



CITY SENSING DATA FUTURES PROJECT

A collaboration between the City of Melbourne and Monash University's Emerging Technologies Research Lab.



This is a smart sensor which detects the temperature and humidity in different parts of Argyle Square to understand the different climates that exist.

Scan this QR code to see the current sensor climate data and find out more.

<https://monash-emergingtechnologies.com.au/city-sensing>



Air Quality sensor

Discover the need to comply to Environmental Protection Agency (EPA) Air Quality Standard New Zealand's air quality standards are aligned to the rest of Melbourne. Air Quality Standard (AQS) for individual street suburbs. Cities can monitor their air quality which can increase the environmental pollution and burn time that bad air exists in the city. For example, this data may be used as an input to an air quality model.

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Introduction

The City Sensing Data Futures project

City Sensing Data Futures reports on a collaboration between the City of Melbourne and Monash University's Emerging Technologies Research Lab. It **outlines and demonstrates an ethics-based approach** to the capture and use of real-time city data in public spaces, which is **inclusive** and respects the core organisational and public values of: **trust, privacy, transparency, open communication and care.**

This report presents three innovations:

1. The City of Melbourne City Data Futures Design Proposal:

A locally tailored design proposal for a digital and physical City Data prototype for the collection, use and communication of data, reflecting the City of Melbourne's values and ethics relating to trust, transparency, engagement and inclusion.

2. The ETLab City Data Futures Methodology:

A transferable and scalable research, design and communication City Data methodology for creating public trust in ethical city data collection for application in city technology testbeds. The methodology creates new locally specific knowledge, insights and recommendations concerning public experience of and engagement with smart city technologies and data, and prompts public conversations about data and digital technology in shared urban spaces.

3. Key Implications for City Data Sensing:

A set of key implications for the design and implementation of City Data sensing. These implications are based on evidence generated through the ethnographic and design research undertaken in this project. They are intended to guide future research and design for ethical City Data Sensing. These implications, along with local knowledge and specifications, guided the City of Melbourne Data Futures Design Proposal. They may be used to guide testing and embedding the Design Proposal in other sites, as well as to inform future City Data initiatives.

To develop these innovations the Emerging Technologies Research Lab curated an interdisciplinary team of designers, ethnographers and smart city experts. The team developed a bespoke set of creative design ethnographic research methods involving field research and prototyping to address the following key questions:

- 1. how do people engage with (or not engage with) real-time data?**
- 2. how do people experience, understand and perceive real-time data being collected?**
- 3. how do people imagine future possibilities of the city through real-time data?**
- 4. how do people experience possible futures through ethnographic interventions and the prototype?**

The project was developed in Argyle Square in the City of Melbourne. Argyle Square was selected because it is an active site in the City of Melbourne's Emerging Technologies Test Bed, with existing sensors installed. The *Experiences and Perspectives of Urban Sensing in Melbourne* project indicated that Argyle Square was the ideal site through which to investigate questions of interest relating to the values of trust, privacy, transparency, communication, engagement and inclusion.



Background

The City Sensing Data Futures report is based on research conducted by the Emerging Technologies Research Lab at Monash University in collaboration with City of Melbourne's Technology and Digital Innovation team between February - June 2021.

The Emerging Technologies Research Lab is an interdisciplinary and internationally embedded research lab which conducts research into the social, cultural and experiential dimensions of the design, use and futures of new and emerging technologies. The Lab is a cross-faculty initiative through the Faculties of Art, Design & Architecture and Information Technology at Monash University.

The City of Melbourne's involvement in this research is underpinned by a council commitment to trial emerging technologies. The establishment of the emerging technology testbed environment in the City of Melbourne enables the council to partner with the community and other organisations to explore ways that Melbourne can grow as a digital city, respond to city challenges and create new opportunities using emerging technology and data.

This report expands on our earlier report [*Experiences and Perspectives of Urban Sensing in Melbourne*](#), which reports on research conducted during the COVID-19 lockdown between June - September 2020.



Participant Profiles

A total of 34 people participated in the project at Argyle Square, including 25 participants during the first stage of speculative fieldwork ethnographic interviews, and 9 people during the Melbourne Knowledge Week Data in the Park tours. Participants were recruited with help from the City of Melbourne Community Engagement Partner, and by directly inviting people in and around the park to participate. The diverse group of people included: 18 men, 15 women, and one gender diverse person, between the ages of 20+ and 50+. Most of them frequently visited the park for three main reasons: as neighbours and for community activities, due to nearby workplaces and business, and as university staff and students.

People using the park



Relationship with the park



5

local residents



3

local business
owner



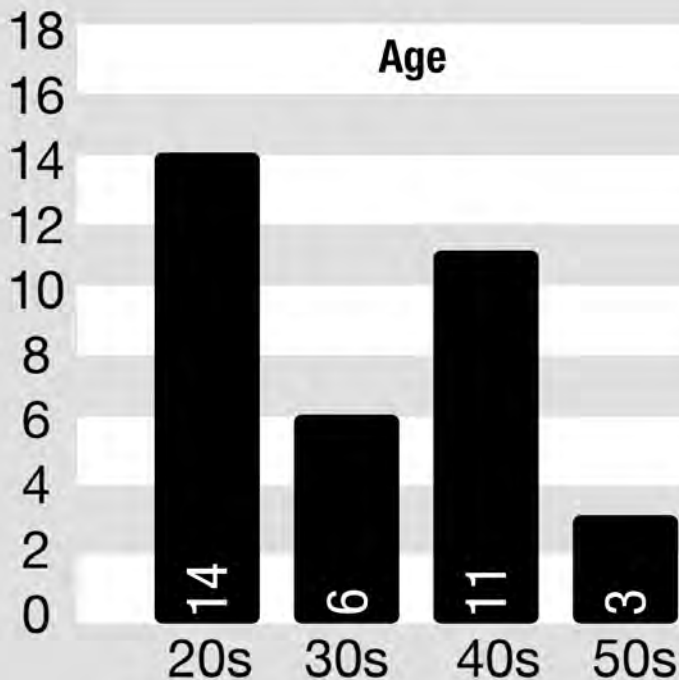
14

work or study
locally



12

visitor



Gender

TOTAL	34
Men	18
Women	15
Gender diverse	1

How to read this report

This report is divided into four key sections.

Section 2

Section 3

EXECUTIVE SUMMARY

The executive summary lays out the key outputs and findings of the project.

KEY IMPLICATIONS FOR CITY DATA SENSING

The following three sections can be read in any order. They are currently structured to prioritise the key practical output of the work - the City Data Design Proposal in Section 4. Section 3 Reports on a set of key implications derived from this project, each of which spells out insights, recommendations and examples of how the implications have been manifested in the Design Prototype or how they might be implemented in future projects.

The Implications are all based on our in depth research and analysis and can be used as universal guidelines for Data Futures.

Section 4

Section 5

DATA FUTURES DESIGN PROPOSAL

The Design Proposal is specific to Argyle Square but easily transferable and adaptable in Melbourne, nationally and internationally.

TRANSFERABLE AND SCALABLE METHODOLOGY

Outlines the Transferable and Scalable Methodology which was employed to create the City Data Design Proposal. The Methodology is explained step by step. Each step is demonstrated with an example of how the methods were used in our research in Argyle Square.

Glossary of terms

City Data Futures is used in this report to refer to future installations of urban sensor technologies, city data collection and use, and communication and engagement techniques and platforms relating to these.

Digital materiality is the combination of inseparable digital and material (physical) objects. For example, we are using Argyle Square as a physical / material site but this site also produces and is linked to data which is a form of 'digital material'.

Transferable in this report refers to the possibility that the design proposal and methodology can be adapted for use by another party.

Methodology is an approach to a research question or problem, which involves the application of a set of research and design methods or techniques.

Design Ethnography is a research and analysis methodology which involves engaging with people in real life and experimental situations.

Design Anthropology is an approach which combines ethnographic and experimental research and design practice, and underpins these with anthropological theory.

Prototype is the draft suite of tools we are using to test whether our ideas work with the public. For the City of Melbourne the prototype consisted of a physical sculptural form, a digital interface and a mode of engagement.



