



Ground Truth in Digital Dublin Deep Mapping in Virtual Reality

Oliver Dawkins

Building
City
Dashboards



Maynooth
University
National University
of Ireland Maynooth



dashboards.maynoothuniversity.ie
[@dashbuild](mailto:dashboards@mu.ie)



Session Outline

- Introduction and Demonstration (12:40pm - 1:10pm [30 mins])
 - Introduction to Ground Truth and Deep Mapping
 - Demonstration of the Structure From Motion (SFM)
- Ground Truthing (1:20pm – 2:30pm [1 hr 10 mins])
 - Form groups to visit and capture ‘Points of Interest’ in the Dublin Docklands
- Demonstration back at the gallery (2:30pm – 3pm [30 mins])
 - Researchers collect data
 - Hands on demonstration of VR and AR technologies
- Session closes (3pm[30 mins])



Building City Dashboards (and Friends)



Jeneen Naji



Gareth Young



Sam Stehle



Oliver Dawkins



Burcin Yazgi Walsh



Jessica Foley
Engineering Fictions



Dublin City Dashboard

Launched in 2014

Key focus

- Enable local authorities to interact with urban data and better understand urban processes
- Provide a tool for citizen engagement

DublinDashboard
City Intelligence

Maynooth University National University of Ireland Maynooth Comhairle Cathrach Bhaile Átha Cliath Dublin City Council

Homepage About DublinDashboard Share

Dublin Overview How's Dublin Doing? Dublin RealTime

Dublin Mapped Dublin Planning Dublin Near To Me

Dublin Housing Dublin Reporting Dublin Data Stores

Dublin Apps Dublin Bay Dashboard

Dublin City Dashboard: <https://www.dublindashboard.ie/>



Cork City Dashboard

Launched in 2017

Key focus

- Improved design
- Better site structure and navigation
- Usability



Home Page | About

Explore

- Real Time Maps
- Data Trends
- Mapped Data
- Planning
- Housing
- Citizen Reporting
- Cork Data Store
- Coastline
- Software & Apps

Cork in Real Time

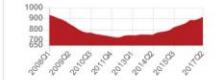
Live Environment



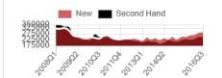
Data at a Glance

Hover over the charts for data, click to see detailed versions. You can browse various statistical graphs [here](#).

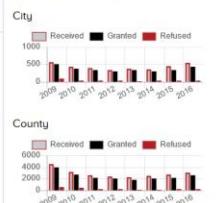
Average Residential Rent



Average House Price



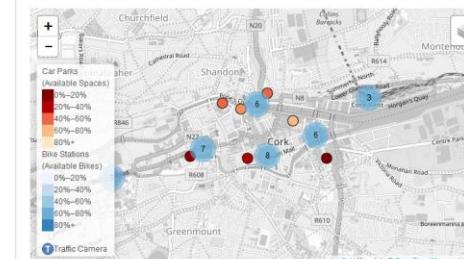
Planning Applications



A Twitter List by @CorkDashboard



Traffic & Travel



Weather

Latest forecast for Mon Feb 11 2019 12:00:00 GMT+0000 (Greenwich Mean Time)



Live Traffic Cams



Cork City Dashboard: <http://www.corkdashboard.ie/>

DUBLIN DASHBOARD



All open-data-sources for Dublin.



Local bulletins using open-data.



Answer questions with



Themes | Stories | Queries | Tools

ABOUT DUBLIN

Dublin is the capital and largest city in Ireland. It is located in the province of Leinster. It covers a total area of **921 km²**, Dublin has a total population of **1.3M** people with a median age of **36.7** and a median household income of **€42821**.

There are four local authorities whose remit collectively encompasses the geographic area of the county and city of Dublin.

Click on the map to see info about each of the local authorities.

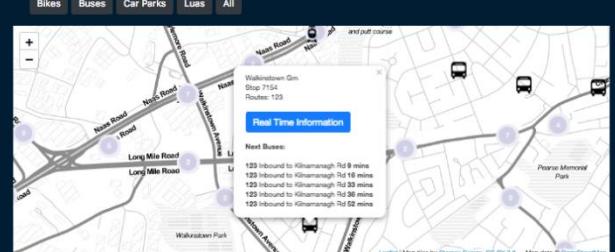
Queries

Getting Around

Public Transport and Parking in the City

The map shows various locations for Dublin's public transit options. Dublin Bike scheme, Dublin Bus bus stops, Luas tram stops, Train stations (coming soon). The locations of city centre car parks are also shown. Motorway travel times (coming soon).

Explore and interact with the map to find out more. Click on an icon to get up-to-date real-time information for that location. For additional information on particular modes of travel see our Transport Theme.





The Big Picture: Your City in the Computer!

