Google

Googling the Future of Spatial?

Ed Parsons
eparsons@google.com
@edparsons

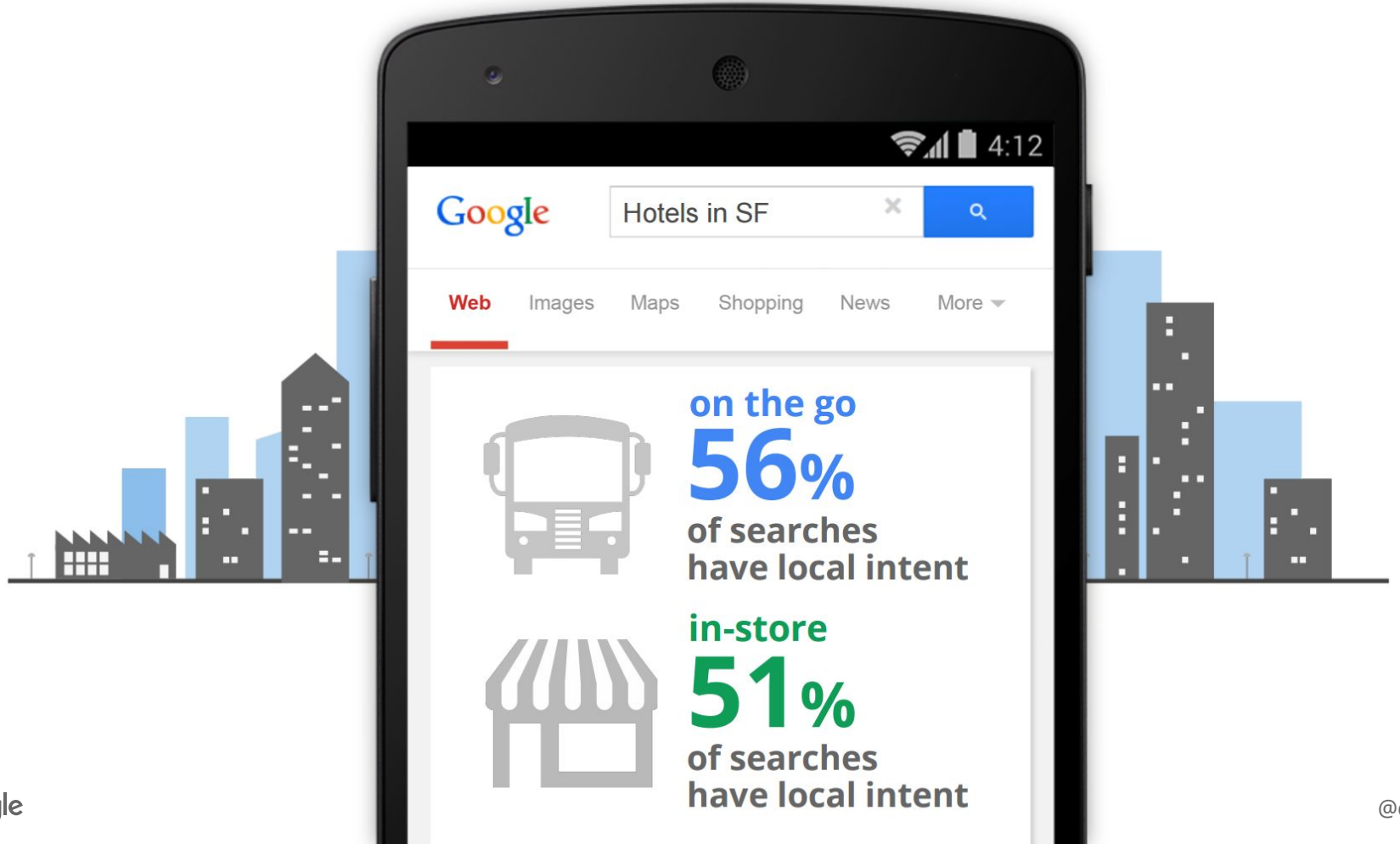
Google’s Geographer in Residence
Google
@edparsons

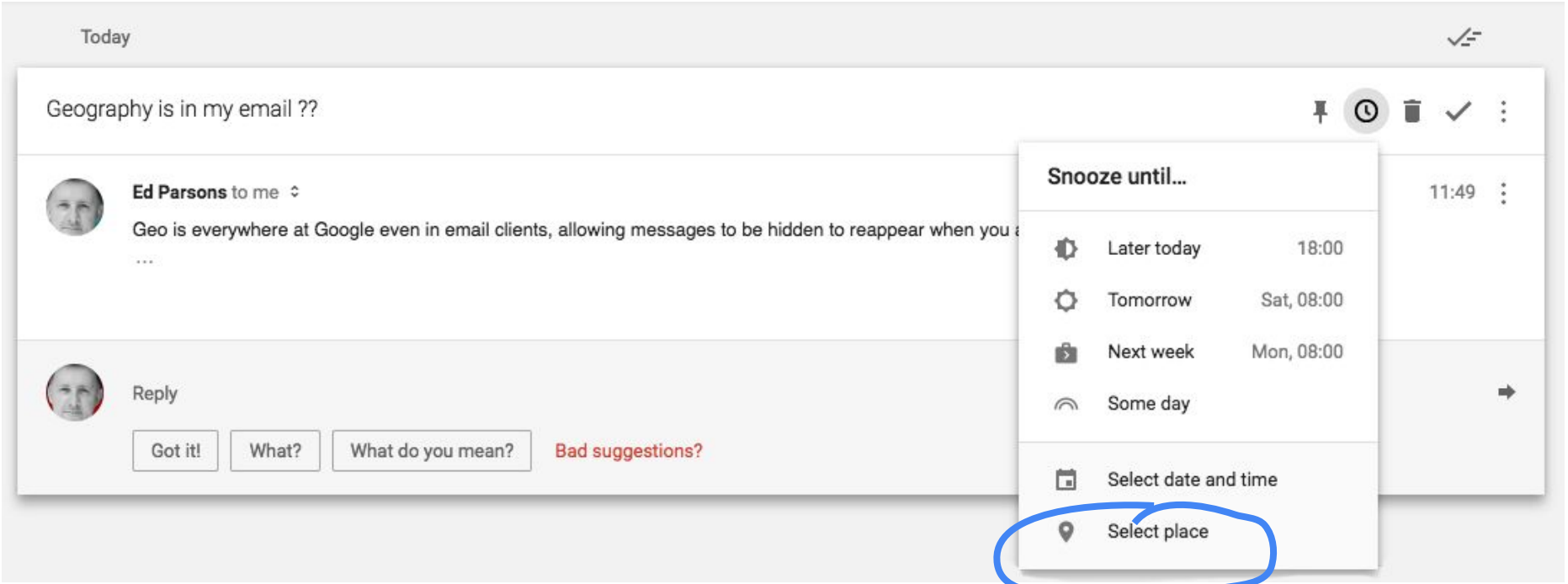
Geography

Google Search I'm Feeling Lucky

"everything is related to everything else, but near things are more related than distant things."

Waldo R. Tobler, 1970


4:12
Google
Hotels in SF
Web
Images
Maps
Shopping
News
More
on the go
56%
of searches
have local intent
in-store
51%
of searches
have local intent


Today
Geography is in my email ??
Ed Parsons to me
11:49
Geo is everywhere at Google even in email clients, allowing messages to be hidden to reappear when you
...
Reply
Got it!
What?
What do you mean?
Bad suggestions?
Snooze until...
Later today 18:00
Tomorrow Sat, 08:00
Next week Mon, 08:00
Some day
Select date and time
Select place

The future…

Some megatrends

Urban, not Suburban
Google
@edparsons

Digital natives

Big data !
Google
@edparsons

Platforms

dis·in·ter·me·di·a·tion

/dis¸in(t)ərmēdēˈāSH(ə)n/

noun

reduction in the use of intermediaries between producers and consumers, for example by investing directly in the securities market rather than through a bank.

Translations, word origin, and more definitions

Horseless carriage
thinking..

near
The future...

