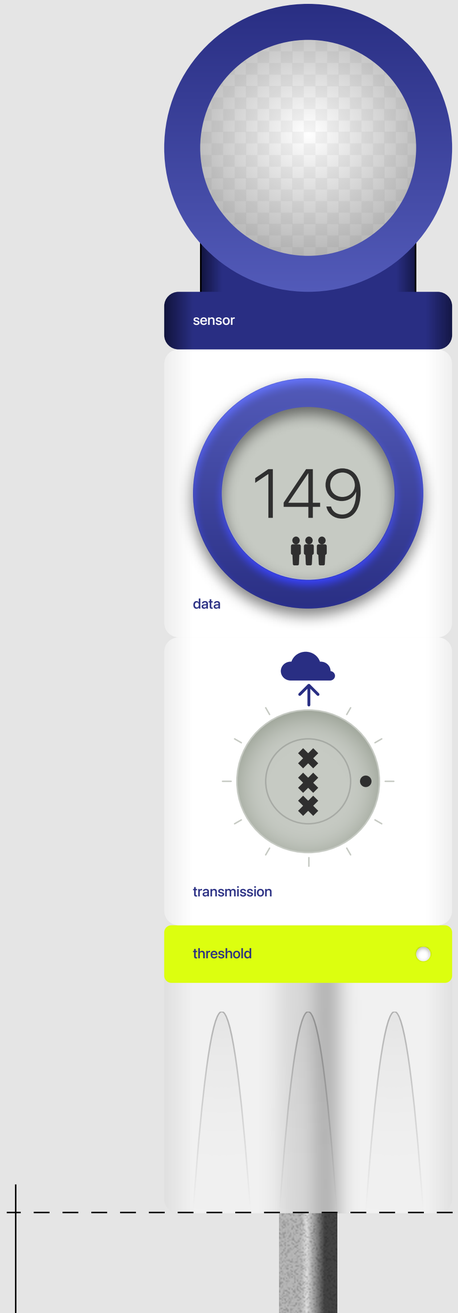
Some information — like recipients of the collected data, or alarming thresholds — might be ‘hard coded’ in the decal, conveying the immutability of these properties.

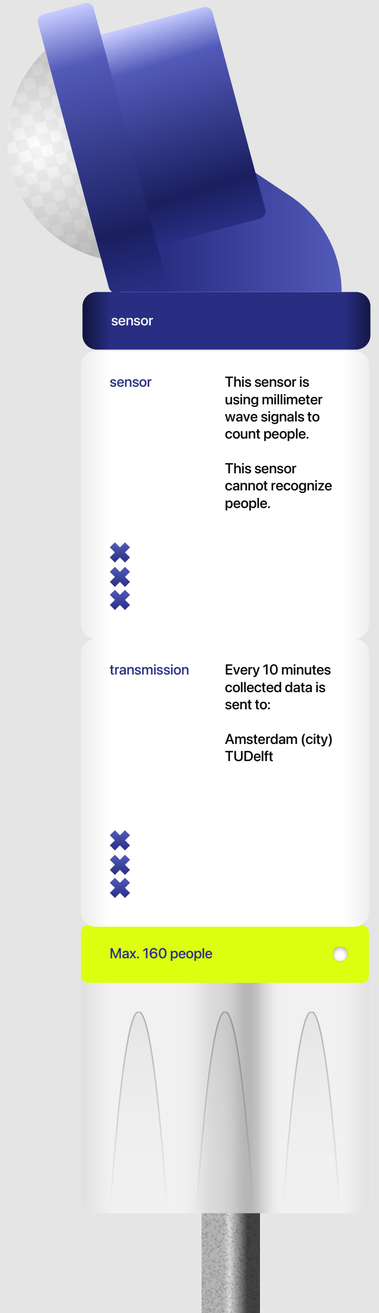
Affiliation

Every module is marked with the city logo to clearly communicate who operates this module.

Language

Left side is in Dutch, right side in English.