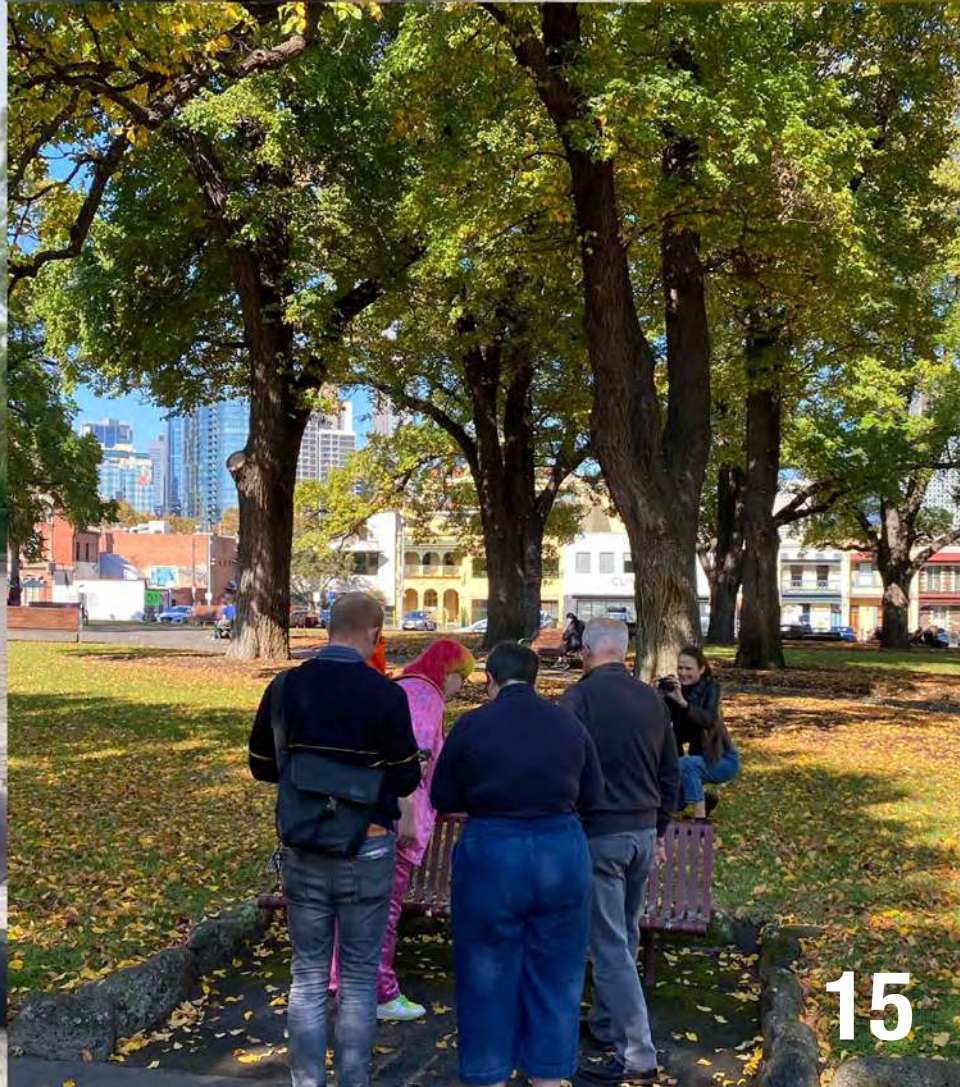
Acknowledgements

We wish to acknowledge the people of the Kulin Nation, specifically the Wurundjeri and Bunurong people on whose land we have worked throughout this project. We wish to pay respect to their Elders, past, present and emerging.

The Monash research team was led by Professor Sarah Pink (Design Anthropologist and emerging technology expert) and project managed by Bianca Vallentine (designer). The team, credited in alphabetical order here and as authors to denote their equally valuable contributions to this project, was: Dr Melisa Duque (Design Anthropologist), Dr Ilya Fridman (Industrial Design Researcher), Dr Debora Lanzeni (Anthropologist, Smart City expert), PhD candidate Robert Lundberg (City and Public Policy expert) and Associate Professor Shanti Sumartojo (Human Geographer and public space expert).

We acknowledge the roles of Lisa Fu (Sensor Family web design and character design), Nicola Hearn (video ethnography) and Tegan Kop (City of Melbourne's Pilot and Trial Lead, Smart City Incubator, Technology and Digital Innovation) who, in addition to their key role in the CoM/ETlab research partnership, led the digital and in-person data tours during Melbourne Knowledge Week.

Finally we thank the 34 people who participated in the project at Argyle Square, without whom our research would have been impossible. Real names have been used for participants who wished for their names to be used. Where requested pseudonyms have been used.







Executive Summary

2.1. The Sensor Family prototype experiment indicated four options for the City of Melbourne City Data Design Proposal

- Permanent installation of a Sensor Family of Sculptures in the park, inscribed with locally meaningful references and quotes, with an embedded QR Code to access data, appropriate signage and inclusive access to an online platform which would offer the public data, information and services. This personalised Sensor Family could additionally be used for event and activity based engagement activities, such as Melbourne Knowledge Week, or as part of a school education program.
- A mobile event or activity-based package of cardboard Family of Sensors sculptures and corresponding digital and material tools (i.e. our materials as in Melbourne Knowledge Week), which can be used to create facilitated engagement for groups, schools, data tours etc.
- A public billboard which will provide informational content as well as QR code links to the website and use the Family of Sensors characters to identify the kinds of sensors in the park.
- A set of further opportunities for Data collection and design are identified, which go beyond the scope of this project, but align with the research findings and values proposed.

2.2. Transferable and Scalable Methodology

The **City Data Futures Methodology** is a transferable and scalable 7-step methodology. It is underpinned by the principle of inclusion and is values-based. It can be used to understand, experiment, evaluate and recommend **Design Proposals and briefs** for trusted city data collection, use and engagement. The methodology employs innovative methods and concepts derived from design anthropology. It is locally responsive, and therefore is transferable and scalable to other city sites. The methodology was conceived and tested in Argyle Square, Melbourne.

The City Data Futures Methodology follows a 7-Step process. The methods we developed could be transferred to similar sites but refined to respond to local circumstances and questions.

Step 1: Site familiarisation and on-site methods refinement

Step 2: Ethnographic fieldwork

Step 3: Ethnographic analysis for prototype conceptualisation

Step 4: Prototype design and fabrication

Step 5: Public prototype experiment

Step 6: Public Engagement Analysis and Evaluation

Step 7: City Data Design Proposal

The values of trust, privacy, transparency, open communication and care, were investigated, analysed, tested and embedded in our insights and recommendations across all stages of the project. They are underpinned by the principle of inclusion.

2.3. Key implications

The project revealed 10 evidence-based implications for City Data Futures. The implications are universal and can be applied to the planning, implementation or evaluation of other City Data Sensing projects in Melbourne, and adapted nationally in Australia and internationally.

- 1. The design of trusted City Data Sensing involves attention to everyday ethics, values, practices and environment.**
- 2. Align city, public and everyday values in City Data Sensing.**
- 3. Create direct lines of acknowledgement and accountability to local values, environments and practices when designing for City Data Sensing.**
- 4. City Data should be engaged with site-based digital, physical and in-person material practices and events.**
- 5. Create opportunities for different informational engagements with City Data.**
- 6. Create possibilities for playful participatory engagements with City Data.**
- 7. Create open communication methods that align with people's existing communication practices.**
- 8. Create opportunities for people to express, enact and receive care through City Data.**
- 9. Portray City data as alive and active - synchronised with life and aligned with life sources.**
- 10. Understand Data as a Digital Asset and create a suite of new 'City Data as'.**

A young boy with a backpack is looking at a map on a table. The map shows a street layout with a red line indicating a path. The background is a blurred outdoor setting with a paved area and some greenery.

Key Implications for City Data Sensing

In this section we report on 10 evidence-based implications. These are based on insights from the ethnographic research undertaken before and during the prototype experiment in Argyle Square.

The implications are universal and can be applied to the planning, implementation or evaluation of other City Data Sensing projects in Melbourne, and adapted nationally in Australia and internationally.

The implications are laid out to demonstrate the key insights they are related to, the recommendations we make on the basis of these insights and to demonstrate their practical application by showing how they were manifested in the Argyle Square City Data Design Proposal. However because ethnography-based insights can be broader than the expectations of project briefs we also note where it fell outside of the scope of this project to apply some implications to the City Data Design Proposal, while suggesting that they can be usefully accounted for in future projects.

3.1. The design of trusted City Data Sensing involves attention to everyday ethics, values, practices and environment

Insight: Everyday trust is inseparable from the everyday ethics, values, practices and environments in which people live. It is a suitable concept for creating trusted City Data Sensing, because rather than seeing trust as something that is generated and driven by technologies, it understands trust coming about as part of everyday environments. It also acknowledges that trust is not a fixed quality of a relationship between a person and technology, but can waver and change.

To gain everyday trust we need to create technologies that respond to the everyday ethics, values, practices and environments in which people live. We need to realise that it is not the technologies themselves that are trustworthy, but the situations and modes in which they are engaged and the power relationships they are part of. This means that we cannot create a design for a transferable trustworthy City Data Sensing technology, but that instead we should create a design for a methodology and process through which new City Data Sensing technologies can participate with people, and organisations in ways and in local sites where they can be trusted by all stakeholders.

Recommendation: Embed City Data Sensing technologies in local situations where they can become part of and participate in networks and communities of trust.

Manifestation in the Design Proposal:

By providing an opportunity for the community to be part of the data by making them aware of the sensors and data at the site, they will trust that there is nothing to hide in the data collection process. Communication tools about data do not need to be explicit, instead they can evoke curiosity.

3.2. Align City, Public and Everyday Values in City Data Sensing

Insight: To generate trust we need to be attentive to values. Our research brought together the City of Melbourne's values with public values which were identified through our ethnographic research in Argyle Square and across other Melbourne sites. By consolidating this into 5 aligned core values - trust, privacy, transparency, open communication and care - we created a framework for a Prototype that resonates with City, Public and Everyday life values.

Recommendation: Discover and align values across stakeholders, make these values explicit in City Data Sensing.

Manifestation in the Design Proposal:

The design proposal presents a set of sculptures and digital resources that connect with these values by: connecting users directly to a trusted organisation (City of Melbourne); offering privacy choices; creating transparency by making data collection visible; having digital and physical elements which connect with the physical park; providing ways for people to access and use data for self care and care for others.

3.3. Create direct lines of acknowledgement of and accountability to local values, environments and practices when designing for City Data Sensing

Insight: Our research demonstrated that by researching and embedding familiar and aligned local values, environment and practices in the design of physical and digital artefacts, communication systems and engagement possibilities City Data Sensing can become a trusted and interesting element of the local environment.