● Ambient Location
● The “New” Realities
● Here come the machines
Google
@edparsons

Ambient Location

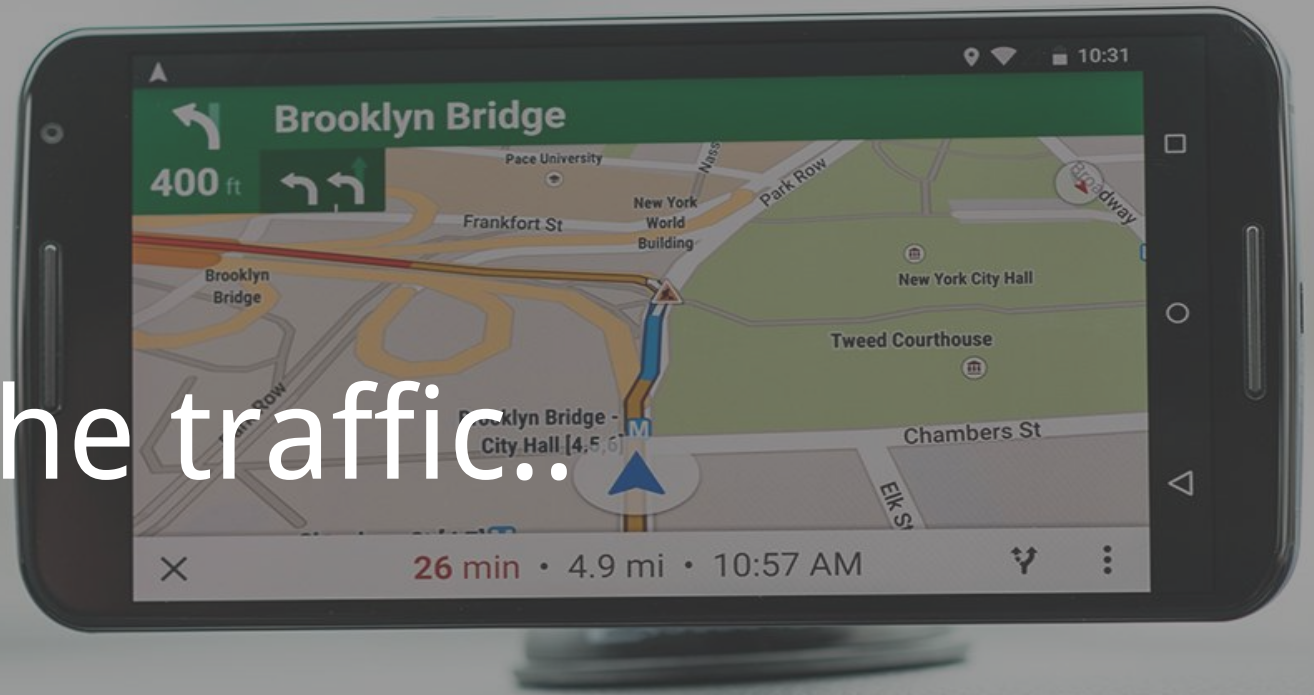
Google

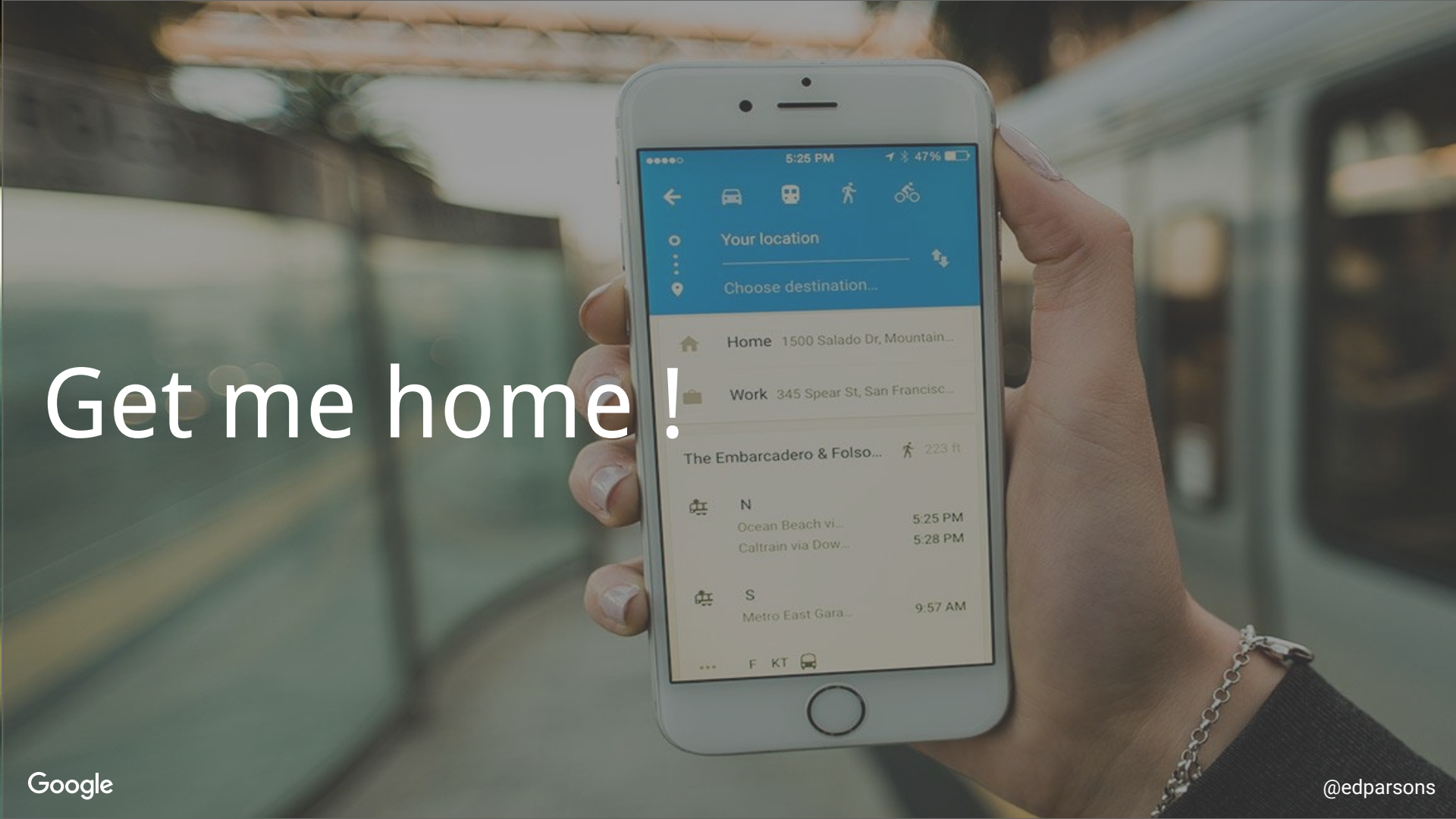
@edparsons

Google

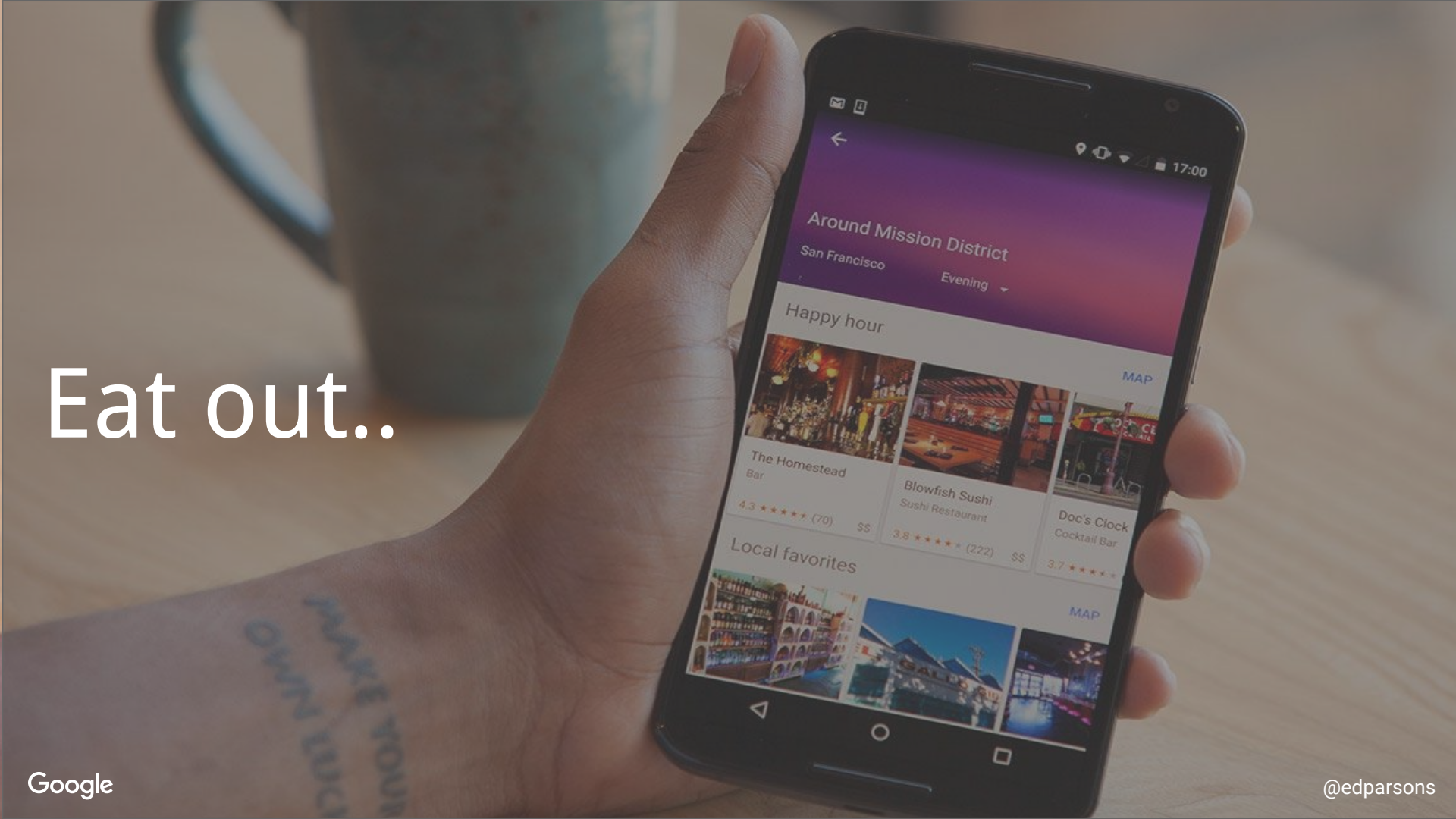
@edparsons

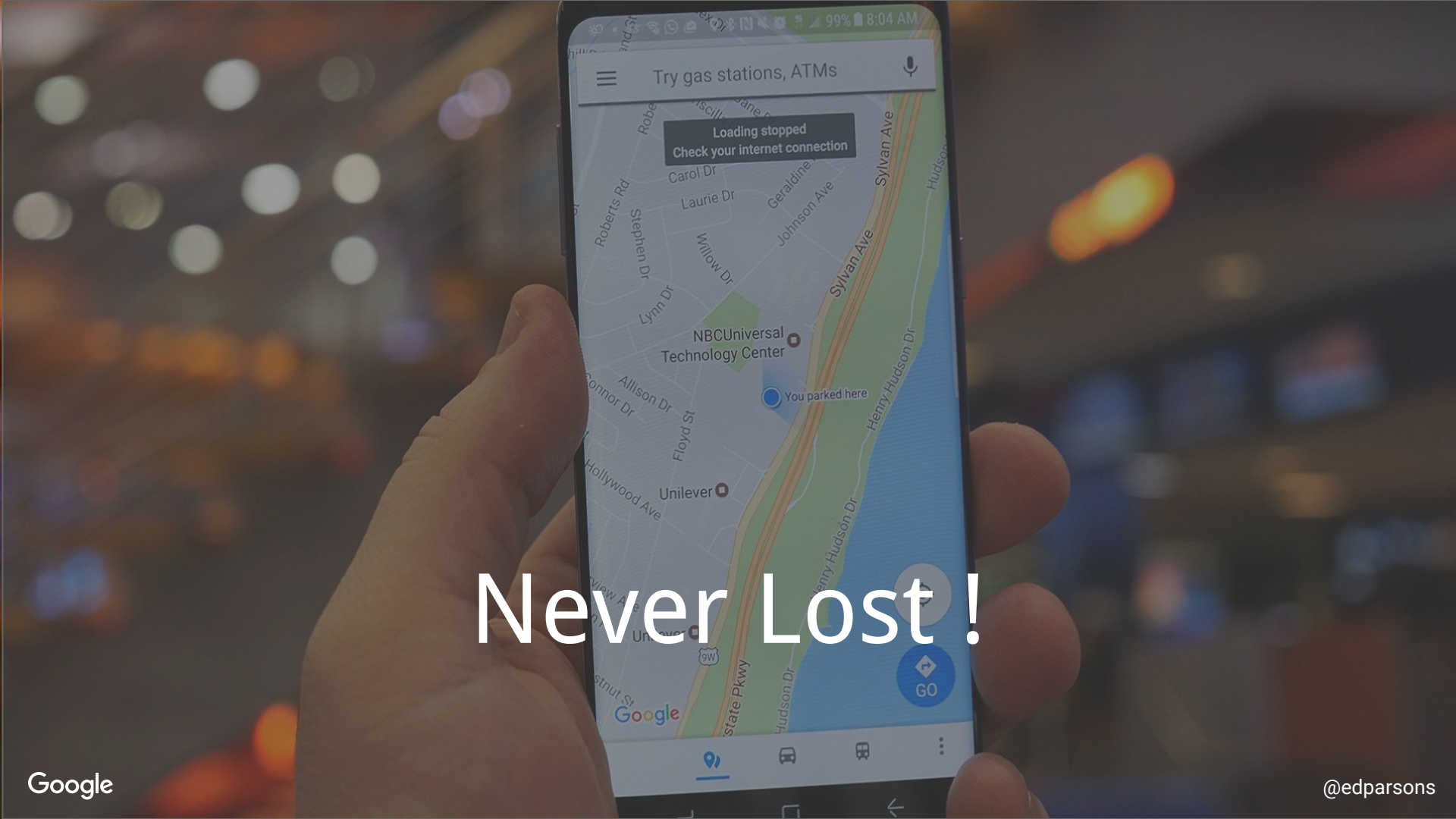
Avoid the traffic..



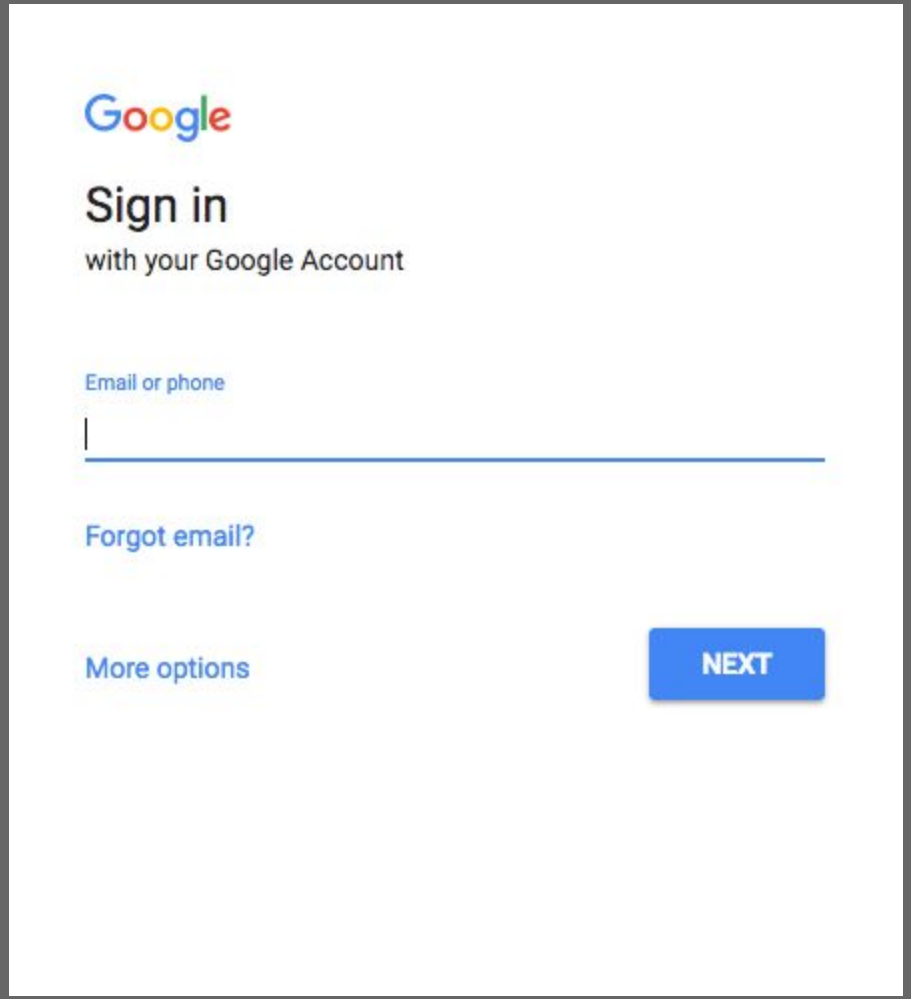

Get me home !
5:25 PM
47%
Your location
Choose destination...
Home 1500 Salado Dr, Mountain...
Work 345 Spear St, San Francisc...
The Embarcadero & Folso... 223 ft
N
Ocean Beach vi... 5:25 PM
Caltrain via Dow... 5:28 PM
S
Metro East Gara... 9:57 AM
F KT
Google
@edparsons

Eat out..


17:00
Around Mission District
San Francisco
Evening
Happy hour
MAP
The Homestead
Bar
4.3 (70) $$
Blowfish Sushi
Sushi Restaurant
3.8 (222) $$
Doc's Clock
Cocktail Bar
Local favorites
MAP


Try gas stations, ATMs
Loading stopped
Check your internet connection
Carol Dr
Laurie Dr
Roberts Rd
Stephen Dr
Willow Dr
Geraldine
Johnson Ave
Sylvan Ave
Lynn Dr
NBCUniversal
Technology Center
You parked here
Allison Dr
Connor Dr
Floyd St
Hollywood Ave
Unilever
Henry Hudson Dr
GO
Google

Never Lost !