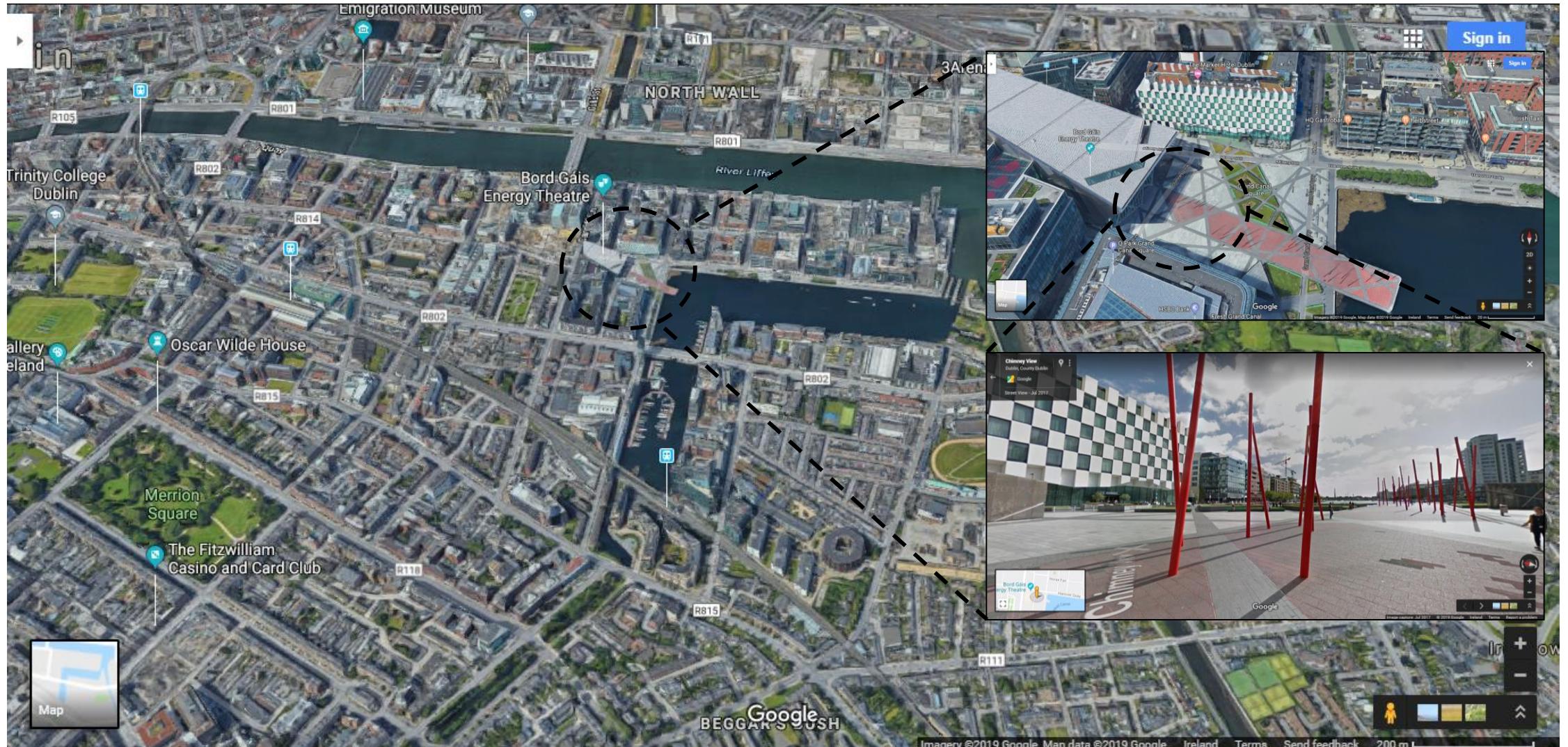
‘When you switch-on your city Mirror World, the whole city shows up on your screen, in a single dense, live, pulsing, swarming, moving, changing picture. This big picture is the “top surface” of the Mirror World. You can dive deeper to explore.’

Mirror Worlds: or the Day Software Puts the Universe in a Shoebox...How It Will Happen and What It Will Mean by David Gelernter (1991)



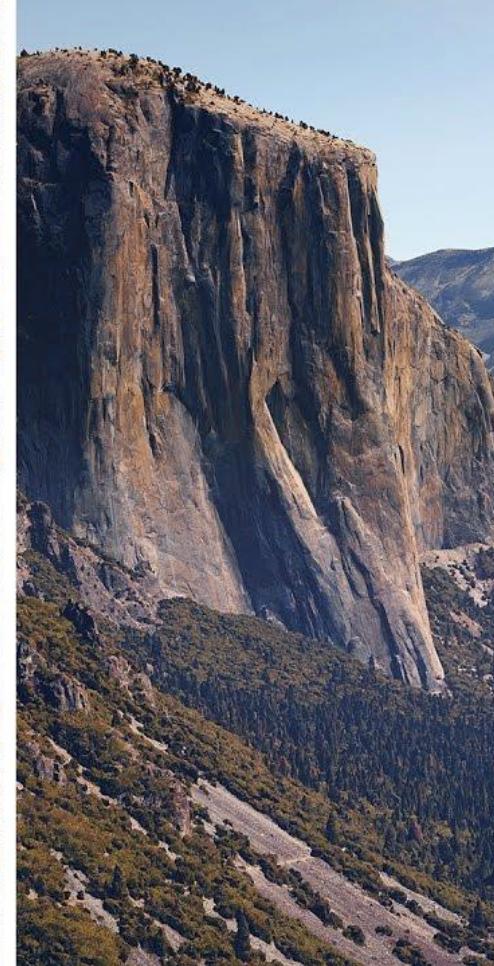


Dublin at a Glance in Google Maps





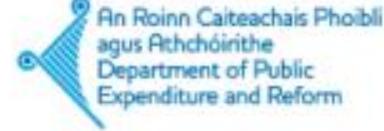
Constructing Google's Mirror World using Photogrammetry (Online Video)



Google Earth's Incredible 3D Imagery, Explained by Nat and Friends on YouTube: https://youtu.be/suo_aUTUpps