Recommendation: Discover and embed local practices, values, and representations of the natural and built environment of the site into the design of City Data Sensing. Engage design anthropological concepts and analysis and onsite design ethnography research and experimentation and testing to identify, activate and assess alignment.

Manifestation in the Design Proposal: The design proposal suggests the inclusion of quotes from local people which represent the core local values that were identified during the ethnographic process.

3.4. City Data should be engaged with site-based digital, physical and in-person practices and events

Insight: City data solutions, the generation of trust and increasing engagement cannot be brought about solely through digital designs or solutions. Rather a key success factor of a digital and physical design, is when it is embedded in locally relevant activities and familiar technology use and data practices. This could be: an individual activity (e.g. a person is interested in the weather and engages with data from sensors to find information); a scheduled activity (e.g. data tours, like history tours or ghost tours); or a community activity related to a sport or festival event held at the site.

Recommendation: City data use and the services and activities connected to it should have continuity to existing everyday and event-based practices that are already treasured and enjoyed elements of individual and community life at the site.

Manifestation in the Design Proposal: The design proposal offers opportunities to connect the permanent and temporary sculpture designs and the digital resources to local events, businesses and schools for educational purposes and to access information that is relevant to them. There are opportunities to further develop the public's concerns, wishes, and ideas into technological solutions as part of a future process.

3.5. Create opportunities for different informational engagements with City Data

Insight: People wish to use city data for informational purposes as well as playfully. People are interested in what the sensors can tell them about the environment regarding things that are not visible to them, such as about ultraviolet rays, animal life, or unseen threats to their own and others personal safety. Our experiments also enabled people to contribute to the prototypes by writing on cardboard sculptures and commenting on digital prototypes.

Recommendation: Make participation and engagement visible and possible, and make possible different ways in which people might use or engage with city data.

Manifestation in the Design Proposal: The public can connect to the data being captured through engagement activities or via educational programs aimed at solving real-world problems surfaced from the data.

3.6. Create possibilities for playful participatory engagements with City Data

Insight: People often engage with data and devices playfully. Existing ETLab research shows that people use self-tracking, body monitoring and voice assistant technologies and data playfully. Similar playful modes of engaging with city data were evident in our research as we learnt how people engaged with the prototype experiment, in the comments participants wrote on the cardboard installations, and on the website, and in our ethnography where interest in the idea of playing with the sensor activation and game-like modes of participation were evident.

Recommendation: Ensure that participatory engagements can go both ways by enabling people to both use data and contribute and share comments in ways that involve playful interactions with data.

Manifestation in the Design Proposal: The design itself is intended to be playful and the Family of Sensors characters have been designed to reference the sensors in the park in a fun, animated way. Through colour, shape and scale the sculptural objects can add vibrancy to the park, prompting and provoking the public to think about and interact with real-time data.

3.7. Create open communication methods that align with people's existing communication practices

Insight: People already use a range of technologies, or signage for information and communication.

Recommendation: Build on these technologies to enable people to engage with data as part of their existing communications ecologies. Examples might be the option to activate visual, audio or tactile (e.g. vibration) smartphone or smartwatch alerts which can be enabled in correspondence with engaging signage.

Allow and support how people are notified when and what data is being collected through these familiar methods. Make communication two-way between the City and the public.

Manifestation in the Design Proposal:

The design proposal is based on people being able to access and use City Data on their smartphones. This creates the possibility of further development of such communication methods.

3.8. Create opportunities for people to express, enact and receive care through City Data

Insight: People would like to use city data for self-care (e.g. knowing to wear sunscreen, knowing how full the park is during a pandemic), they would like city data to care for them (e.g. telling them when they have sat still on a bench too long, telling them about their exercise), to care for the public (e.g. around safety questions), to help local businesses (e.g. if to set up outdoor tables relating to weather).

Recommendation: Create city data alerts that people can subscribe to (e.g. safety alerts, capacity alerts; embed playful alerts in the infrastructure (e.g. bench alert), provide dedicated safety data alerts.

Manifestation in the Design Proposal:

The digital platform and smartphone access opens the possibility of such uses of data and alerts to be developed.

3.9. Portray City data as alive and active - synchronised with life and aligned with life sources

Insight: City data continually changes in ways that are in sync with human, animal and plant life as it happens. It follows the changes in the environment, in the life sources (air, weather, soil) and movement and activities of people and other species. City data is part of the city and part of life - we should take the opportunity this offers to emphasize city data as alive, active and accessible.

Recommendation: Ensure that sculpture and web design incorporates or emphasises the 'live' elements of both data and the environment itself.

Manifestation in the Design Proposal:

It is possible to include information relating to these issues in the information content of signage and the website. However, engaging people with data as living would also form a key aspect of city data engagement events and educational activities.

3.10. Understand Data as a Digital Asset and create a suite of new 'City Data as'

Insight: Data is emerging as a Digital Asset across multiple industry and policy domains. There is an opportunity to create ethical, transparent and non-monetized versions of digital data asset management which will grow digital and in-person engagement and trust.

Recommendation: Create new "City Data as ..." and "City Data ..." models which play out these values.

'City Data as a Service' model: The growth of the service economy has accustomed people to accessing services online. The idea of City Data as a Service would shift this by making City Data services freely available. A City Data as a Service model. This would need to be underpinned by new research to shape the data services and create accessible and inclusive ways of using them.

'City Data as a solution' model: applying the 'real world' questions that the local community have, in partnership with tech innovators.

'City Data Community' model: involving local people and businesses - digital and physical community around City Data Sensing - open data, sharing etc. (e.g. smart citizen community) to create human focussed results to questions.

'City Data Advocates' model: Encourage and support community based City Data advocates.

'City Data as Education' model: An education based community outreach program, so schools and students can better understand how data can be a tool to create solutions.

Manifestation in the Design Proposal:

It is beyond the scope of the present design proposal to embody all of these possibilities, however it has been designed in such a way to be open to adding them.



I'm a pedestrian sensor who counts how many people are in the park, how long they stay and in which parts of the park. This data helps with planning for new parks and enhancing existing ones.

Scan this QR code to see the current pedestrian data and find out more!

<https://family-of-sensors.webflow.io/pedestrian>



HOW CAN I GET A PERSONALISED EXPERIENCE AND GET ACCESS TO MY DATA?

Putting Melbourne on the tech map

CAN YOU MEASURE CLIMATE CHANGES?

HOW CAN I PARTICIPATE AND ACCESS THE DATA?

CAN YOU MEASURE CLIMATE CHANGES?

Do you sense pollution?
or pollen?

What sort of Data should never be collected?

time
nap!



true transparency
includes the option
to opt-out

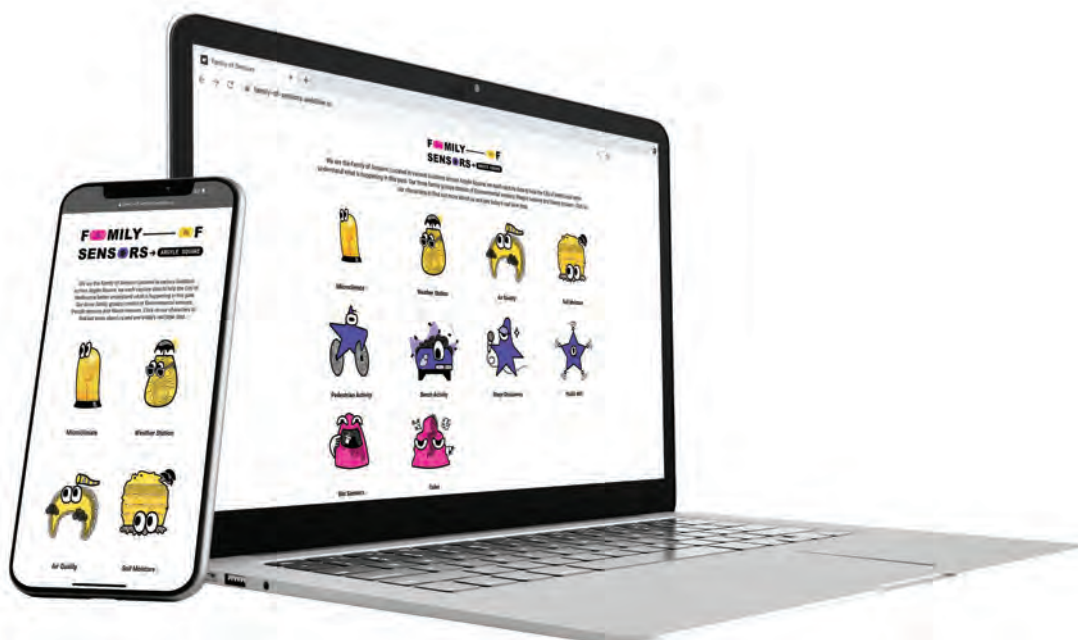


City Data Design Proposal

The City Data Design Proposal has been developed as a model that can be adapted for other city technology testbeds. To do this successfully the design should incorporate the following:

- **Create a way for the public to actively engage with the design that encompasses a range of access points that account for physical, social, economic or cultural abilities**
- **Create curiosity, either through an object or engagement activity that allows people a way to interact with real-time data**
- **Create an opportunity for multiple layers of engagement - specifically a combination of physical and digital interactions**
- **Incorporate the public's values into the design**
- **Incorporate sustainable understandings of materiality, developed in accordance to the proposed life span of the design and OHS and Public Liability guidelines of public forms**
- **Use ethnographic findings to guide the design**

The proposal presented here is designed for Argyle Square and ideally each new installation of it would be developed through the locally specific research and design process outlined in section 4. However, it is also possible to adapt the Design Proposal rapidly for installation in other public City Data contexts, with the caveat that certain refinements will be needed in order to ensure that it is locally derived and relevant.