Google
Sign in
with your Google Account
Email or phone
Forgot email?
More options
NEXT

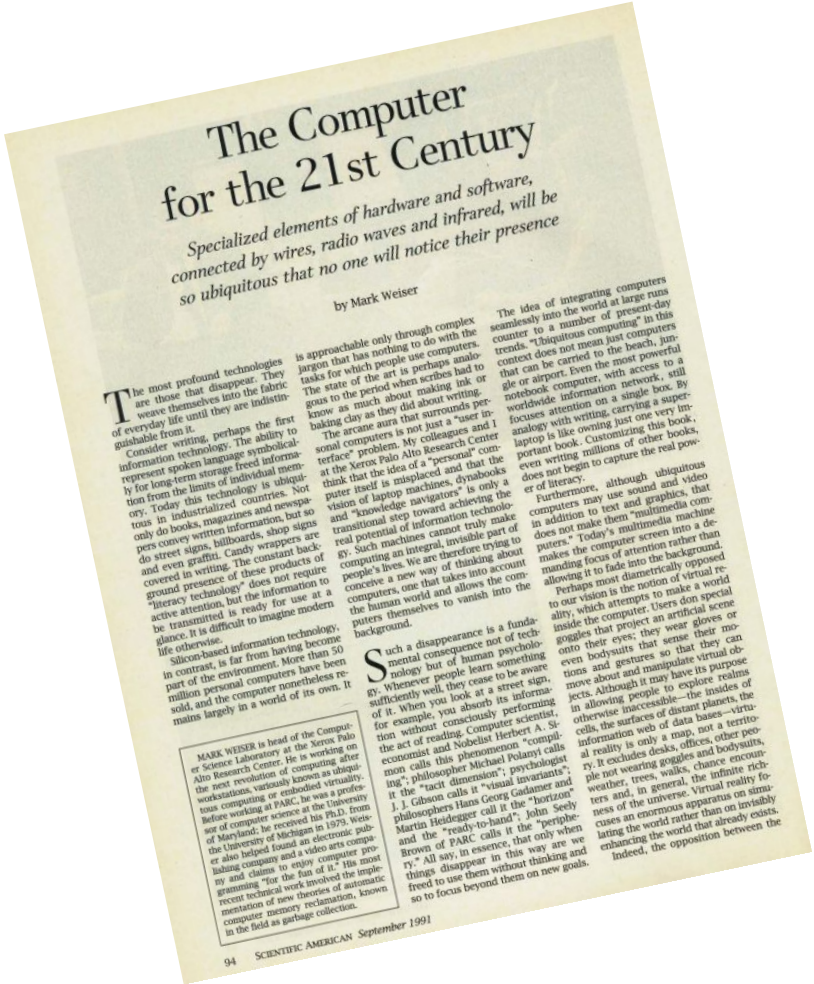
Egocentric

Google

@edparsons

Google

@edparsons



The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

Consider writing, perhaps the first information technology. The ability to represent spoken language symbolically for long-term storage freed information from the limits of individual memory. Today this technology is ubiquitous in industrialized countries. Not only do books, magazines and newspapers convey written information, but so do street signs, billboards, shop signs and even graffiti. Candy wrappers are covered in writing. The constant background presence of these products of "literacy technology" does not require active attention, but the information to be transmitted is ready for use at a glance. It is difficult to imagine modern life otherwise.

Silicon-based information technology, in contrast, is far from having become part of the environment. More than 50 million personal computers have been sold, and the computer nonetheless remains largely in a world of its own. It is approachable only through complex jargon that has nothing to do with the tasks for which people use computers. The state of the art is perhaps analogous to the period when scribes had to know as much about making ink or baking clay as they did about writing.

The arcane aura that surrounds personal computers is not just a "user interface" problem. My colleagues and I at the Xerox Palo Alto Research Center think that the idea of a "personal" computer itself is misplaced and that the notion of laptop machines, dynabooks and "knowledge navigators" is only a transitional step toward achieving the real potential of information technology. Such machines cannot truly make computing an integral, invisible part of people's lives. We are therefore trying to conceive a new way of thinking about computers, one that takes into account the human world and allows the computers themselves to vanish into the background.

Such a disappearance is a fundamental consequence not of technology but of human psychology. Whenever people learn something sufficiently well, they cease to be aware of it. When you look at a street sign, for example, you absorb its information without consciously performing the act of reading. Computer scientist, economist and Nobelist Herbert A. Simon calls this phenomenon "compiling"; philosopher Michael Polanyi calls it the "tacit dimension"; psychologist J. J. Gibson calls it "visual invariants"; philosophers Hans Georg Gadamer and Martin Heidegger call it the "horizon" and the "ready-to-hand"; John Seely Brown of PARC calls it the "periphery." All say, in essence, that only when things disappear in this way are we freed to use them without thinking and so to focus beyond them on new goals.

The idea of integrating computers seamlessly into the world at large runs counter to a number of present-day trends. "Ubiquitous computing" in this context does not mean just computers that can be carried to the beach, jungle or airport. Even the most powerful notebook computer, with access to a worldwide information network, still focuses attention on a single box. By analogy with writing, carrying a supercomputer is like owning just one very important book. Customizing this book, even writing millions of other books, does not begin to capture the real power of literacy.

Furthermore, although ubiquitous computers may use sound and video in addition to text and graphics, that does not make them "multimedia computers." Today's multimedia machine makes the computer screen into a demanding focus of attention rather than allowing it to fade into the background.

Perhaps most diametrically opposed to our vision is the notion of virtual reality, which attempts to make a world inside the computer. Users don special goggles that project an artificial scene onto their eyes; they wear gloves or even bodysuits that sense their motions and gestures so that they can move about and manipulate virtual objects. Although it may have its purpose in allowing people to explore realms otherwise inaccessible—the insides of cells, the surfaces of distant planets, the information web of data bases—virtual reality is only a map, not a territory. It excludes desks, offices, other people not wearing goggles and bodysuits, weather, trees, walks, chance encounters and, in general, the infinite richness of the universe. Virtual reality focuses an enormous apparatus on simulating the world rather than on invisibly enhancing the world that already exists. Indeed, the opposition between the

MARK WEISER is head of the Computer Science Laboratory at the Xerox Palo Alto Research Center. He is working on the next revolution of computing after workstations, variously known as ubiquitous computing or embodied virtuality. Before working at PARC, he was a professor of computer science at the University of Maryland; he received his Ph.D. from the University of Michigan in 1979. Weiser also helped found an electronic publishing company and a video arts company and claims to enjoy computer programming "for the fun of it." His most recent technical work involved the implementation of new theories of automatic computer memory reclamation, known in the field as garbage collection.

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."

Mark Weiser, 1991
Chief Scientist Xerox PARC

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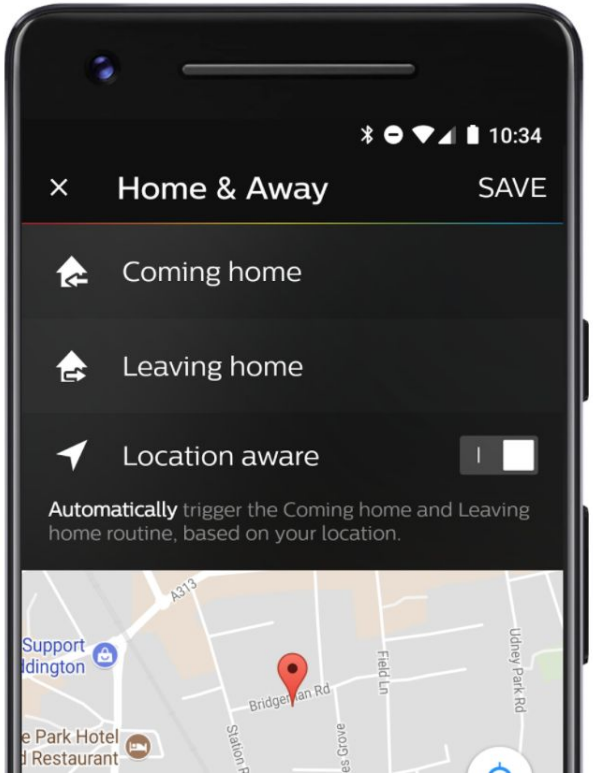
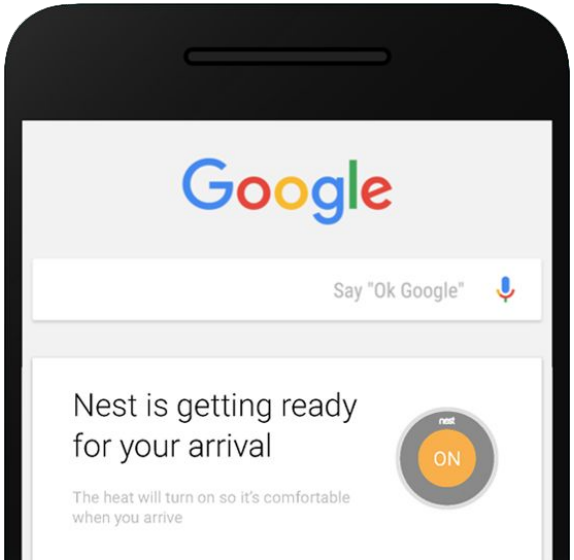