10th - 12th MAY, 2019



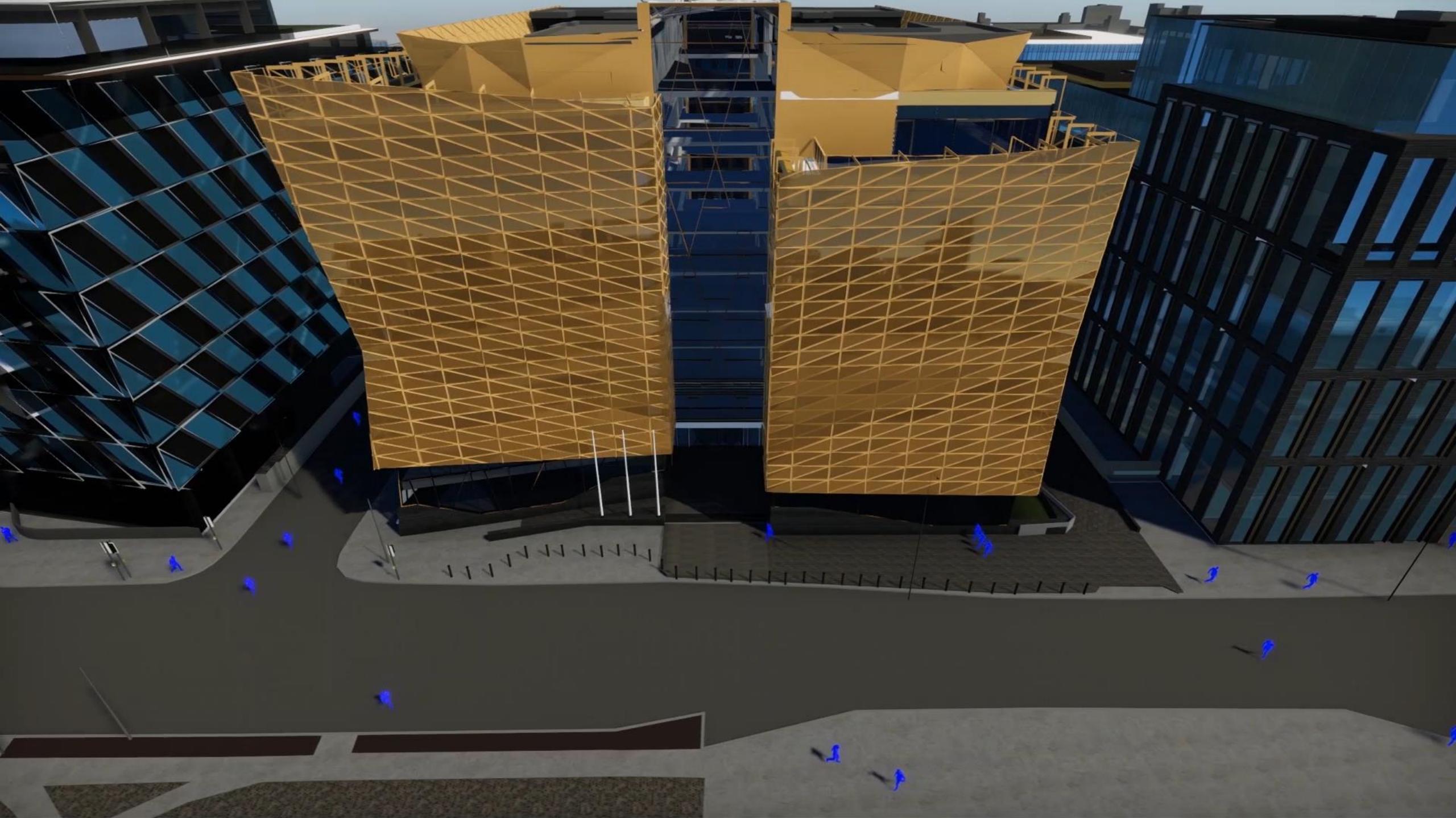
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3D Data Hack Dublin: <https://3ddatahack.ie/>

3D Data Model Resources for Dublin Docklands SDZ: <https://data.smartdublin.ie/dataset/3d-data-hack-dublin-resources>



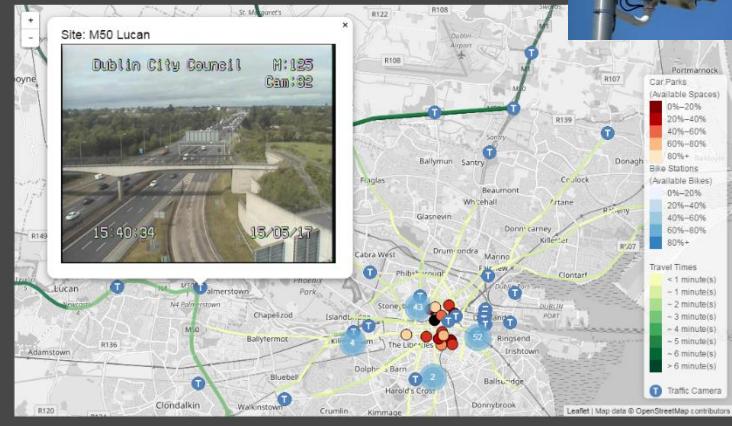


Real-Time Sensors

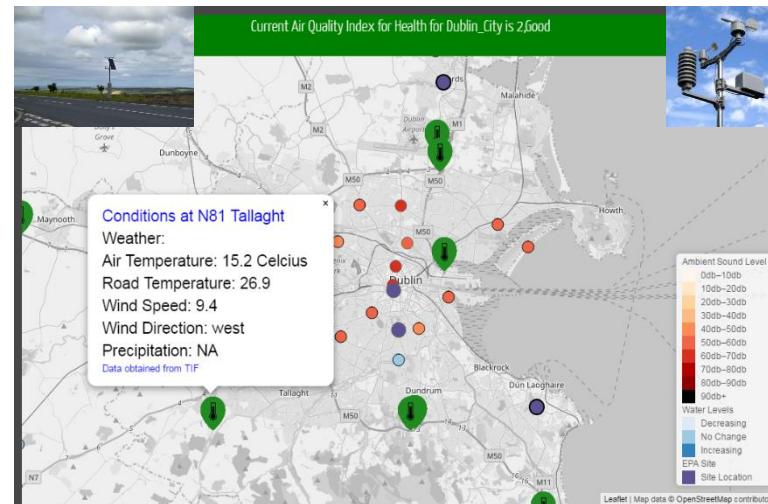
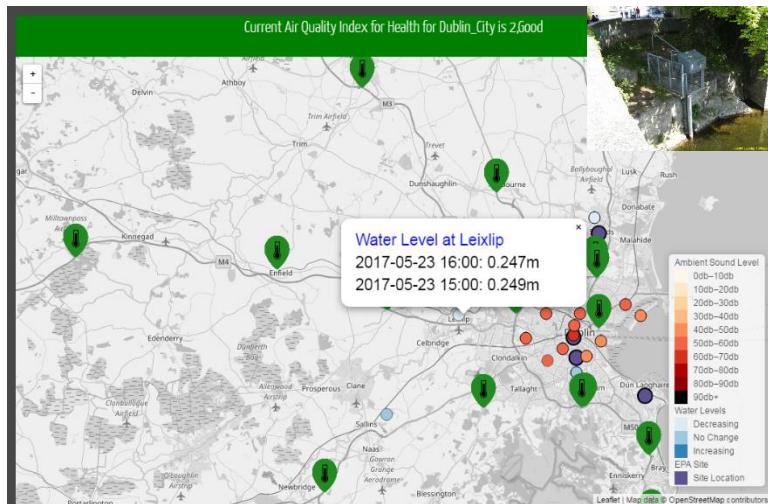
Home - Dublin Real Time
Dublin Traffic & Travel



Home - Dublin Real Time
Dublin Traffic & Travel



Home - Dublin Real Time
Dublin Traffic & Travel



Dublin City Dashboard: <https://www.dublindashboard.ie/>



Real-Time Data Feeds (Dublin Bikes)

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Data-Driven Decision Making for Urban Governance



PREFEITURA

CENTRO DE OPERAÇÕES



Ground Truth (a situated perspective)

In the middle of the street, a man is on the lookout for taxis (there are no more taxis at the taxi stand)

An 86 passes by. A 96 passes by. A "Tony-gencyl" deliveryman passes by.