Modules



Sensors

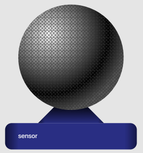
Blue and bold. Each sensor has a pronounced silhouette, recognizable from a distance.



mm-wave sensor



mm-wave sensor (sideview)



environmental noise sensor



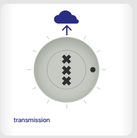
air quality sensor

Feedback

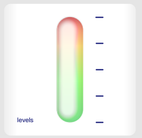
Make data and connection visible: what is measured, what is communicated, what thresholds are relevant.



real-time data



transmission interval



real-time data



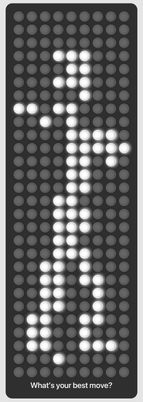
threshold indicator

Interactive

Playful and thought-provoking. These modules invite citizens to interact with data: from playing games, downloading data, to contesting the sensor through a literal on/off switch.



Press to play



Dance moves



Download data



On / Off switch



Citizen adjust threshold



Suggestions



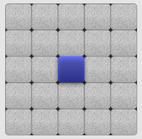
Periscope

Other

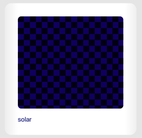
Supporting elements like demarkations on street level, information surfaces, solar panel modules.