10:34
Home & Away
SAVE
Coming home
Leaving home
Location aware
Automatically trigger the Coming home and Leaving home routine, based on your location.
A313
Bridgeman Rd
Field Ln
Udney Park Rd

PHILIPS
Hue white
ambiance


Google
Say "Ok Google"
Nest is getting ready for your arrival
The heat will turn on so it's comfortable when you arrive
nest
ON

nest
18
IN 20 MIN
22

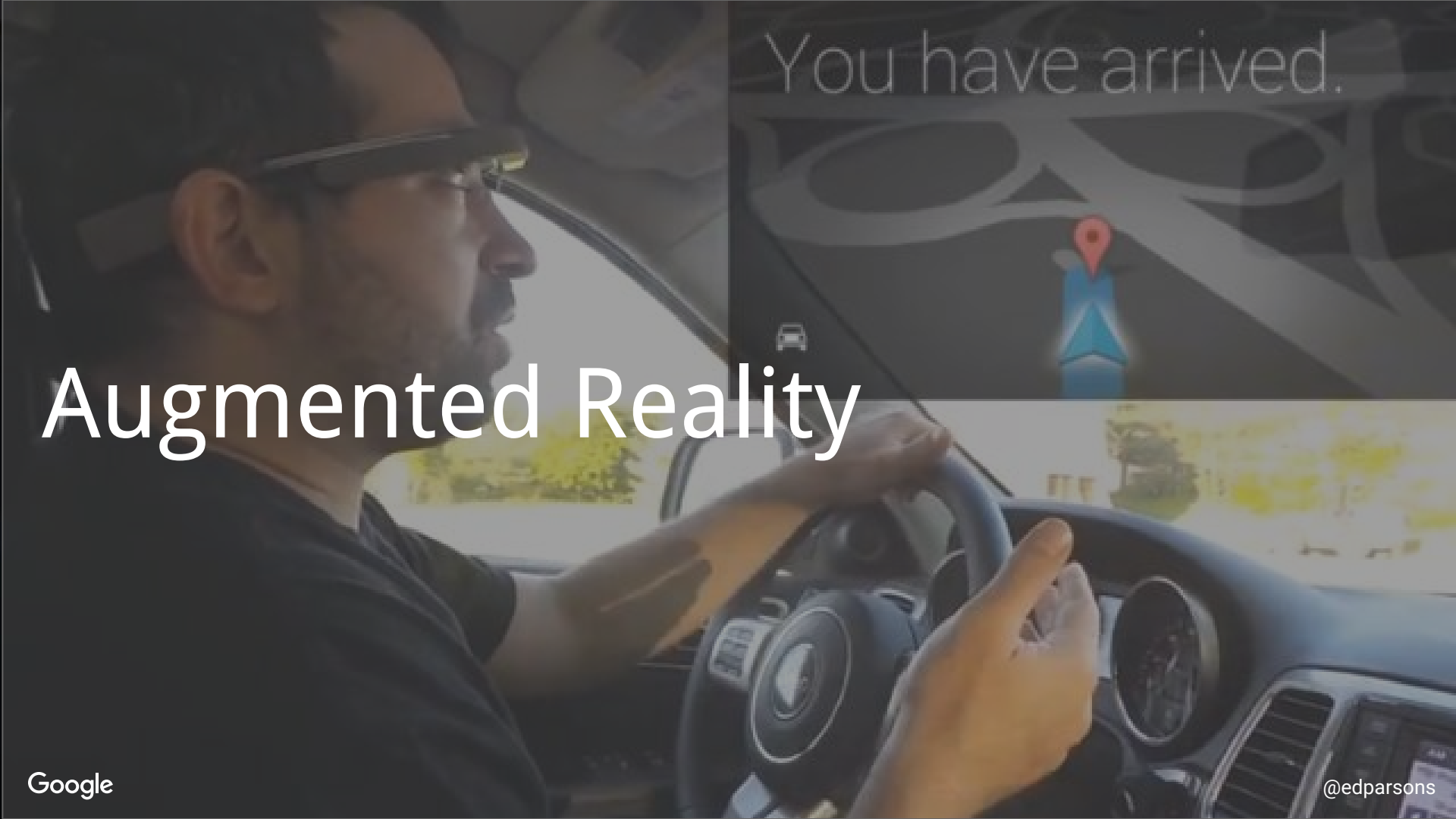
The “New” Realities..

Virtual Reality

Google

@edparsons

Google Earth VR



Augmented Reality

Google

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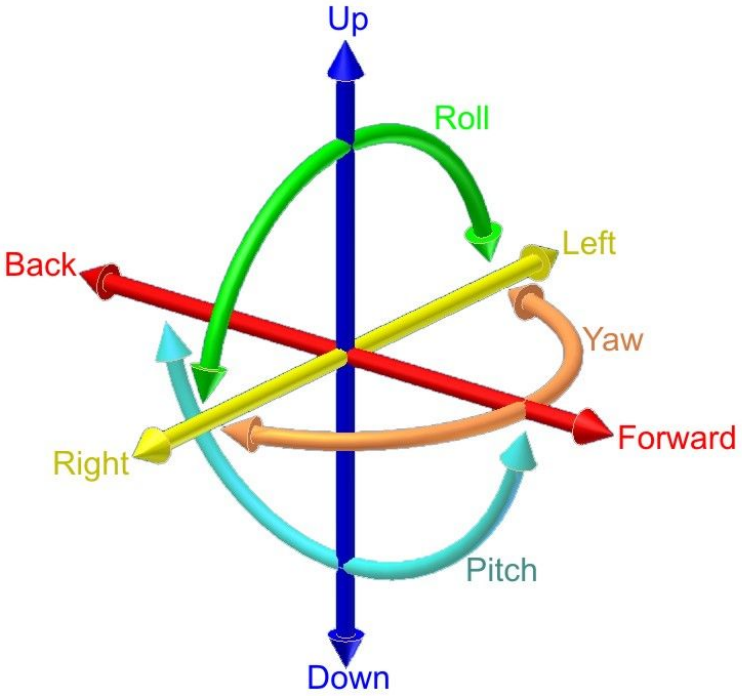
Google
@edparsons

The DoF Problem ?



Simultaneous Localization And Mapping

Google

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Google

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Here come the machines..

1995-2005

2005-2015

2015 +

Google Earth Engine

The Earth Engine Data Catalog

Landsat & Sentinel
10-30m, 14-day

MODIS
250m daily

Planet
<1m daily–weekly

Terrain & Land Cover

Weather & Climate
NOAA NCEP, OMI, ...

... and many more, updating daily!