Malissard Dubernay rapid transit passes by.

Again the pigeons go round the square. What triggers off this unified movement? It doesn't seem linked to any exterior stimulus (explosion, detonation, change in light, rain, etc.) nor to any particular motivation; it seems completely gratuitous: the birds suddenly take flight, go round the square and return to settle on the district council building's gutter.

It is two twenty.

A 96. Elegant women. A lost Japanese man, then another, smiling, ask a passerby for directions. He points them to rue des Canettes and they immediately head for it.

Passage of a 63, an 87, and a "Dunod éditeur" van.

Near the bus stop, a woman puts stamps on three letters and drops them into a mailbox.

Small poodle-type dog.

A sort of double of Peter Sellers, with a very pleased expression on his face, walks by the café. Then a woman with two very young children. Then a group of 14 women coming from rue des Canettes.

I have the impression that the square is almost empty (but there are at least twenty human beings in my line of sight).

A 63.

A postal van.

A child with a dog

A man with a newspaper

A man with a large "A" on his sweater

A "Que sais-je?" truck: "La collection 'Que sais-je' a réponse à tout [The 'Que sais-je' collection has an answer for everything]"

A spaniel?

A 70

A 96

Funeral wreaths are being brought out of the church.

It is two thirty.

A 63, an 87, an 86, another 86, and a 96 go by.

An old woman shades her eyes with her hand to make out the number of the bus that's coming (I can infer from her disappointed look that she's waiting for the 70)

They're bringing out the casket. The funeral chimes start ringing again.

The hearse leaves, followed by a 204 and a green Mehari.

An 87

A 63

The funeral chimes stop

A 96

It is a quarter after three.

Pause.

Perec, G. 2010. An attempt at exhausting a place in Paris. Wakefield Press. [Original French publication in 1975]



Deep Mapping

‘GIS routinely generates cartographic mappings of the physical, superficial, and infrastructural features of the earth: “thin” maps in contrast to “deep” maps.... A deep map is fine-grained, detailed, and situated in multiscalar geographic space which, though bounded, is connected within networks, times, and places. Deep maps are multilayered and draw heavily on multimedia and hybrid methodologies able to capture the many ways of knowing. They represent a weave of narrative and multisourced depictions of people, places, and objects that reflect the cadence and terrain of everyday life all connected through the geographic space that lies behind.’

Bodenhamer, D.J., Corrigan, J. and Harris, T.M. eds., 2015. Deep maps and spatial narratives. Indiana University Press.



Practical Activity - Ground Truthing



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

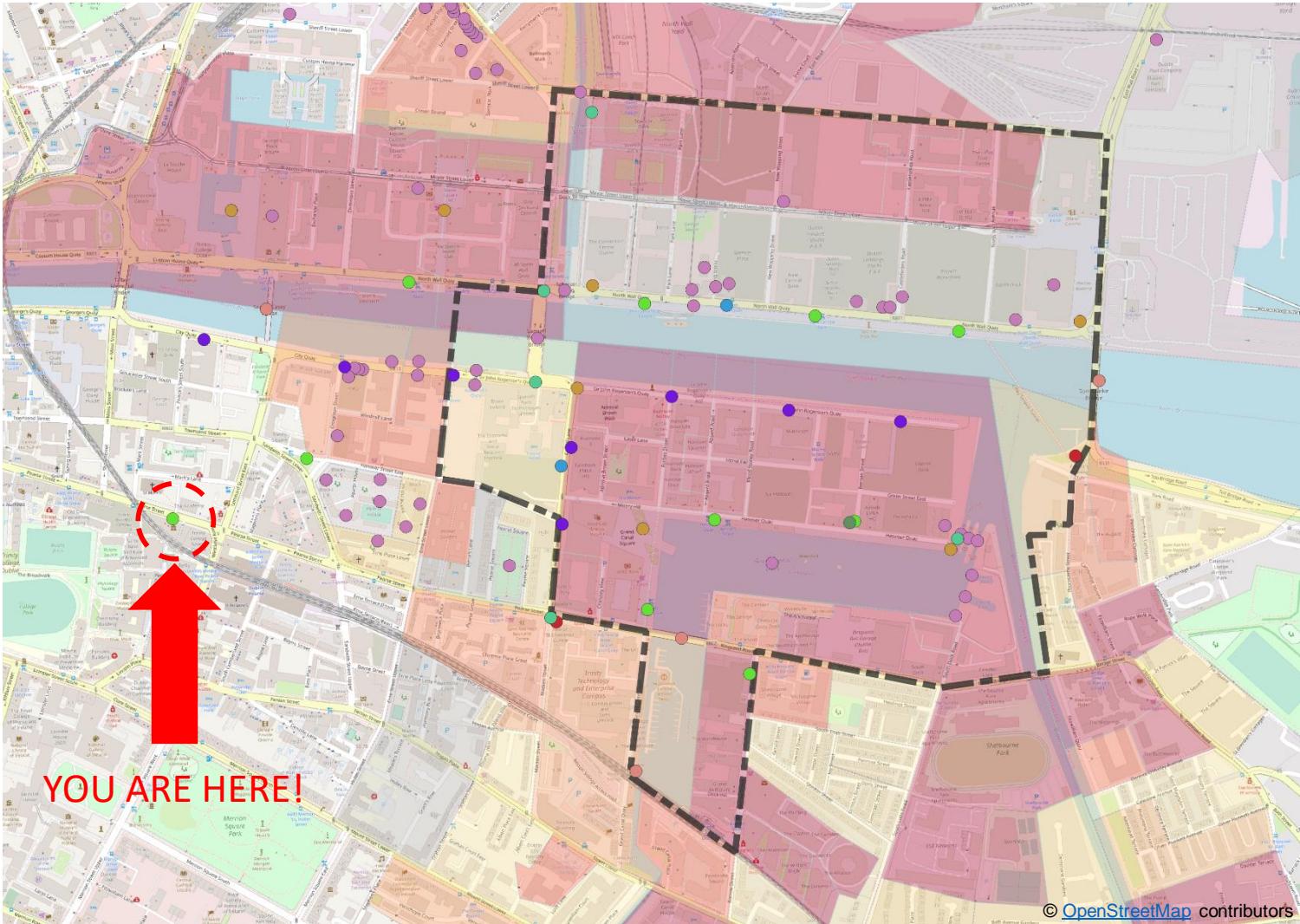
VISIT WHAT'S ON SUPPORT GET INVOLVED ABOUT HIRE