Street dot



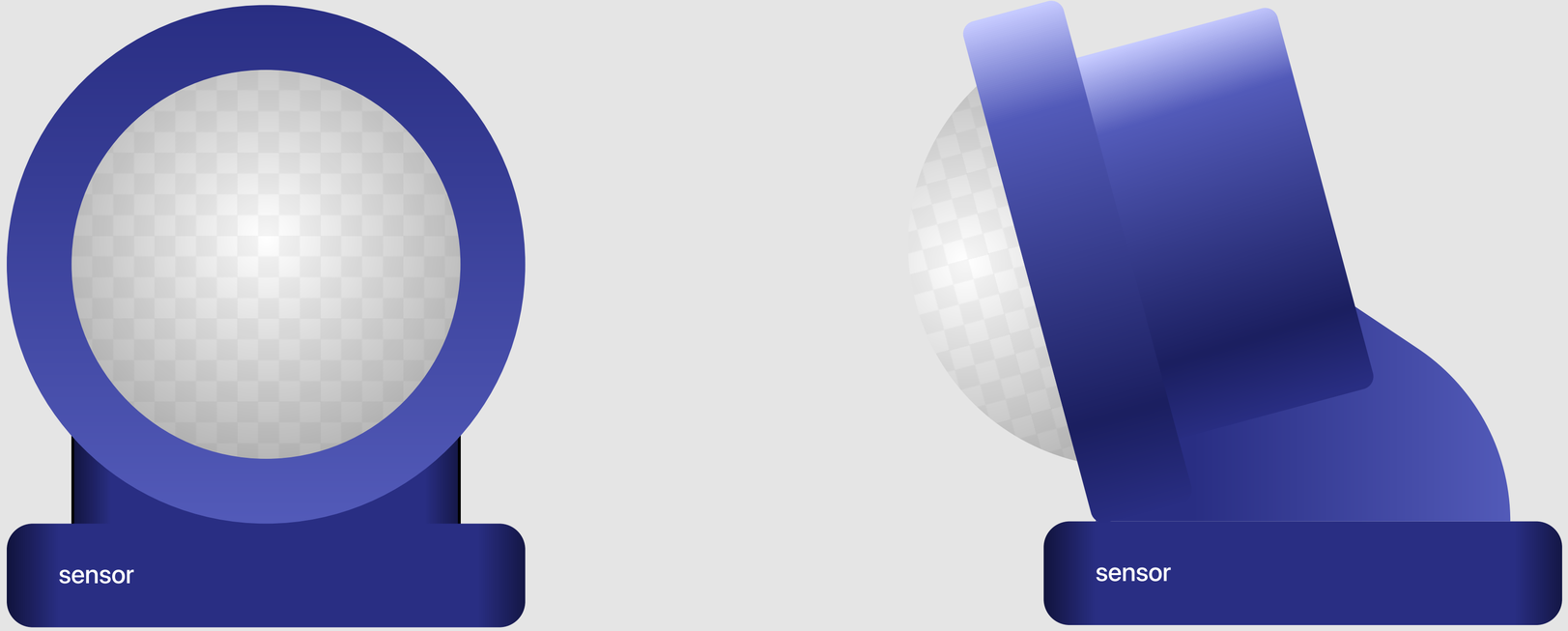
Sample demarkation



Solar power



Information surface

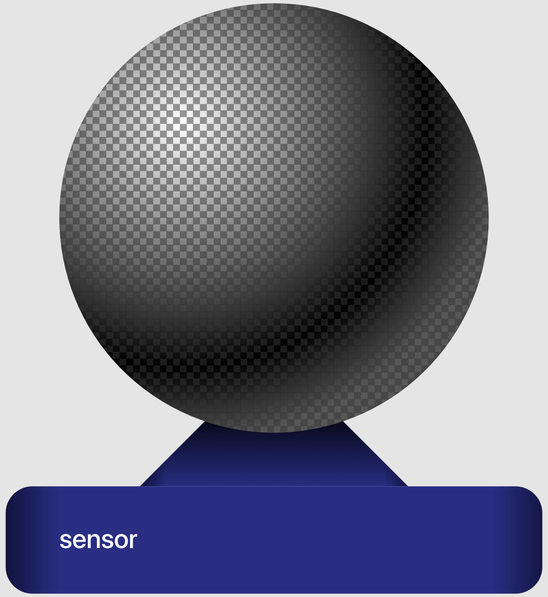


Mm-wave sensor

Has a frosted window in with a 120 star radial section dome.

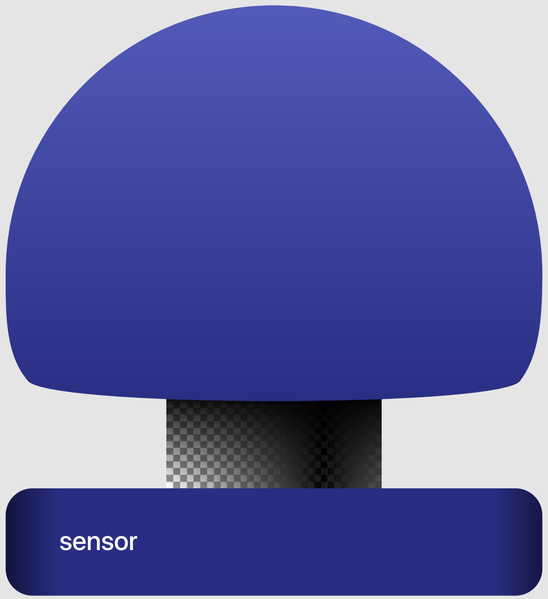
Environmental noise sensor

A exaggerated microphone.



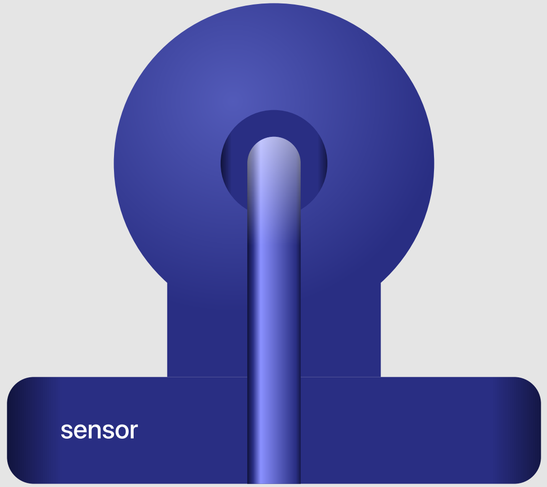
Air quality sensor

Inspired by the citizen science sensor.



Water quality sensor

The probe is suspended in the water.



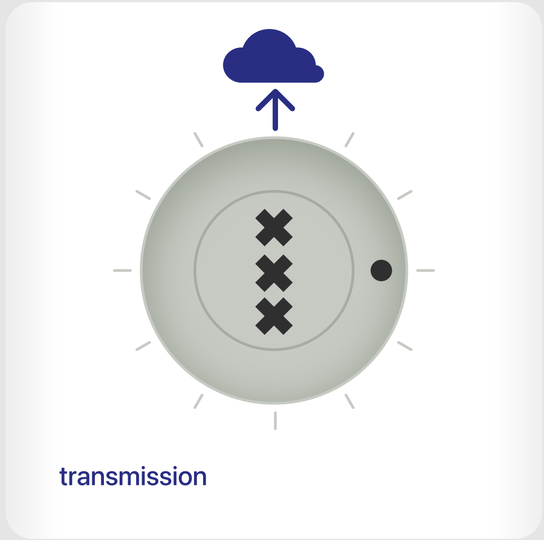
Real time data

Display showing the current value and parameter that is being measured. Because of the e-ink display, the screen-refreshes are slow and obvious, conveying slowness.