> 200 public datasets

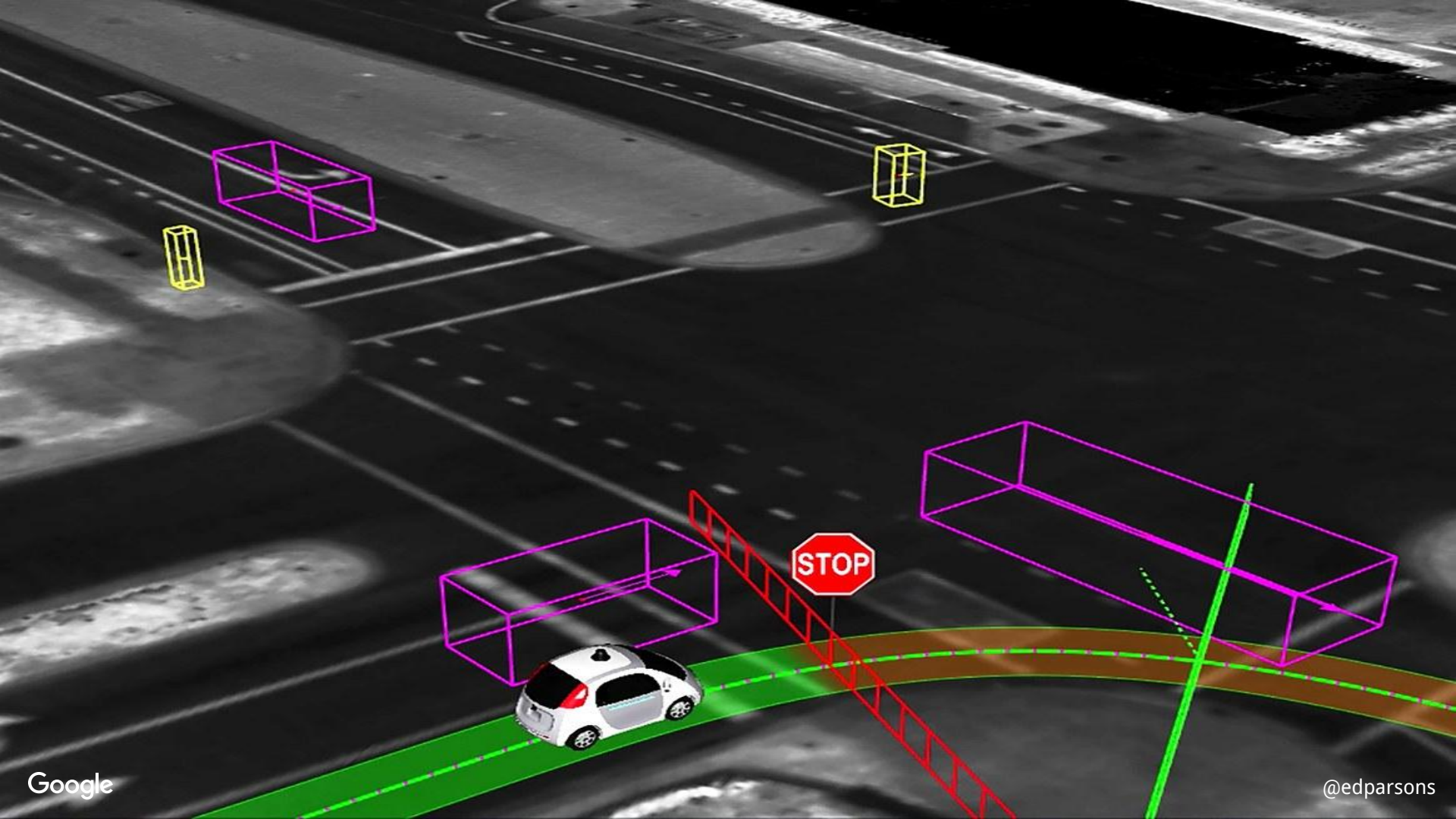
> 5 million images

> 4000 new images every day

> 5 petabytes of data

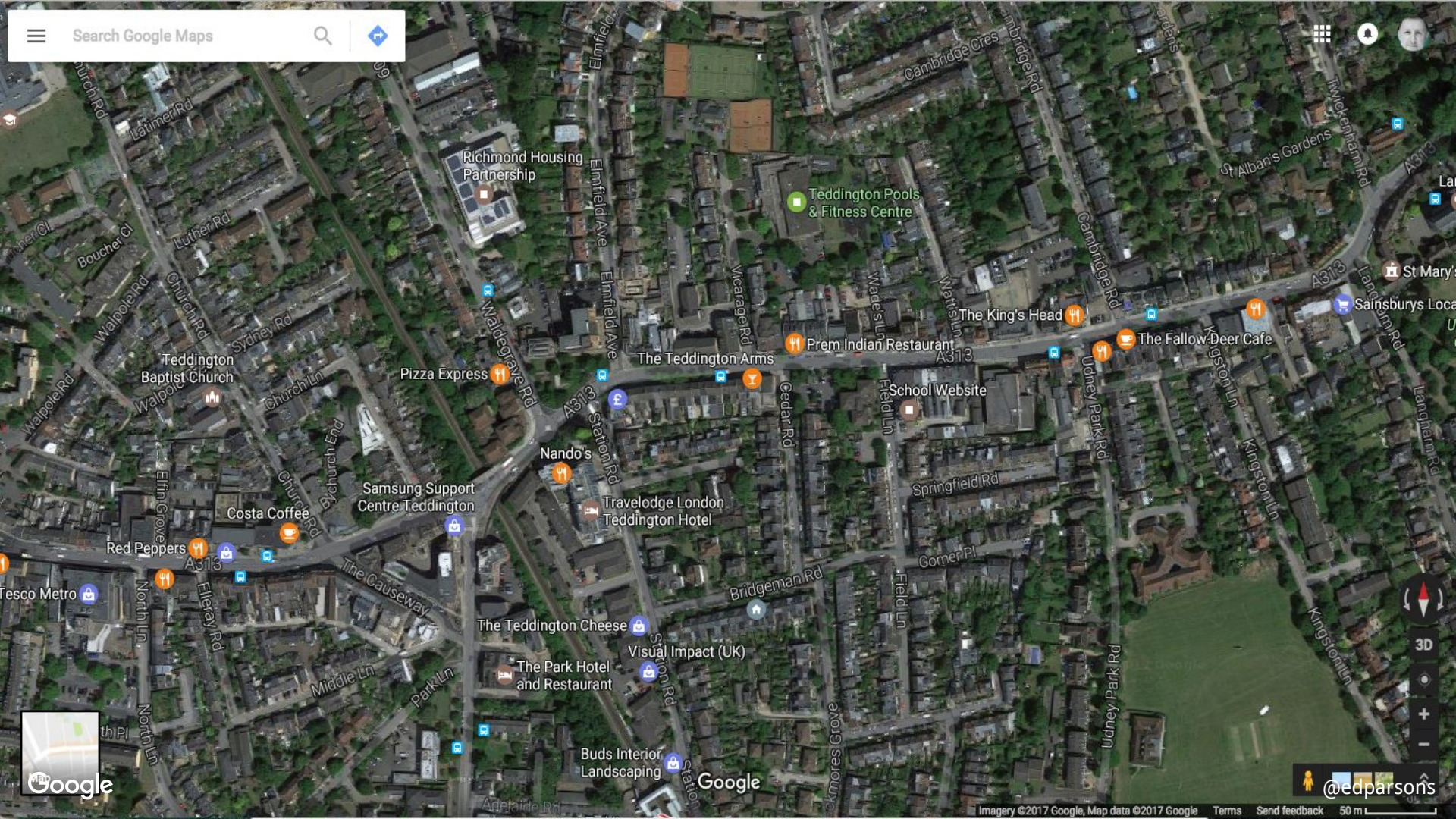
Simple Demo

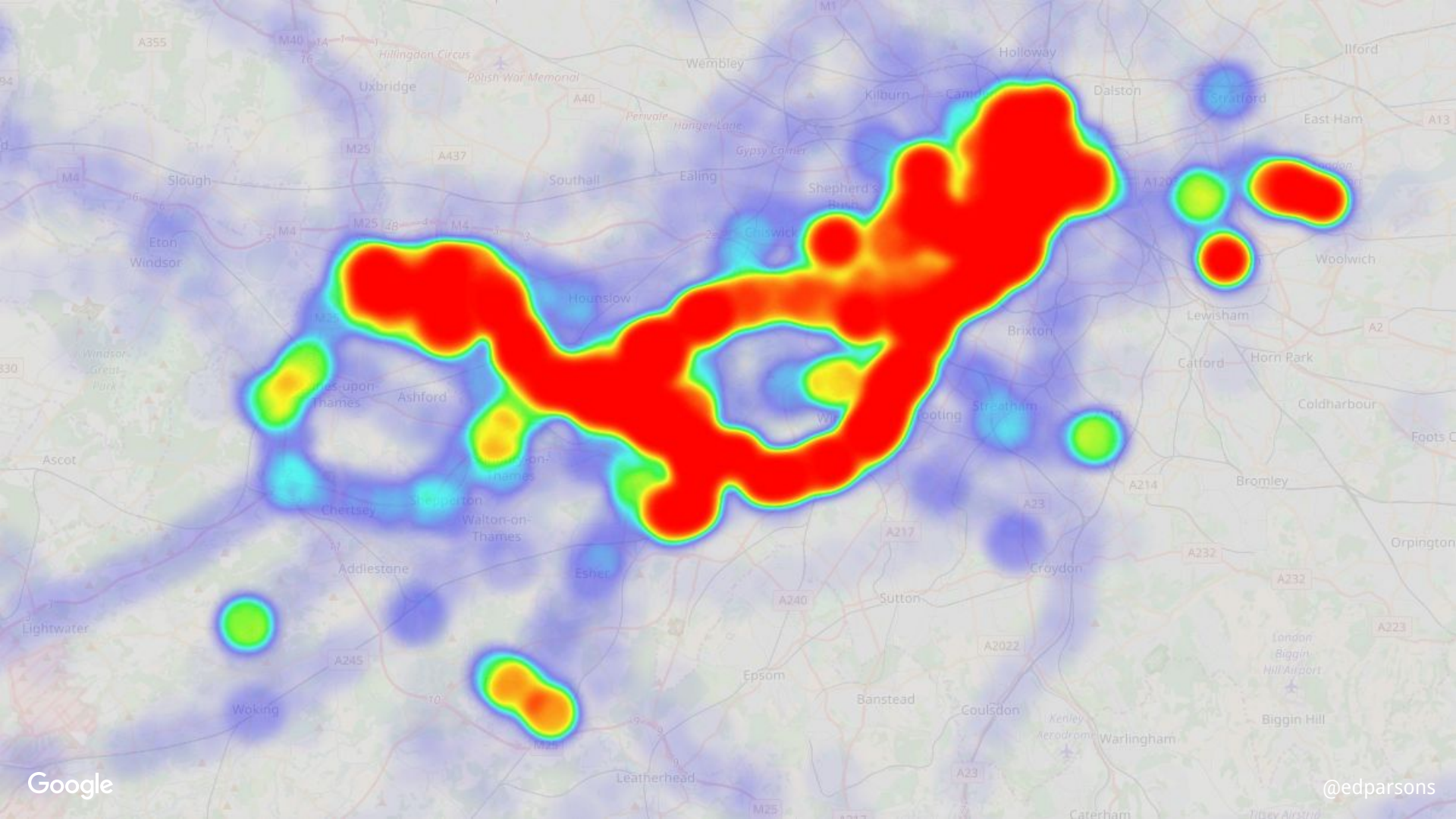
WAYMO
Google
@edparsons

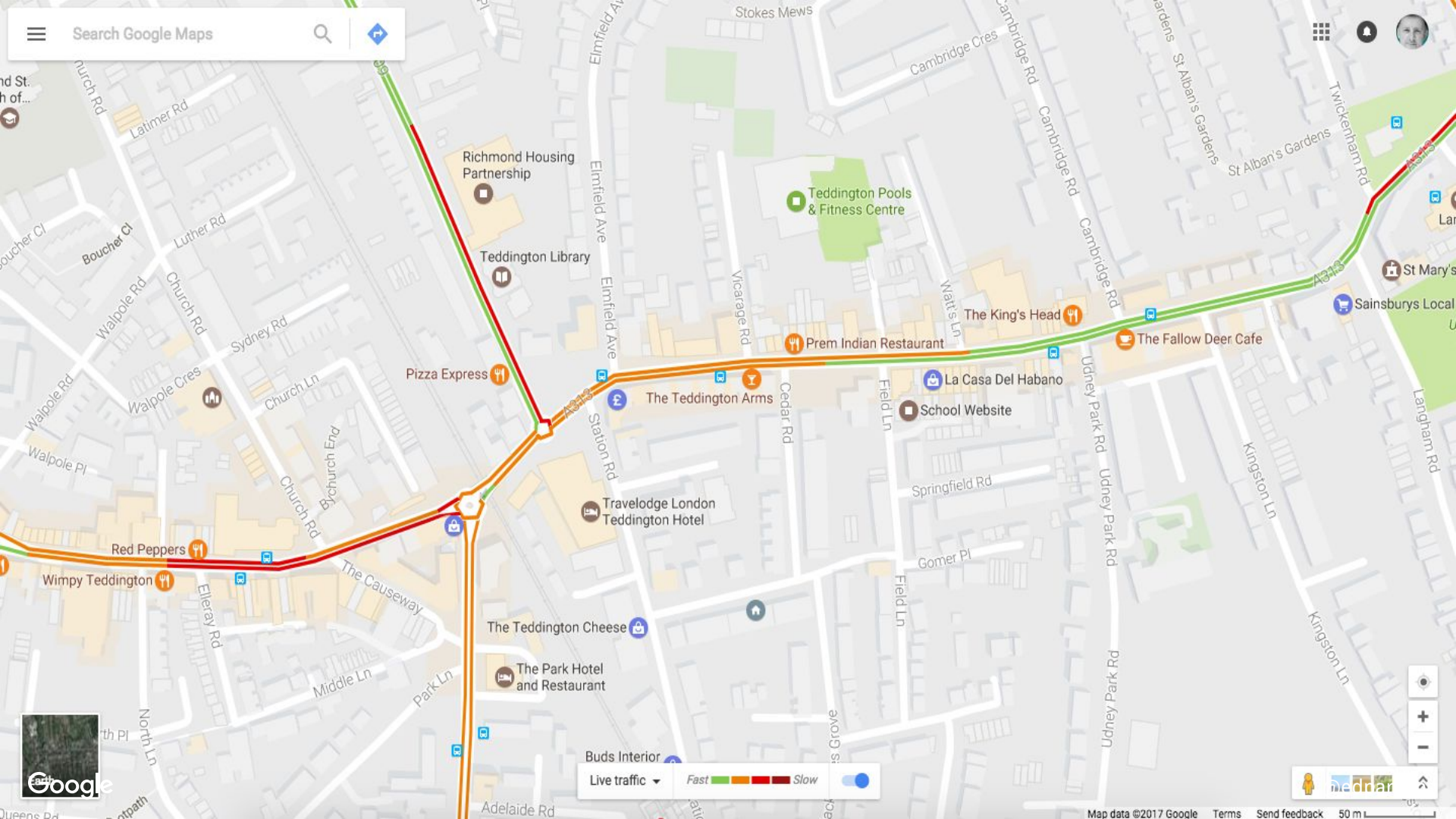


Google

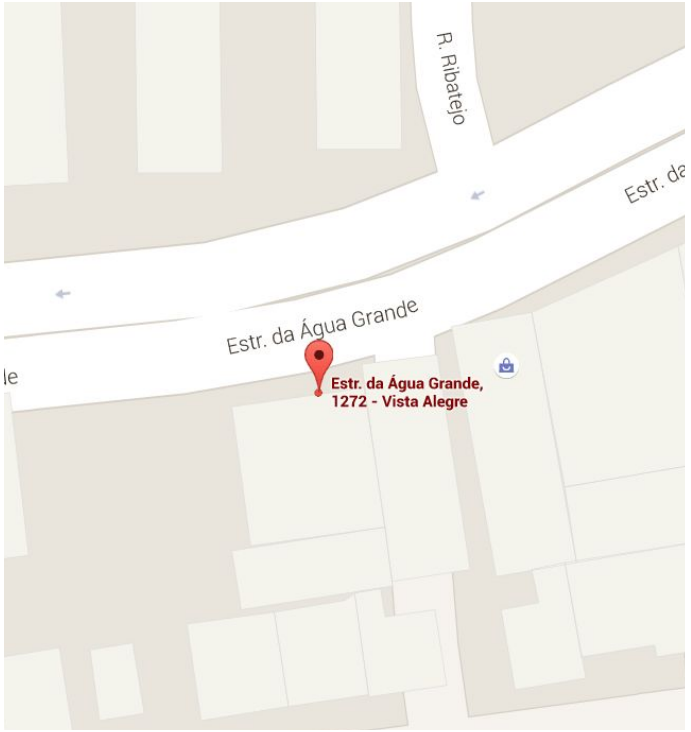
@edparsons


Search Google Maps
Richmond Housing Partnership
Teddington Pools & Fitness Centre
Teddington Baptist Church
Pizza Express
The Teddington Arms
Prem Indian Restaurant
The King's Head
The Fallow Deer Cafe
School Website
Nando's
Travelodge London Teddington Hotel
Samsung Support Centre Teddington
Costa Coffee
Red Peppers
Tesco Metro
The Teddington Cheese
Visual Impact (UK)
The Park Hotel and Restaurant
Buds Interior Landscaping
Sainsburys Loca
St Mary's
Elmfield Ave
Waldegrave Rd
Church Rd
Walpole Rd
Sydney Rd
Church Ln
Bychurch End
Elfin Grove
Station Rd
Vicarage Rd
Cedar Rd
Field Ln
Wades Ln
Watts Ln
Cambridge Rd
Udney Park Rd
Kingston Ln
Langham Rd
Springfield Rd
Gomer Pl
Bridgeman Rd
The Causeway
Elleray Rd
North Ln
Middle Ln
Park Ln
A313
Google
@edparsons


Google
@edparsons


Search Google Maps
Richmond Housing Partnership
Teddington Library
Teddington Pools & Fitness Centre
Pizza Express
The Teddington Arms
Prem Indian Restaurant
The King's Head
The Fallow Deer Cafe
La Casa Del Habano
School Website
Travelodge London Teddington Hotel
Red Peppers
Wimpy Teddington
The Teddington Cheese
The Park Hotel and Restaurant
Buds Interior
Sainsburys Local
St Mary's
Live traffic
Fast
Slow
Map data ©2017 Google
Terms
Send feedback
50 m