GALLERY INFO DUBLIN Q





Points of Interest in Dublin's Docklands





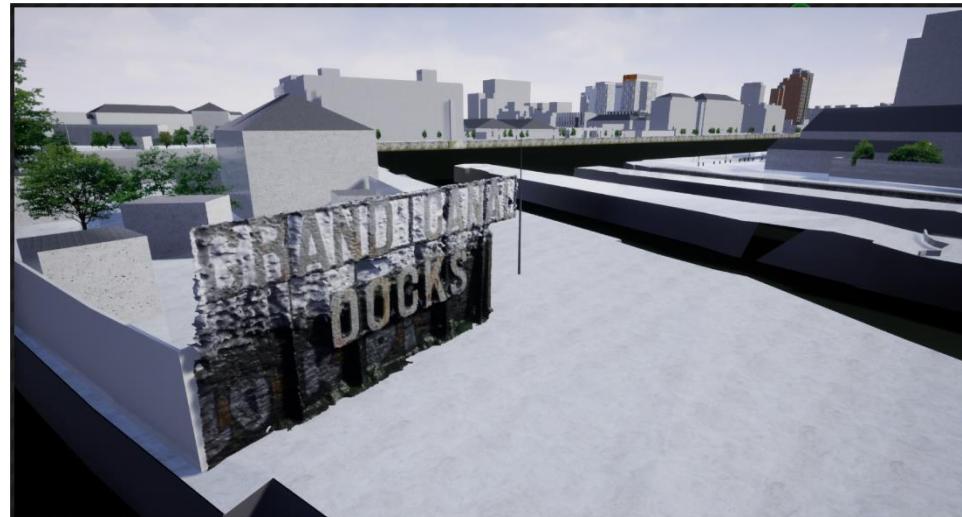
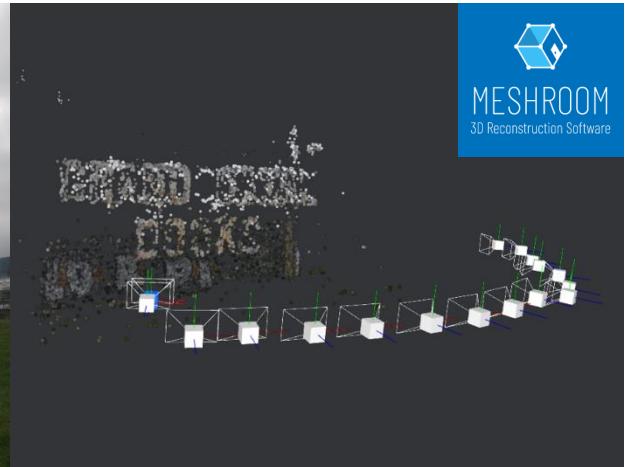
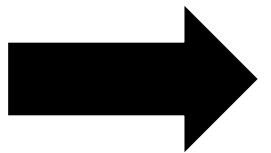
Reconstructing Digital Dublin

“Thousands of electronic eyes and ears continuously capture the city’s unfolding, interwoven narrative threads, and spin them out into cyberspace....In countless spatially and temporally displaced, inherently ambiguous fragments, Dublin electronically doubles itself”

Mitchell, W.J. 2002. ‘Electronic Dublin’. Volume Project



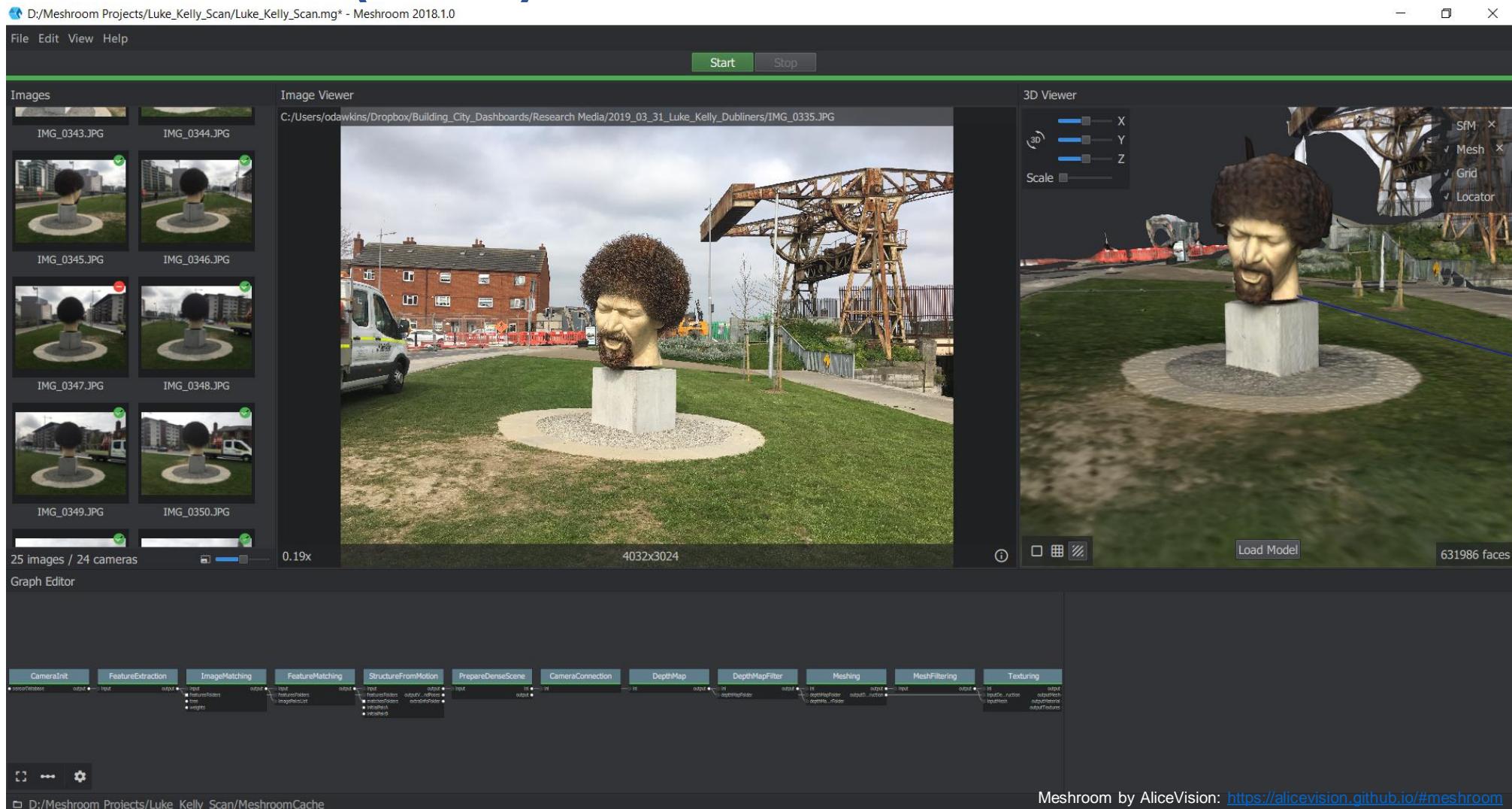
Crowdsourcing through First-Person 3D Data Capture