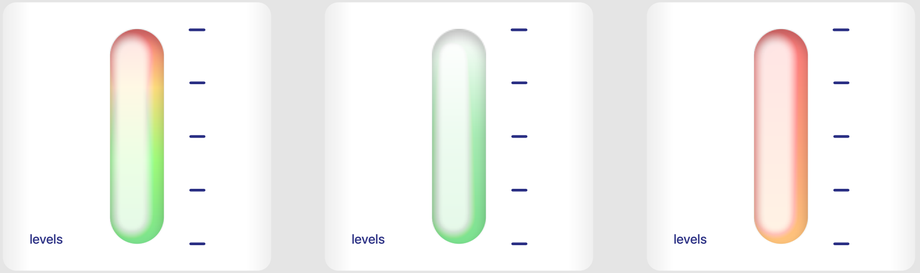
Data transmission

This display shows a clock like interface that shows when the next transmission to what organization will happen.



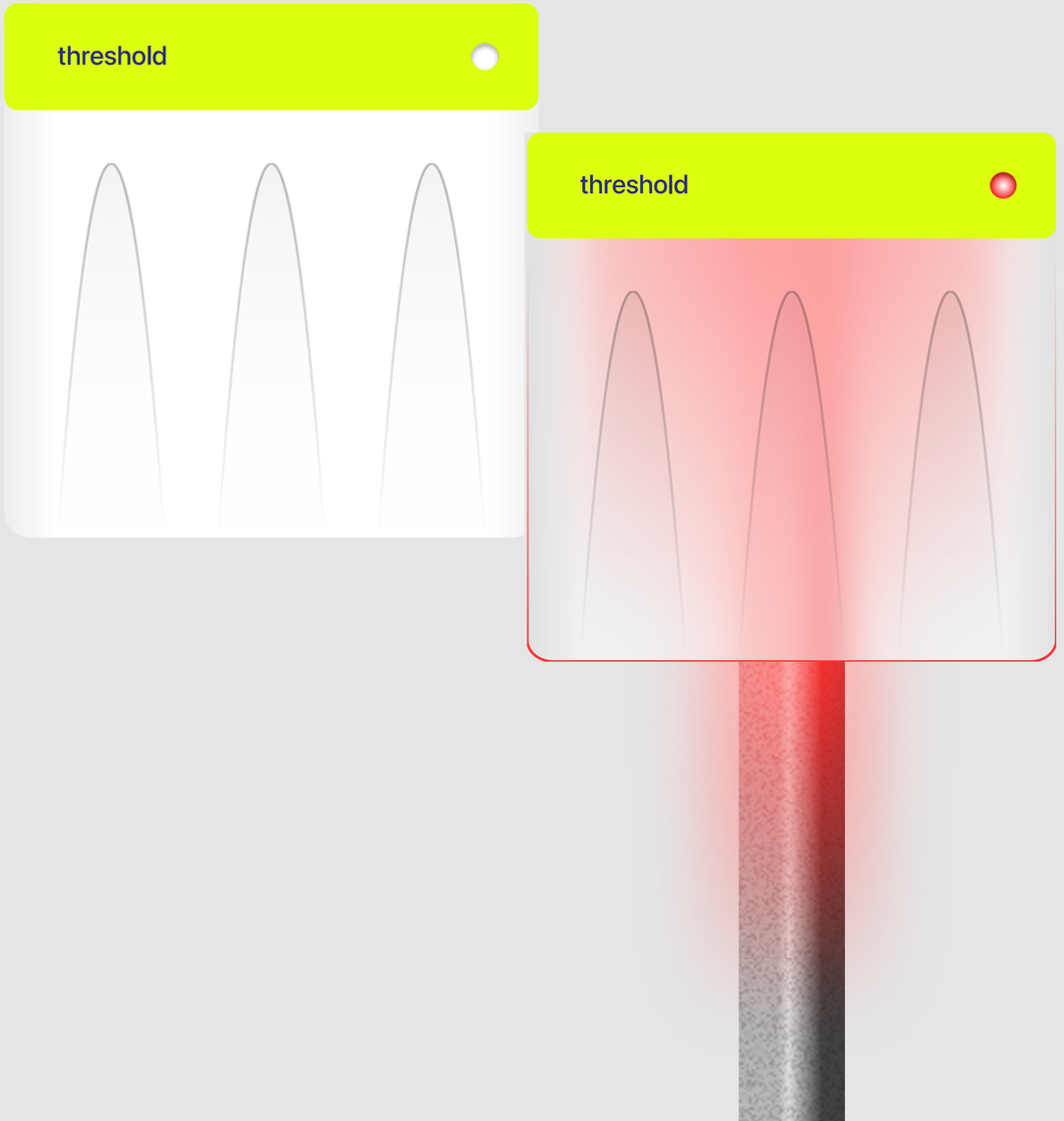
Levels indicator (needs attention)