Option 1: Family of Sensors permanent sculptural objects and digital elements

This option is a refinement of the research prototype, using a sculptural (physical) object, QR codes and website (digital) to inform the public users of Argyle Square about the use of sensors and data capture in the park. We suggest making permanent sculptures in the park using durable materials. The sculptures should have embedded in their shape a singular QR code that takes the public user to the Family of Sensors website. A locally embedded quote from the ethnography, plus a project description should be inscribed on the exterior of the sculpture.

Material possibilities:

Molded concrete, steel, wood, perspex, molded plastic

Ways to include text/graphic elements like the QR code:

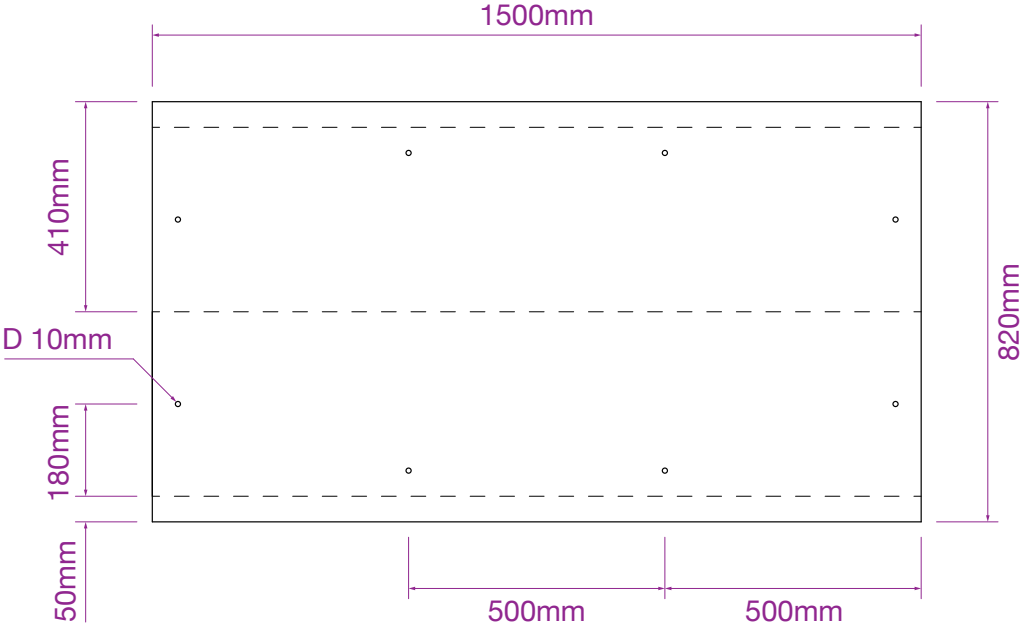
Etching, laser cutting, surfaces adhering e.g. flocking, sticker decals, plates, screen printing

Considerations:

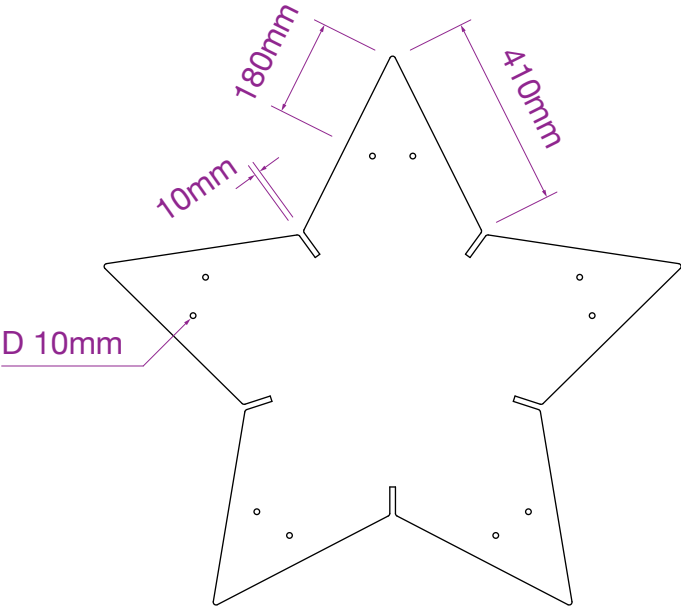
- The object design will need a flat side to incorporate the QR code
- Suitable testing of the QR code on the surface will be needed to ensure the QR code works effectively. Curves and reflections will diminish its effectiveness
- OHS, design suitability, and public acceptance need further testing
- The Family of Sensors website will need proper licensing and consideration of the design licenses needs further consideration
- Public comments are not currently displayed on the website, however there is capability – this capability would require moderation and active engagement by the CoM team
- There is an opportunity for the City Data Design Proposal to be taken forward as a public artform in partnership with Monash University

People-focused sculpture cardboard prototype template

Part A x 1



Part B x 2



Notes

- Broken line indicates fold
- Dimensions repeated across part unless otherwise indicated
- Circular holes intended for cable tie assembly

This technology uses the use of a 3D sensor, known as a LiDAR sensor, to create a 3D map of the area around it. This sensor can detect the shape and size of objects and the distance between them. It can also detect the movement of objects and the direction they are moving in.

LiDAR sensors are used in a variety of applications, including self-driving cars, robotics, and mapping. They are also used in the City of Melbourne's People Sensing Technology in Argle Square.

The City of Melbourne is testing People Sensing Technology in Argle Square. This technology uses LiDAR sensors to detect the presence of people in the square and to track their movement. The data collected is used to improve the design and management of the square.

Scan this QR code to see the real-time data and to see how the technology works.

<https://www.cityofmelbourne.vic.gov.au/argle-square>



CITY OF MELBOURNE IS TESTING PEOPLE SENSING TECHNOLOGY IN ARGLE SQUARE

The City of Melbourne is testing People Sensing Technology in Argle Square. This technology uses LiDAR sensors to detect the presence of people in the square and to track their movement. The data collected is used to improve the design and management of the square.

Scan this QR code to see the real-time data and to see how the technology works.

<https://www.cityofmelbourne.vic.gov.au/argle-square>





Option 2: Public engagement model with temporary objects

This option provides the City cardboard templates which they can print and erect for engagement activities and data tours as a means to engage with the public. Some design modifications have been made to these templates to make them easier to construct with the design incorporating the QR code, ethnographic quotes and project description directly on the surface.

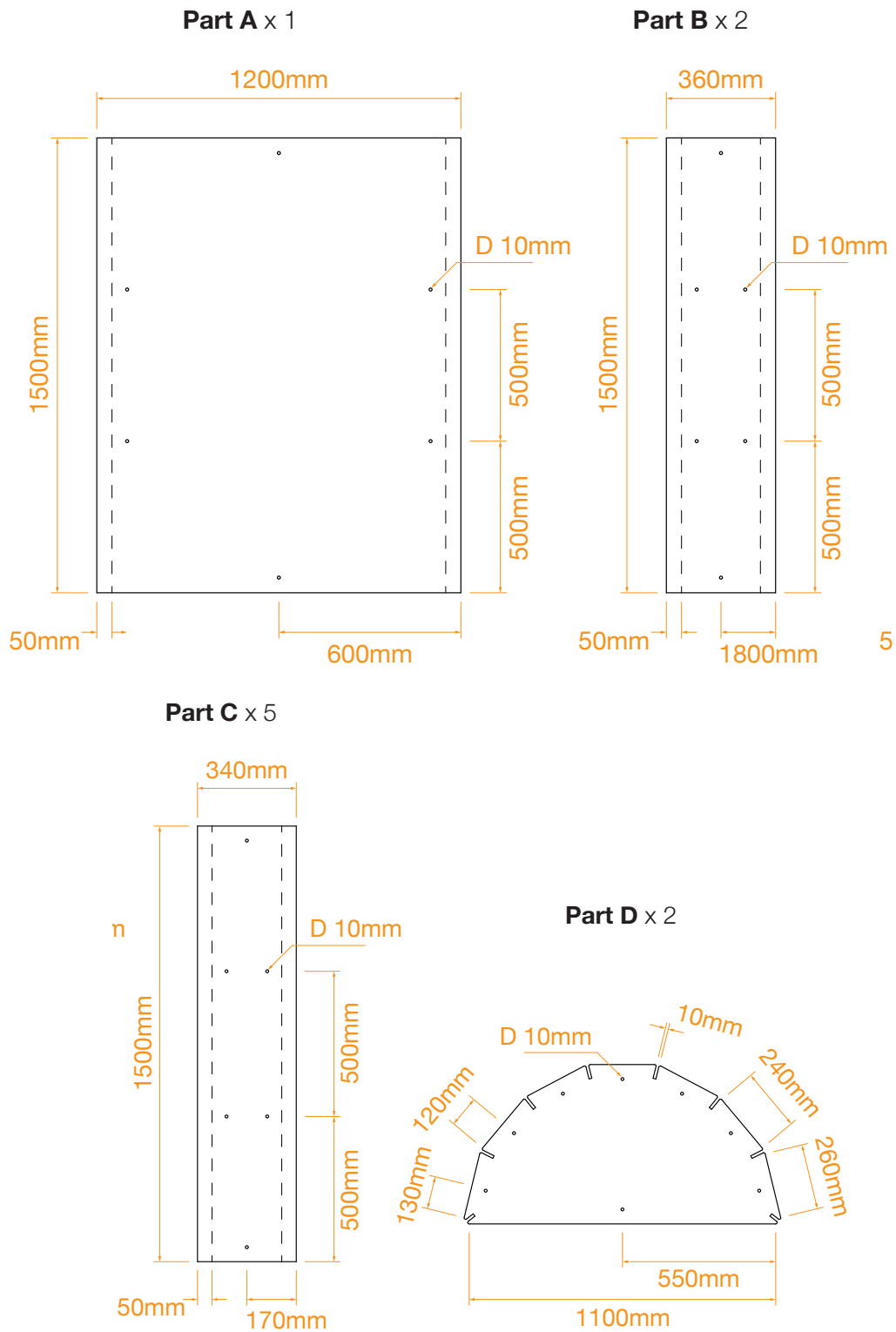
Considerations:

- **These temporary objects are for public engagement or education, for example opportunities include partnering with schools, tech innovators or businesses to co-design for data use in the park**
- **The Family of Sensors website will need proper licensing and consideration of the design licenses**



Participants interacting with the Family of Sensors sculpture

Environment-focused prototype cardboard sculpture proposal



Notes

Broken line indicates fold

Dimensions repeated across part unless otherwise indicated

Circular holes intended for cable tie assembly

Participants interacting with the Family of Sensors sculpture



QR code linking to website.

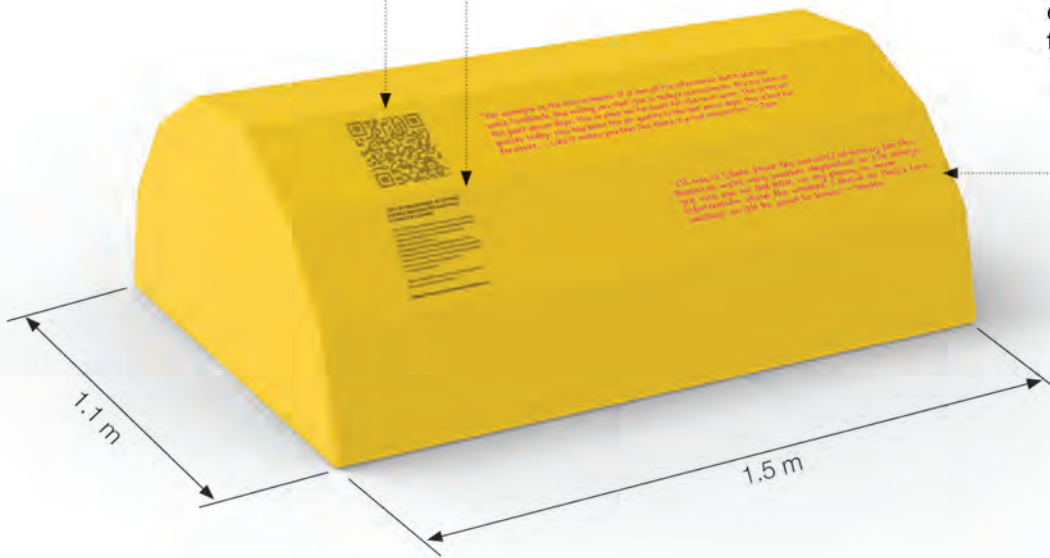
CITY OF MELBOURNE IS TESTING ENVIRONMENT SENSING TECHNOLOGY IN ARGYLE SQUARE

The City Sensing Data Futures Prototype is part of an ongoing research partnership between the City of Melbourne and Monash University's Emerging Technologies Research Lab looking at how the City can transparently communicate its use of sensors and the kinds of data that is captured in Argyle Square.

Scan this QR code to see the real-time data and find out more!

<https://family-of-sensors.webflow.io>

Statement about data collection and invitation to visit website



very weather
me BOM, on my
ther, I thrive d
o." - 'Martin'

Participant quotes

Option 3: Family of Sensors public signage

Using the Family of Sensors characters to create a public billboard that notifies the public of the use of data and sensors, including the QR code linking through to the Family of Sensors website.

Considerations:

- The billboard will only inform public users of the site and lacks the two-way communication seen in this project, so whilst it will notify users, it may exclude some users and may not attract all users to use the QR code to find out more information
- Braille and multi-language options should be considered for the billboard and digital interfaces
- The Family of Sensors website will need proper licensing and consideration of the design licenses
- There is opportunity to make the sign more interactive if it is fixed



Printed signage proposal

CITY OF MELBOURNE IS TESTING ENVIRONMENT SENSING TECHNOLOGY IN ARGYLE SQUARE

The City Sensing Data Futures Prototype is part of an ongoing research partnership between the City of Melbourne and Monash University's Emerging Technologies Research Lab looking at how the City can transparently communicate its use of sensors and the kinds of data that is captured in Argyle Square.

Scan this QR code to see the real-time data and find out more!

<https://family-of-sensors.webflow.io>



CITY OF MELBOURNE IS TESTING WASTE SENSING TECHNOLOGY IN ARGYLE SQUARE

The City Sensing Data Futures Prototype is part of an ongoing research partnership between the City of Melbourne and Monash University's Emerging Technologies Research Lab looking at how the City can transparently communicate its use of sensors and the kinds of data that is captured in Argyle Square.

Scan this QR code to see the real-time data and find out more!
<https://family-of-sensors.webflow.io>



CITY OF MELBOURNE IS TESTING WASTE SENSING TECHNOLOGY IN ARGYLE SQUARE

The City Sensing Data Futures Prototype is part of an ongoing research partnership between the City of Melbourne and Monash University's Emerging Technologies Research Lab looking at how the City can transparently communicate its use of sensors and the kinds of data that is captured in Argyle Square.

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CITY OF MELBOURNE IS TESTING PEOPLE SENSING TECHNOLOGY IN ARGYLE SQUARE

The City Sensing Data Futures Prototype is part of an ongoing research partnership between the City of Melbourne and Monash University's Emerging Technologies Research Lab looking at how the City can transparently communicate its use of sensors and the kinds of data that is captured in Argyle Square.

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Opportunities for deployment across the city

This opportunity would assemble the elements of the Family of Sensors into a range of pavement, wall and street pole sculptures to be installed across key sites in Melbourne's CBD. This would be designed to provoke curiosity and offer educational and engagement opportunities to the public, involving learning about data and connecting users to their city data.

This approach follows the logic of making data visible by incorporating public artform and the Playable Cities concepts (successfully developed by Troy Innocent in 2017) by building on existing static poles, walls and footpaths in popular meeting places or locations where people dwell throughout the city, in order to introduce them to data sensing initiatives. Below we present a set of initial ideas of how to incorporate these concepts into the City's landscape. These are initial concepts and require additional refinement before they can be properly implemented. They could be applied together or as separate concepts across the city.

Concept 1: Stacked Family of Sensors poles

Using the existing infrastructure of street poles, apply the Family of Sensors sculptural elements as mounted objects vertically on the poles. These would include a QR code, character icons, a project description and people's quotes as decals over the sculpture.

Considerations:

- The individual sculptural elements could be reconfigured in different ways to make each pole unique and interesting, 'playable' in a sense. This could be a community outreach activity in terms of assembling the best compositions of the poles or simply a randomised reconfiguration to create a dynamic streetscape
- The QR code, quotes and descriptions deliver an immediate way to access the data or at least start to understand it, making it visual and evoking curiosity
- The QR code, quotes and characters icons could form part of a larger educational offering for schools to engage and connect to the data and Family of Sensors website
- There are multiple options of fabrication suitable for these designs. These would need to be investigated in consultation with suitable manufacturers. For example, the method rotational moulding may be used with post-consumer recycled plastic, which would align to CoM's values around sustainability
- Braille and multi-language options should be considered for the interfaces



Concept 2: Sticker decals would apply the Family of Sensors across surfaces in the city

Considerations:

- The location, placement and wear of decals needs to be considered in relation to their desired lifespans prior to deployment
- Reducing visual competition with other advertising and signage
- Braille and multi-language options
- Other engagement activities that link the Family of Sensors stickers to their CBD locations i.e. a treasure hunt concept for educational engagement activities



Concept 3: Painted signs with 3D effect.

'3D-look' painted signs applied to ground surfaces where people dwell or wait are a visual opportunity to engage the audience about data in a compelling way.