MESHROOM
3D Reconstruction Software



Data Processed using Structure from Motion (SfM) in Meshroom





Taking Digital Photos for SfM

- Try to take pictures from all angles
- Take overlapping images
- Fill each image with the object
- Include the background to help identify camera orientation
- The object or area should be well lit
- Ideally shoot in indirect light
- Don't use flash
- Avoid reflections and transparent objects
- Avoid single coloured surfaces
- You can take photos of the same object in different patterns to avoid blind spots
- You can take close-ups for added detail
- Scenes with moving objects don't work
- More images are better than less. Images that don't work can be omitted later.
- Avoid changing focal length and shallow depth of field
- Consider using manual settings (may require a different camera app)
- Consider using a tripod

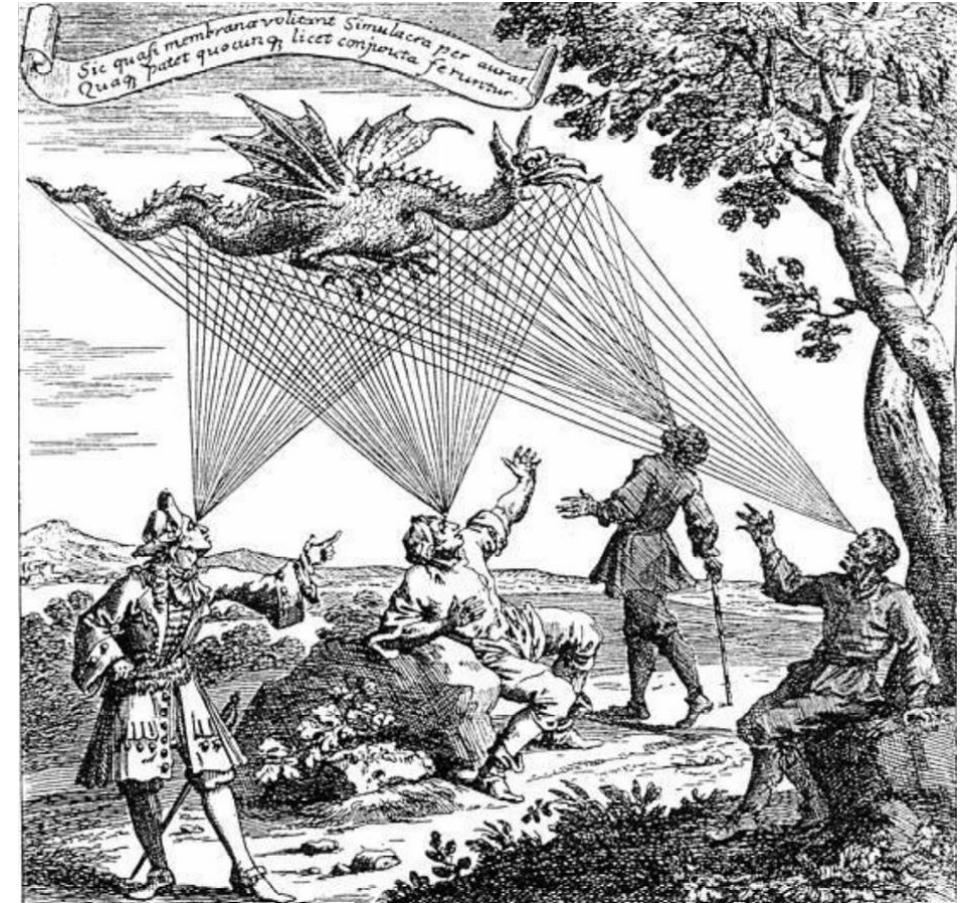
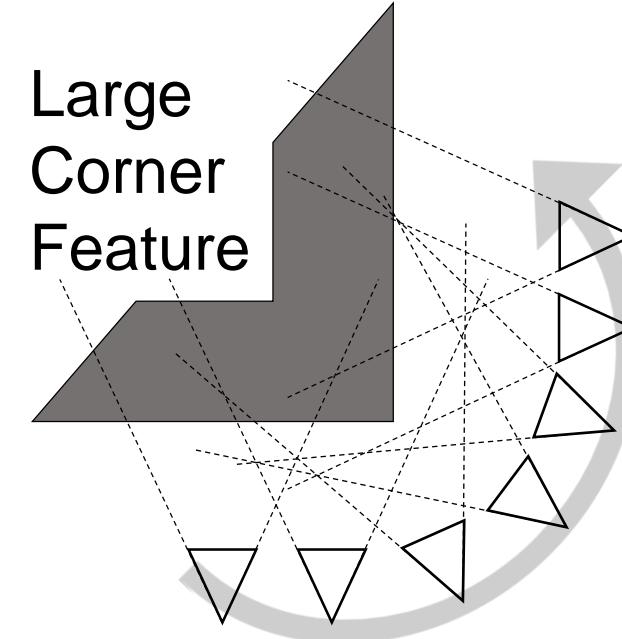
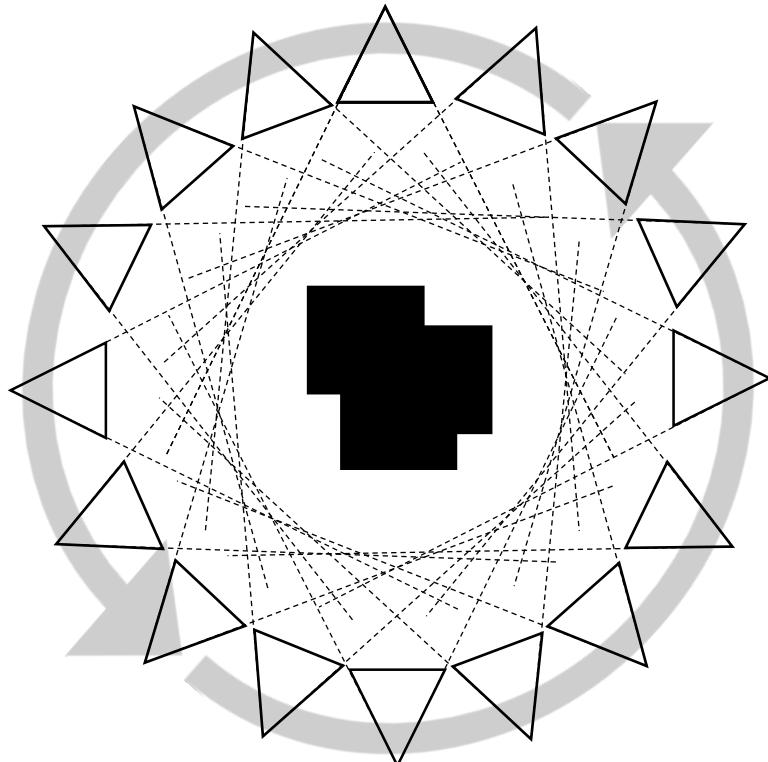