For values that can range, this indicator makes it possible to gage whether the value is ‘low’, ‘high’, or maybe ‘alarming’



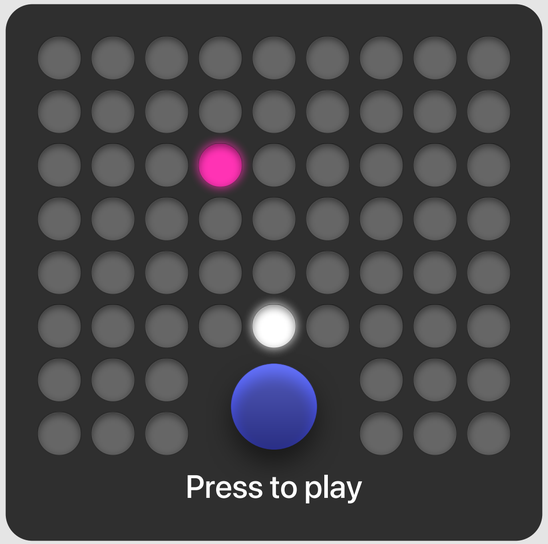
Threshold indicator

For sensors with a clear ‘too much’ threshold, this threshold indicator can signal a threshold has been crossed to anyone from afar.



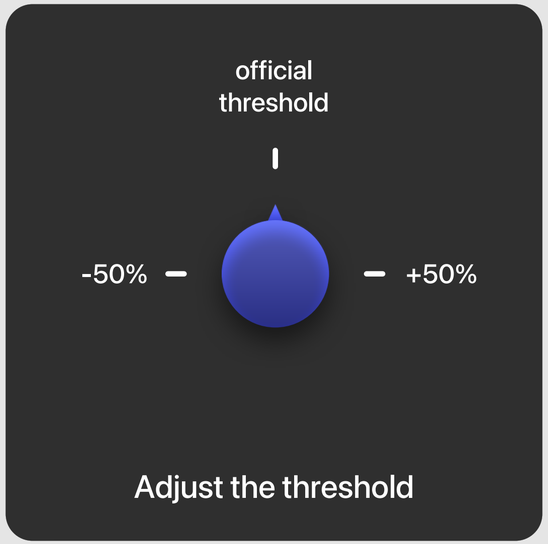
Play a game

Press to play and see how the sensor perceives you.
Win or lose? See the threshold indicator chip in.



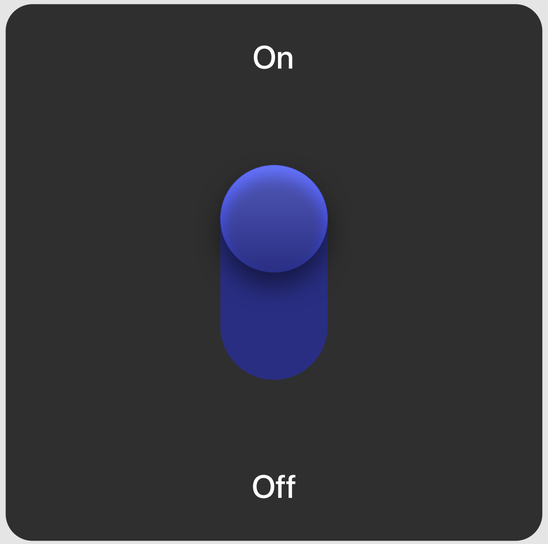
Threshold adjuster

What is too much noise? Too many people? Have people adjust the threshold themselves.