Considerations:

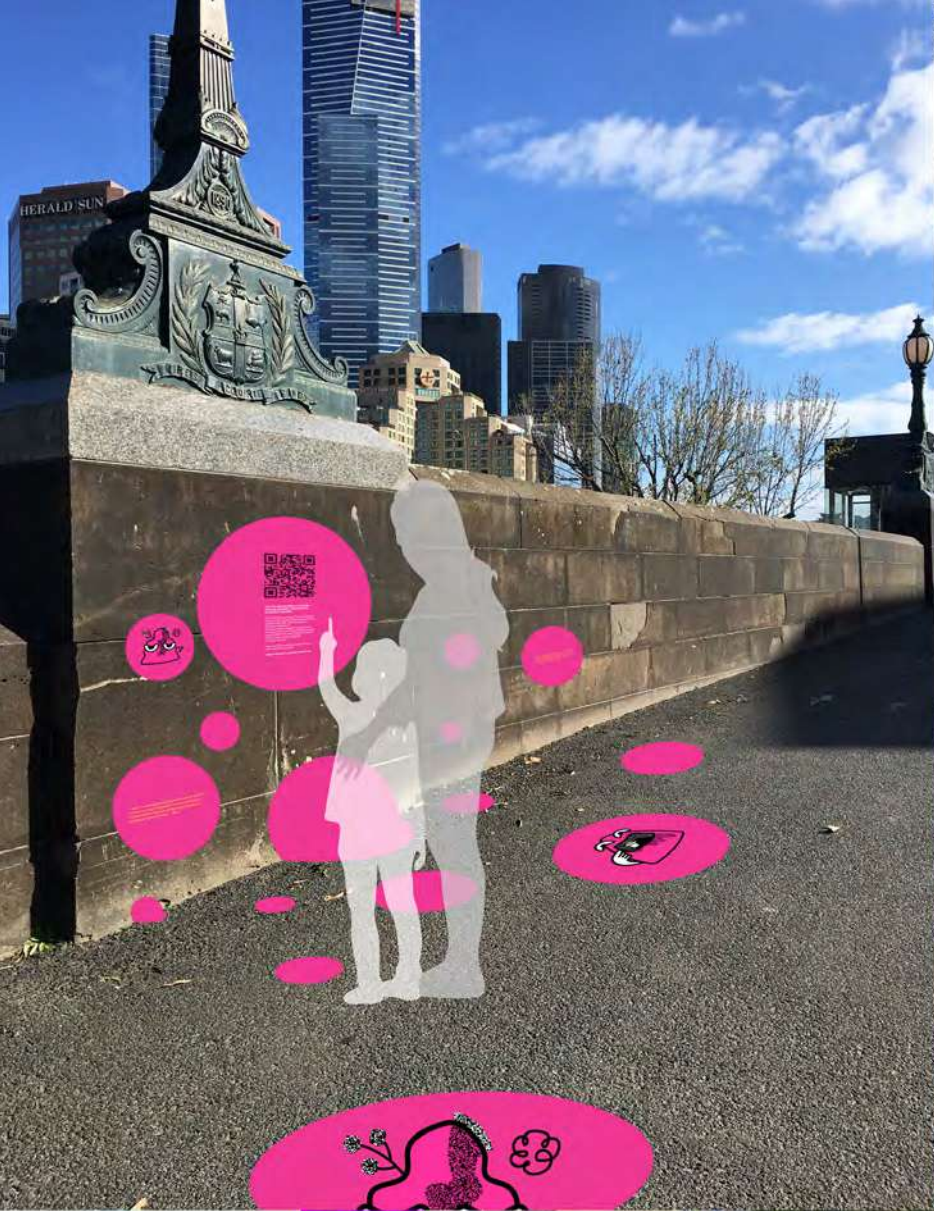
- Placement is crucial to where this 3D painting is applied, suggested locations are Federation Square, near train stations, Bourke Street mall, Elizabeth Street
- The 3D effect only looks convincing from one viewing angle. Signs may look confusing from different standing positions
- Braille and multi-language options should be considered for the billboard and digital interfaces
- An active engagement strategy could help mobilise understanding of city data sensing



Further opportunities for Data collection and design

In addition to our City Data Design Proposal there are opportunities for the City of Melbourne to use education and tech communities to help solve real-world problems and opportunities that were surfaced in the ethnography.

- **weather conditions of the park**
- **UV index in the park**
- **busyness of the park**
- **activities in the park**
- **heritage and biodiversity of the park**
- **how the public can feel safer with use of sensors, safety apps and controls**
- **digital tools that alert users of the park when data is being collected**





Transferable and Scalable Methodology

The **City Data Futures Methodology** is a new transferable and scalable methodology which can be used to understand, experiment, evaluate and recommend **Design Proposals and briefs for trusted city data collection**, use and engagement. The methodology employs innovative methods and concepts derived from design anthropology. It is locally responsive, and therefore is transferable and scalable to other city sites. The methodology was conceived and tested in Argyle Square, Melbourne.

Values

The methodology is underpinned by a set of key values relating to city data (Appendix 4). These should be drawn from the City stakeholders, existing studies and knowledge, and publics. For example, in the Argyle Square study these were derived from three sources: values agreed in partnership with the City of Melbourne; public values and international case studies identified in the *2020 Experiences and Perspectives of Urban Sensing in Melbourne Report*; and values emerging during the ethnographic research process. These values structure the ethnographic analysis in Section 3 (page 21) we demonstrate how they manifest in the Argyle Square study. The values we identified in the Argyle Square study are likely to be transferable and applicable to other studies. However we recommend their local applicability is tested and the possibility of adding new locally and organisationally specific values should be workshopped with stakeholders.

Value 1

Trust:

People need to feel they can trust the organisations, technologies and people who collect, use and share city data and organisations need to ensure that they enable trust by investing and demonstrating appropriate values in their technologies and practices.

Value 2

Privacy:

In order to trust, people need to be in control of the levels of privacy they are willing to relinquish and the information they are prepared to share. To ensure privacy is respected we need to understand how and why people understand their privacy, what they value about it, what doesn't matter and their perceptions of the benefits, ethics and risks of sharing information.

Value 3

Transparency:

Transparency regarding the data that is being collected, its use and who has access to it is important for generating trust and to reassure people that their privacy is respected. To make city data transparent we need to know both what levels of awareness already exist, are desired and what transparency means to local people.

Value 4

Open Communication:

To generate trust and transparency, clear, accessible and active open communication of engaging content that people are interested in is required. We need to understand what content people wish to know about how city data is collected, what content they are interested in regarding the knowledge produced through city data and how this is best presented. Communication should also be two-way, enabling people to comment on digital platforms.

Engagement is part of open communication between the City and the Public. It underpins public participation in the form of data sharing, data use, and the generation of trusted relationships. Engagement involving city data is digital and physical/material, in that it involves both the physical space of the city and the digital space of data and platforms. These digital, physical and in-person elements are never separated, therefore when we conceptualise engagement in this context we should always consider all three.

Value 5

Care:

Care is often embedded in people's everyday practices towards themselves (such as health), towards others close to them, and in relation to public issues (such as safety). Enabling people to use data to care for themselves and others supports their participation and engagement. Transparency and open communication about how the City uses data to care for people (e.g. their health, comfort and their privacy), public spaces (e.g. aspects of their environments), and local communities and businesses helps generate trust.

These values were investigated, analysed, tested and embedded in our insights and recommendations across all stages of the project. They are underpinned by the principle of **inclusion**. We need to ensure that designs for future City Data respect the principles of inclusive design, and account for the needs and interests of diverse groups relating to the values of trust, privacy, transparency, open communication and care. Knowledge about existing data practices, technology use, access and hoped-for futures of diverse people can support this, but existing structural social inequalities and digital exclusion are barriers.

Methods

The City Data Futures Methodology follows a 7-Step process. The methods we developed could be transferred to similar sites but refined to respond to local circumstances and questions.

Step 1: Site familiarisation and on-site methods refinement

Step 2: Ethnographic fieldwork

Step 3: Ethnographic analysis for prototype conceptualisation

Step 4: Prototype design and fabrication

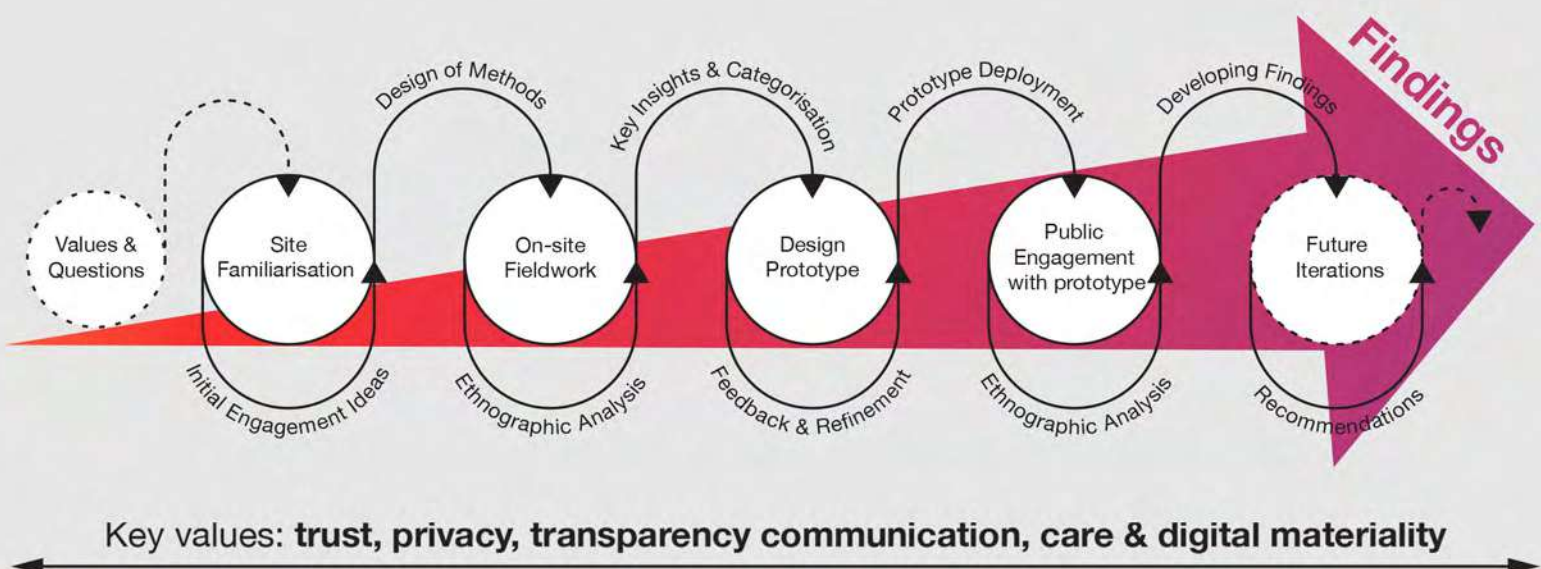
Step 5: Public prototype experiment

Step 6: Public Engagement Analysis and Evaluation

Step 7: City Data Design Proposal

In this section we detail the methods steps and exemplify how they were applied in Argyle Square.