Illustration from Oculus artificialis teledioptricus sive Telescopium, 1685
Image via AliceVision: <https://alicevision.github.io/index.html#history>

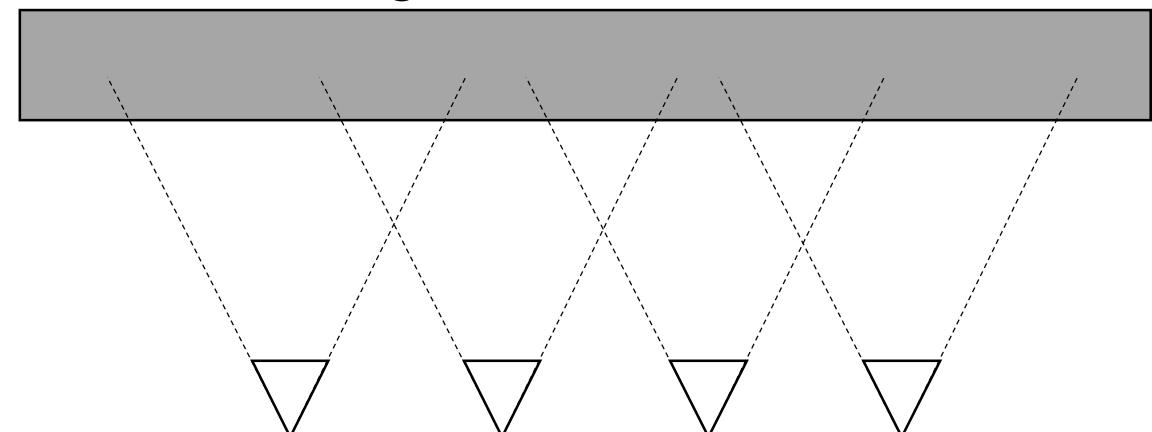


SFM Capture Strategies

Full 360° Capture



Large Linear Feature





Online Hosting via Sketchfab



Sketchfab EXPLORE BUY 3D MODELS FOR BUSINESS Search 3D models

York Minster Bronze Model
3D Model

virtualarchitectures FOLLOW

Add To Embed Share

Triangles: 576.8k Vertices: 289.8k More model information

A photoscan of the bronze model of York Minster which was designed to be tactile and incorporates braille for blind and partially sighted visitors.

York Minster Bronze Model by Virtual Architectures on Sketchfab:
<https://sketchfab.com/3d-models/york-minster-bronze-model-4b95fa350db7426ba4b67413d143dbb2>



Ground Truthing

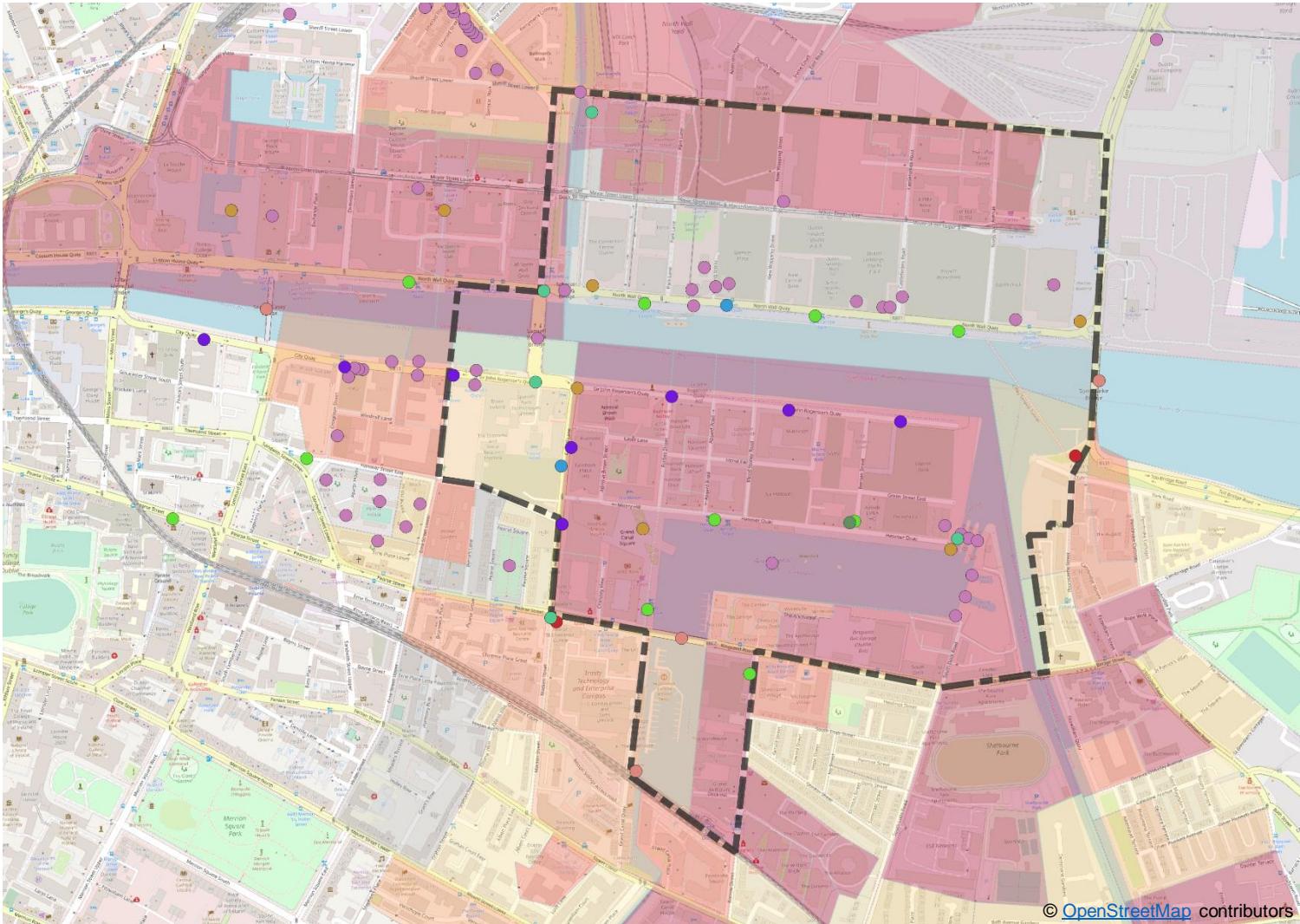
- Form groups of 4-5 people
- Go into the Dublin Docklands
- **Search out points of interest and explore the borders of the local authority boundaries**
- Can you identify the points of interest
- **Capture photos, sound and video**