On/Off switch

What if people could just switch off the sensor?



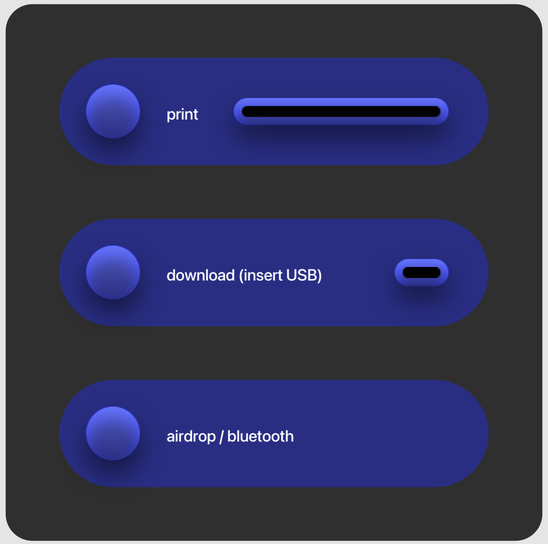
Suggestion box

Let citizens drop their notes with suggestions in this box.



Data pick up box

Lower the threshold to obtain the data from the sensor. Either print the data on a receipt, download a file on your USB or activate the Bluetooth or Airdrop interface.



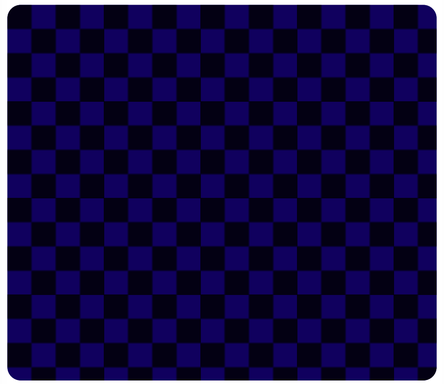
Data periscope

See the city through the eyes of data. Move the periscope around to explore what the sensor can actually see.



Solar power

Solar panel to power the sensor.



solar

Info panel

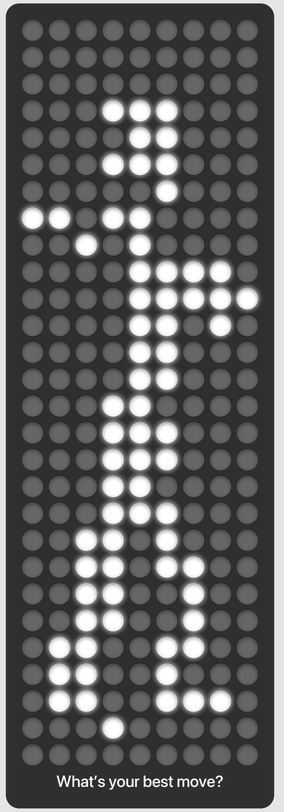
Space to share information

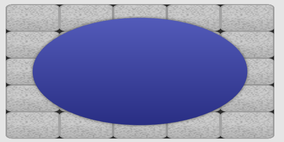
Ut placet, inquam
tum dicere
exorsus est
laborum et quasi.

information

Dance game

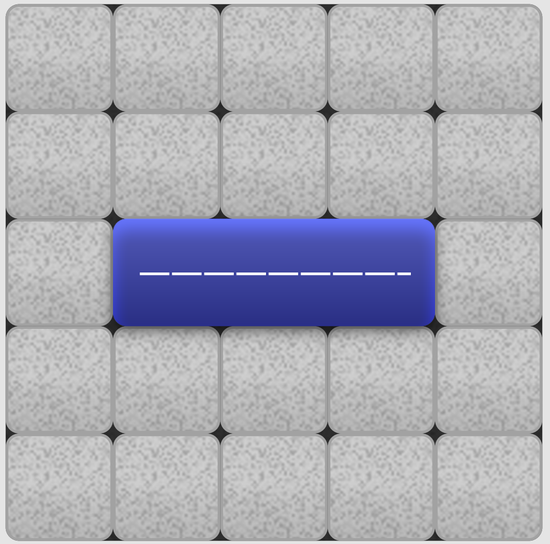
Stand ont he spot and see the point cloud the sensor has for that particular spot. Make a cool move and see the indicator celebrate your coolness.