Research method process



Step 1: Site familiarisation and on-site methods refinement

This method is integral to the set-up of the onsite research and involves the whole research team:

- **learning from the City stakeholders regarding the existing conditions of the site and their aspirations for it**
- **understanding the physical (natural and built environment) and digital layouts of the site and accounting for ways the site is integrated into city or neighbourhood annual event cycles**
- **spending time on the site to attune themselves to the environment of the site, its daily rhythms and observed activity**
- **refining research questions in response to the local site-specific context**
- **remaining on the site to design tailored research methods to respond to the research questions and the specific local conditions, site layout and technologies**
- **testing and refining the methods within the team to evaluate their site-specific applications**

In Argyle Square the team: worked with City of Melbourne to understand the site and the opportunities to connect the research and prototype to city events; went on-site to observe and discuss the site as a research environment; held all-team research and methods planning meetings at the site or in a nearby cafe; tested methods with each other on the site.

Step 2: Ethnographic fieldwork

On-site ethnographic fieldwork with people who use the site for diverse purposes provides essential insights into: how the values map onto the actual experiences of local people, and how they are reflected in their concerns, local practices, ways of enjoying public space, experiences and feelings relating to data collection and use, priorities for data and imagined future ways of participating and engaging with data.

To investigate the first two research questions with participants in public space, go-along and speculative methods were developed.

Go-along interviews:

This activity responds to question 1: how do people engage with (or do not engage with) real-time data? It involves participants showing researchers how and where they perform their usual routines or activities at the research site, and discussing how they imagine this in the future. This provides insights into how they use and move around in or through the site, their existing data practices and understandings and experiences of data and how they imagine the possibilities of data. Go-along interviews should be audio and/or video recorded where participants consent.

In Argyle Square these methods created significant discussions with participants. Many people could imagine incorporating Argyle Square data into how they already understand their surroundings. The research method of interviewing people in these surroundings or touring these surroundings revealed these understandings and future imaginations. For instance, one participant, 'Martin', had owned a cafe near Argyle Square, for about two and a half years. Although his cafe was not actually in the park he felt it was **"definitely part of this park."** He saw the park, its conditions and what happens in it as directly related to his business, since: **"If it's a nice day, people order here, go sit in the park, or if they're from the park, they'll see us and say 'oh, we'll go and get a coffee' and come over to us."**

Two kinds of data stood out to him as directly related to the success of his business: weather and microclimate, and pedestrian footfall data. He considered that access to microclimate sensor data would enhance his existing practices of checking weather predictions. Pedestrian footfall would tell him how busy the neighbourhood and the cafe, might be on any given day: **"I'd like to know the people walking in and out, that'd be great to know... how many people are walking past the shop... I'd like to know how many people are going through the park as well."**

As Melbourne recovered from the COVID-19 lockdown, he was additionally interested in pedestrian data as indicative of wider trends as people increasingly came back into his area of the city, explained: "It's always nice to know what the area's doing. Whether or not it translates into us being busy I don't know, it's just good to know the numbers, if they do correlate to a busy day or a quiet day. It would be good to see."



ETLab researchers interviewing City of Melbourne's Tegan Kop and a participant during the City Data Tour

'If you were a sensor' activity:

This activity responds to question 2: *how do people experience, understand and perceive real-time data being collected?*, by asking participants to engage with sensors and data in public space generally and with specific reference to the research site. Participants are encouraged to discuss what data they would collect and share and with whom if they were sensors themselves. The dialogue with researchers is shaped in such a way that acknowledges and surfaces their feelings about the human relations, and power dynamics with government and corporate entities, involved with data collection and management. The inclusion of opportunities for speculation and imaginative responses can open up new ways to understand how people feel about data and technology in their everyday lives. 'If you were a sensor' activities should be audio and/or video recorded where participants consent.

In Argyle Square these methods were successfully employed with participants in the park.



Sophie was a frequent visitor to Argyle Square, who emphasised its value to the local community. Like many participants she was surprised sensors were being trialled there, telling us "I didn't even know that you could sense parks" and reflecting "I guess it would be to track activity, if the park is actually being used, and if it's been used properly, so maybe um they're not like cameras or anything are they?."

Sophie role-played the bench sensor under the trees where she usually sat during her work lunch breaks. **“I like it, it feels cozy, so maybe if I was a bench sensor I would probably place myself like near the trees so you could see who sits here.”**

Sophie also considered how the sensor could be installed in a way that cared for and protected the wellbeing and aesthetics of the park environment. She told us, as a sensor she would probably look like **“those solar lights that you stick on the ground, ‘cause I wouldn’t wanna put anything on the trees ‘cause I wouldn’t want to damage anything, but maybe something that you stick on the ground and sort of pops up and faces that way, that is small and not as noticeable.”** As a bench sensor Sophie would collect data **“every time someone sits down and sits up, that’s probably a count of one that goes into.”** She envisaged her data management would entail putting **“that into like a spreadsheet, so you’ve got like foot traffic along with demographics.”**

Sophie was reassured by knowing the bench sensor was **“just to count how many people use the bench [instead of cameras]”** and appreciated the value of sensors and data for the Square’s wellbeing and maintenance. In her words: **“obviously these trees are super super old, so if it’s struggling in a way, if people are misusing it [park] so it’s probably good to capture that data so we can improve it.”**



Step 3: Ethnographic analysis for prototype conceptualisation

Ethnographic materials should be analysed to respond to the research questions 1 and 2 and with reference to the Values. New values are also likely to be added at this stage as they emerge from the ethnographic analysis.

However, analysis is a process that draws not simply on ethnographic materials but that combines different materials and knowledge of different kinds. This includes the ethnographic findings, existing knowledge, and theoretical knowledge needed to shape the findings conceptually. We recommend the participation of a trained design anthropologist in this process. Design anthropological concepts relevant for shaping City Data analysis include: digital materiality; social innovation; everyday design; everyday ethics, envisioning futures and practice; and trust.



The purpose of the ethnographic analysis is to create the knowledge base and insights necessary to develop the first stage prototype and to guide how the prototype can be locally embedded. The following questions can be posed:

- **What and whom do people already trust or not trust?**
- **How do people use the site and how is this relevant to city data?**
- **How do people experience the existing city data technologies and signage at the site?**
- **What are people's existing digital practices at, and relating to, the site?**
- **What are people's feelings about privacy and transparency?**
- **What new values come to light?**
- **How might people become engaged in further everyday prototype in event-based or everyday activities?**

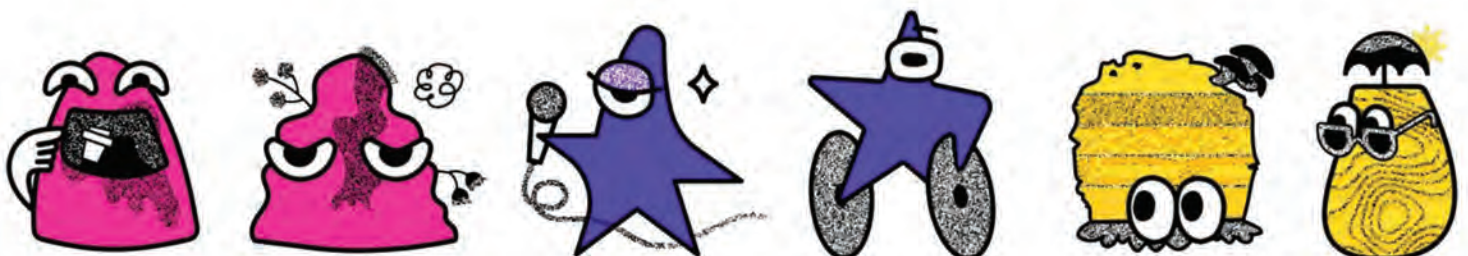
The ethnographic analysis can also provide specific insights to guide the prototype design with reference to how it might best connect people with the site, the data and the city:

- **the characteristics of the installed prototype at the physical site**
- **on-site placement of the prototype**
- **requirements for signage**
- **requirements for a suitable digital element that can be accessed easily through smartphones or other ubiquitous technologies**
- **appropriate engagement elements which are activity-based**
- **possible service-based elements of the prototype that can be engaged with digitally**
- **this will depend on local possibilities and resources, researchers should be prepared to be creative and to innovate at the stage of mapping a prototype to the local site.**

In Argyle Square we ensured that the prototype was **locally embedded** by drawing on the analysis to create a **design that was directly accountable to the context in which it would be tested** by being attentive to and representing the following:

- **local people's interests and concerns revealed through the ethnography (for example, what they would like to know and where they would like limits to be placed)**
- **local people's existing practices of using the park and existing data practices**
- **the sensors already installed in the park and their intention and capabilities**
- **the built environment of the park (such as the stage and the park's layout)**
- **the presence of data in the park, made explicit for instance through signage QR codes and the angular 'tech' design of the prototype**
- **making city data part of the rhythm of Melbourne by featuring it in Melbourne Knowledge Week**
- **enabling city data to be part of social learning in City Data Tours**
- **portraying city data as alive, active and accessible through the website**

This was manifested in the concept of the Sensor Family City Data Prototype consisting of a set of cardboard sculptures and a website installed and activated during Melbourne Knowledge Week events, thus embedding the prototype in an event-based engagement activity.