Please be back at the Science Gallery by 2:30pm

We ask that you share any media you capture with us at the end of the session.
Please fill out a consent form before doing so.



What can you tell us about our map?





Points of Interest Revealed





Discussing the data

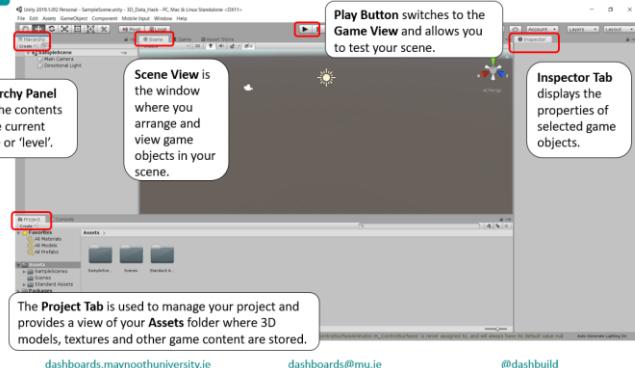
- Smart infrastructure in the map was digitised from a public presentation to the Construction IT Alliance (CitA) by Smart Dublin in 2018:
<https://www.cita.ie/wp-content/uploads/2018/05/SmartDublin-General-11.5.18-PDFs.pdf>
- Historic Sites data was obtained from data.gov.ie:
<https://data.gov.ie/dataset/national-monuments-service-archaeological-survey-of-ireland> [Online map viewer here:
<http://webgis.archaeology.ie/historicenvironment/>]
- Home construction date is derived from CSO Small Areas and associated boundaries datasets [see ‘Small Areas (18,641)’]:
<https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics/>



3D Data Hack - 3D Model User Guides

Unity Game Engine

The Unity User Interface



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Adding a script to close your built desktop application with the Escape key (2)

```
using UnityEngine;
using System.Collections;

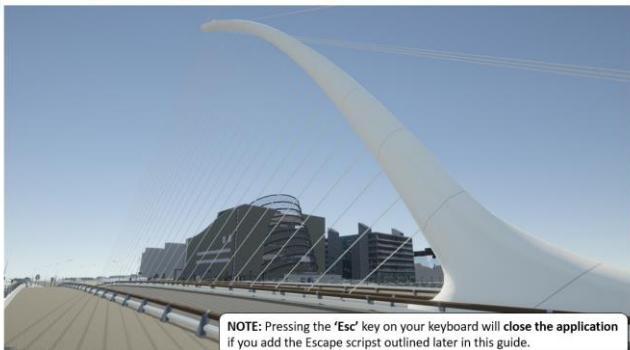
// This script exits the application upon pressing the Esc key
public class Escape : MonoBehaviour {

    // The default Start function is used for initialization
    private void Start ()
    {
    }

    // The Update function is called once per frame
    void Update ()
    {
        if (Input.GetKey(KeyCode.Escape))
        {
            Application.Quit();
        }
    }
}
```

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Run your application .exe to test

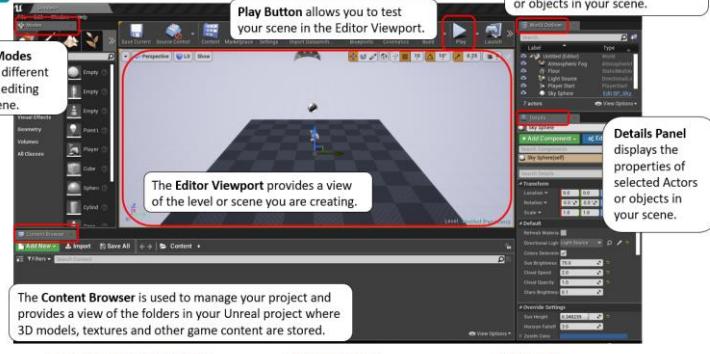


NOTE: Pressing the 'Esc' key on your keyboard will close the application if you add the Escape script outlined later in this guide.

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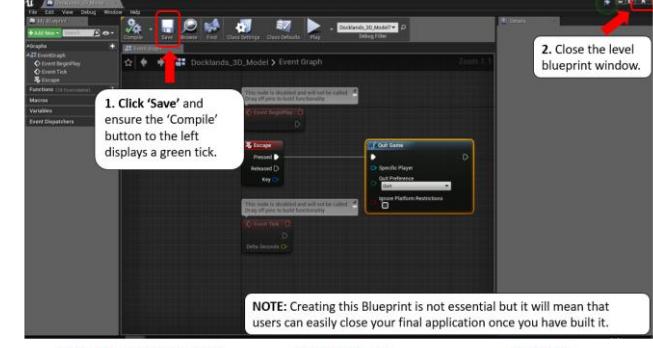
Unreal Engine

Unreal Engine User Interface



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Creating a Blueprint to close your application with the Escape key (4)



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Run your application .exe to test



NOTE: Pressing the 'Esc' key on your keyboard will close the application if you added the Escape blueprint as outlined earlier in this guide.



Building City Dashboards

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