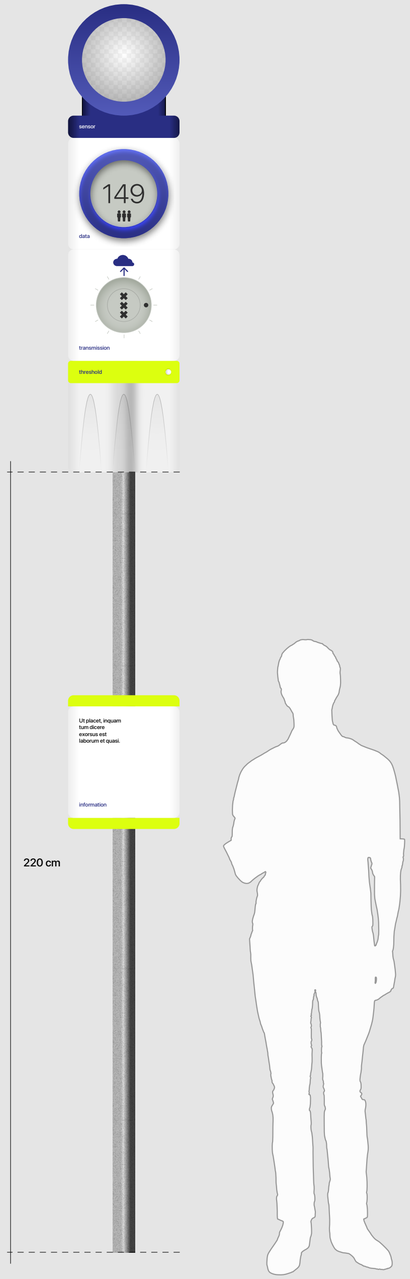
Sample area demarkation

Communicate where the sensor sample area is delimited.



Construction





Base measure: 32 x 32 x 32 cm

Modules are cubes, or fit within these constraints.