Family of Sensors characters used on the website and on the sculptural object stickers

The prototype included a set of sculptural objects, a set of playful characters that symbolised each data sensor's unique function, a website and a process of inviting people to engage with these. Whilst the prototypes appear simple, they directly respond to local values and interests identified through the ethnography research.

Family of Sensors sculptural objects



CITY OF MELBOURNE IS TESTING ENVIRONMENT SENSING TECHNOLOGY IN ARGYLE SQUARE

The City of Melbourne has funded a trial of an innovative technology partnership between the City of Melbourne and Microsoft. The City has funded a trial of an innovative technology partnership between the City of Melbourne and Microsoft. The City has funded a trial of an innovative technology partnership between the City of Melbourne and Microsoft.

Scan this QR code to see the live data and find out more.

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Step 4: Prototype design and fabrication

This step involves considering the information that a design must communicate, the level of community engagement that is sought, the research questions that must be answered and the materials which are available and appropriate for use within a given context. A flexible approach to the materiality and overall end design must be taken to successfully create a suitable outcome. A transferable prototype must be accessible to a wide range of users encompassing physical, social and economic factors. If one accessibility point is not available to a person, there should be another point of entry to engage with the prototype and access information. In response to this, physical, digital and engagement prototyping approaches should be considered for their suitability at this stage.

The following questions should be considered to inform prototype development:

- **What are the research questions/ problems that we must address?**
- **What have the ethnographic findings told us?**
- **Have we ensured our design is ethical, sustainable and accessible?**
- **What local frameworks (e.g., OHS, weather, durability) do we need to consider?**
- **Does it allow for the community to engage?**

In Argyle Square for the City Data prototype, we utilised low cost fabrication materials of cardboard, chalk paint, stickers, posters (physical); a free website platform (digital); and aligned (engagement) to existing public activities to test the prototype. By doing this in the testing phase we have deliberately in built flexibility to all three components of the prototype so we can make adjustments as needed.

Step 5: Public prototype experiment

This step involves a second stage of on-site fieldwork, which is aligned to local practices or events through which participants engage with the prototype and with future real-time data possibilities. It is designed to respond to research questions 3 and 4.

- 3. How do people imagine future possibilities of the city through real-time data?**
- 4. How do people experience possible futures through ethnographic interventions and the prototype?**

The precise methods that will be used to respond to this question will be site-specific, and will respond to the characteristics of the prototype. They may involve the following: accessing and engaging with real-time city data through digital or material prototypes; engagement with city data and data technologies in ways that are guided or facilitated; connecting with local events to test the ways in which they can be used as engagement events.

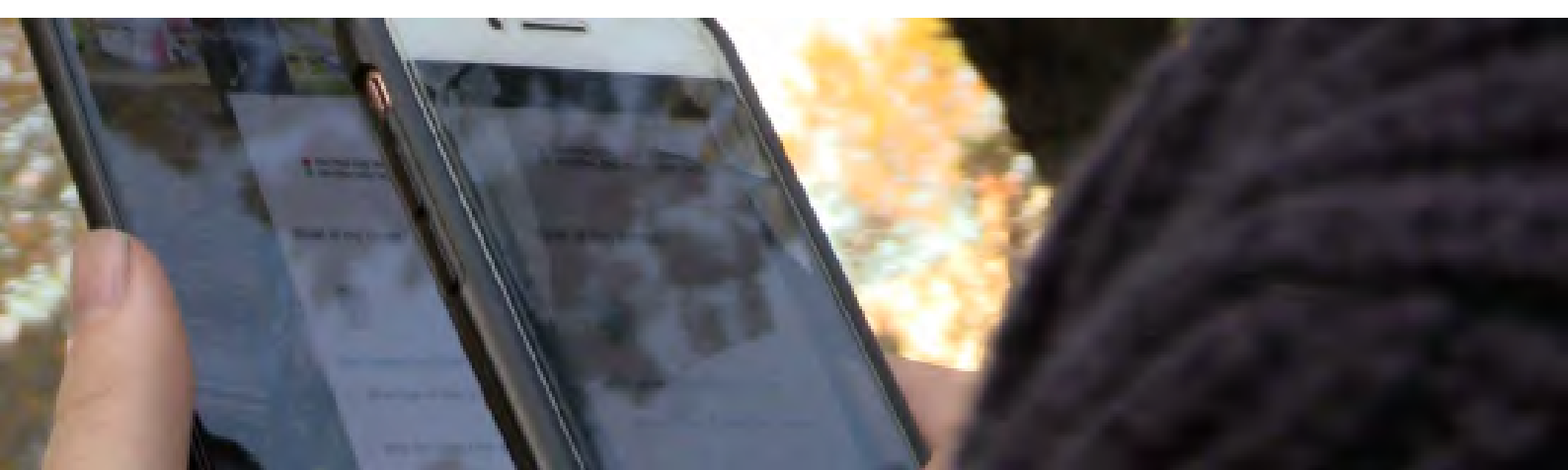


During Melbourne Knowledge Week we installed a set of prototype sculptures, 'The Sensor Family', in Argyle Square. These physical objects were connected to a digital platform and accessed via a QR code.

The research team used four methods:

- **Observations of: how park visitors interacted with the prototypes (e.g. getting close to them, moving them, reading their signs, testing QR scans, and walking around each one after the other); online engagement (e.g. logs, time spent navigating the site, and comments left).**
- **Accompanying and audio and video recording, one on-line 'Data Tour' and the three in person sessions of the 'Data Tour' of the sensors and presentation of the Digital Twin, by the expert Technology and Digital Innovation Lead from the City of Melbourne;**
- **Conducting go-along interviews with people joining the tours once they had finished;**
- **Inviting tour participants to activities designed to enable them to engage with the city data elements: writing directly onto the physical Family of Sensors prototype with paint pens, sometimes suggesting they add thoughts they had just expressed during an interview; using the QR code stickers and information posters to explore the Family of Sensors website along with the Digital Twin.**

Transferring this step to another site requires taking advantage of site-specific events and close cooperation with local authorities to leverage what is already happening in the research site, or developing new activities or events through which to test the prototype.



Step 6: Public Engagement Analysis and Evaluation

The purpose of the analysis and evaluation in this step is to respond to the following research questions:

- 3. How do people imagine future possibilities of the city through real-time data?**
- 4. How do people experience possible futures through ethnographic interventions and the prototype?**

In order to understand how people's encounters with real-time data enabled them to imagine or suggest possible city data futures, and to assess how and where the values invested in the prototype were successfully achieved through the circumstances created by the ethnographic methods, event-based participation and the physical and digital elements of the prototype.

The findings of this analysis and evaluation are created in such a way that they can inform the development of the locally informed City Futures Design Proposal.

In the Argyle Square study the interview materials, the participant's words written on the sculptures, the website responses and fieldnotes were analysed to produce the Key Implications for City Data Sensing (section 3), these principles have guided the final City Data Design Proposal (section 4).

Step 7: Data Futures Design Proposal

The Data Futures Design Proposal is the final output of the City Data prototype. It builds on steps 1-6 to produce design recommendations that can be taken forward to produce a final series of tools to communicate with the public about city data.

The Data Futures Design Proposal is informed by the following elements:


- **Ethnographic insights from the site-specific research (Section 3, page 21)**
- **Universal key implications derived from the meta-analysis of city data questions (section 3, page 21)**
- **City, public and everyday life values.**

The final design recommendations for the *City of Melbourne Data Futures Design Proposal* located at Argyle Square is based on the above process. It offers a brief that Council can take forward to communicate how city data is captured and used to the public users of Argyle Square.

The *City of Melbourne Data Futures Design Proposal* key recommendations are:


- **Create a way for the public to actively engage with the design that encompasses a range of access points that account for physical, social, economic or cultural abilities**
- **Create curiosity, either through an object or engagement activity that allows people a way to interact with real-time data**
- **Create an opportunity for multiple layers of engagement - specifically a combination of physical and digital interactions**
- **Incorporate the public's values into the design**
- **Incorporate sustainable understandings of materiality, developed in accordance with the proposed life span of the design and OHS and Public Liability guidelines of public forms**
- **Use ethnographic findings as a guide for the design**





This is a smart climate sensor who detects the temperature and humidity in different parts of Argyle Square to understand the different climates that exist.

Scan this QR code to view the current smart climate data and find out more!



<https://www.illinois.gov/energy-and-environment/energy/energy-2020>

Air Quality sensor

Learned through a course by Environmental Protection Agency (EPA), Cook and understand how Argyle Square's air quality conditions are different in the city of Chicago. Air quality is crucial to human well-being. Cities can track their own air quality and how long that bad air stays in the city. For example, this data may be used as an input of quality planning.