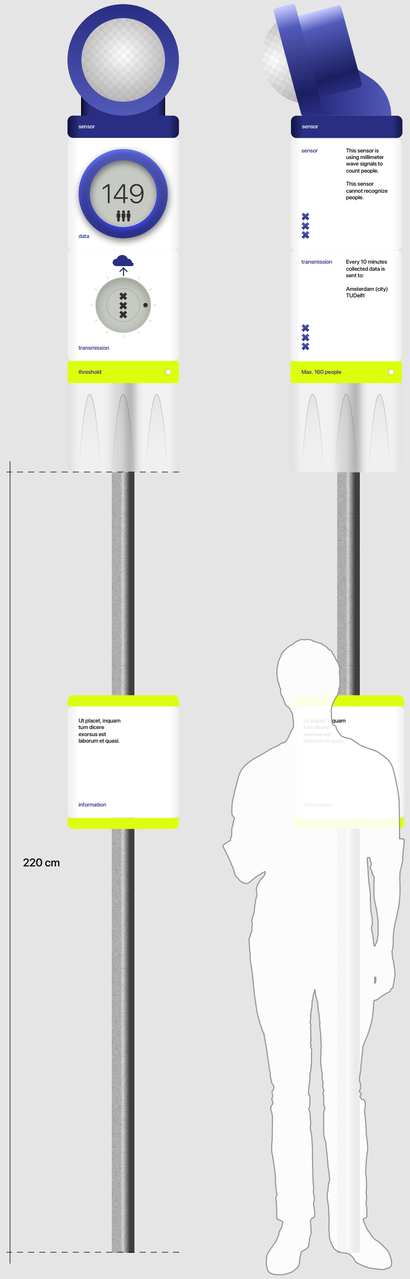
Height: 220 cm

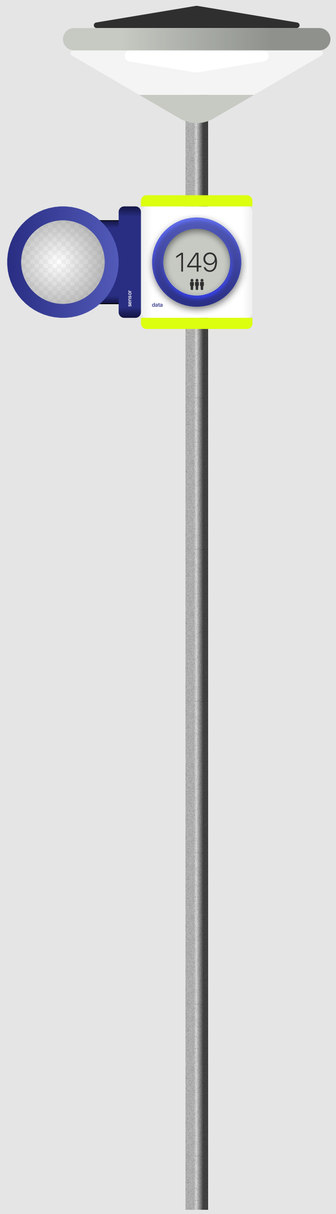
Following the guidelines for traffic signs in the Netherlands, the bottom rim of the top-mounted modules are 220cm above the sidewalk.

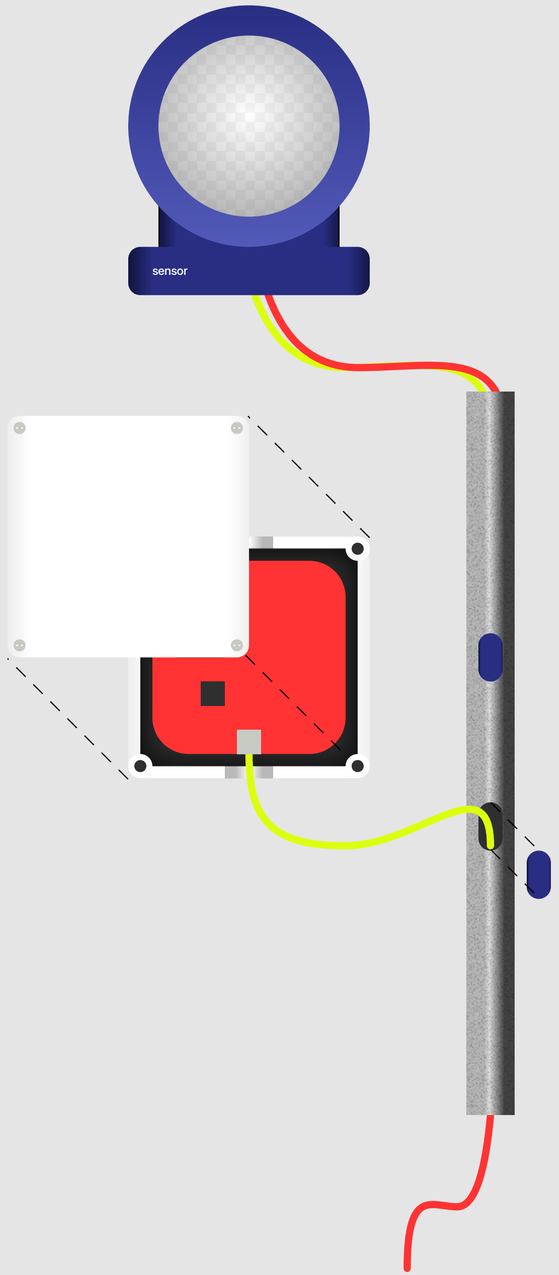
Pole mounted

All modules are mounted on a standard traffic sign pole (ø 48mm). This will greatly help visibility in public space, but also the affiliation of the sensors. No other organization is allowed to place poles in public space, but the city.

This even allows for alternative mounts, e.g. in conjunction with a street light.







Communication

All modules are wired, with wires coming through slots in the central pole.

Mounting

Modules have a back panel that can be removed for mounting and servicing.