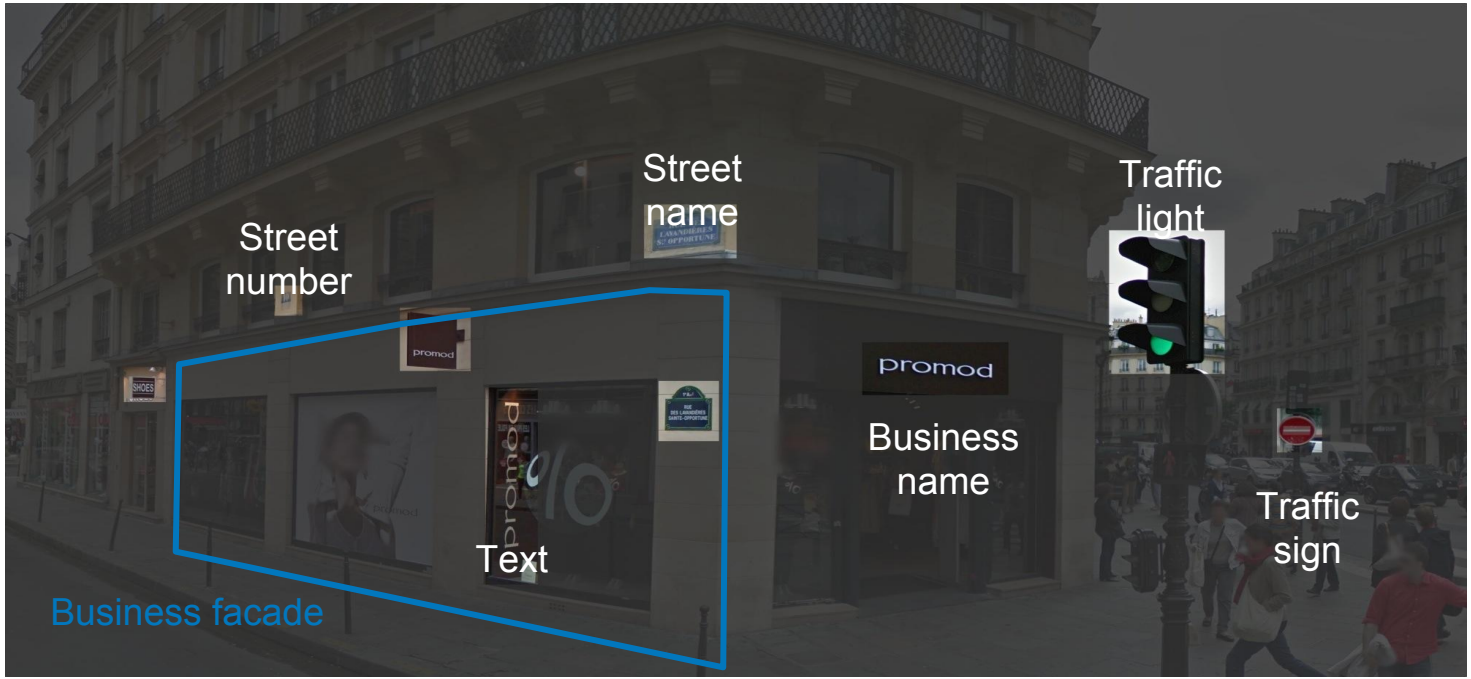
Where exactly is *1272* Estrada da Água Grande?



Google Street View
Explore the world at google.com/streetview

Object Recognition

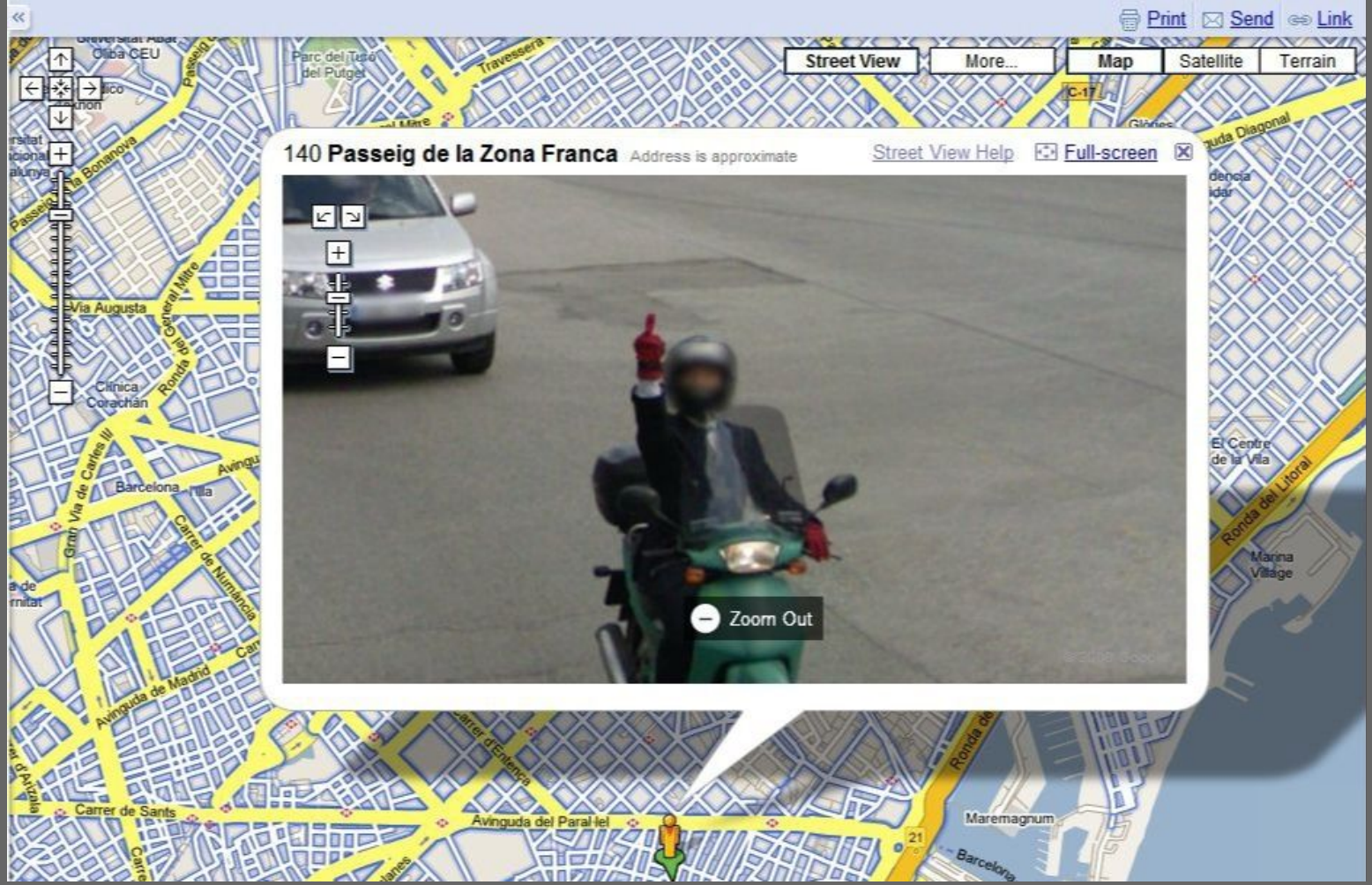
Semantic Extraction from Street View Imagery



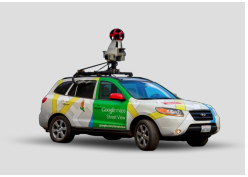
Face blurring (or not…)

Google

@edparsons

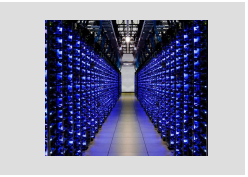

Print
Send
Link
Street View
More...
Map
Satellite
Terrain
140 Passeig de la Zona Franca
Address is approximate
Street View Help
Full-screen
Zoom Out
Parc del Turó del Putget
Travessera
Via Augusta
Clínica Corachán
Barcelona
Carrer de Numància
Avinguda de Madrid
Carrer de Sants
Avinguda del Paral·lel
Ronda del Litoral
El Centre de la Vila
Marina Village
Maremagnum
Barcelona

Semantics from imagery: Key Ingredients

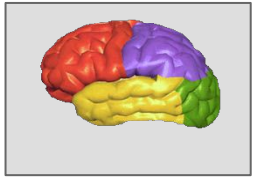


Accurately posed imagery

Very Large Labeled Datasets



Google Compute Power

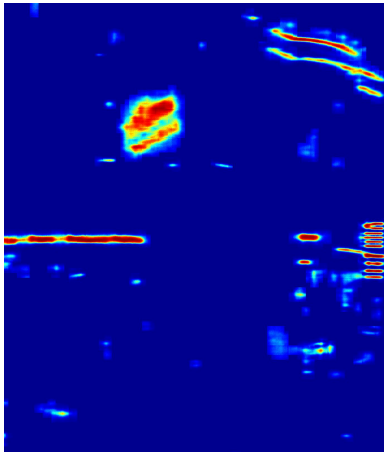


Deep Learning

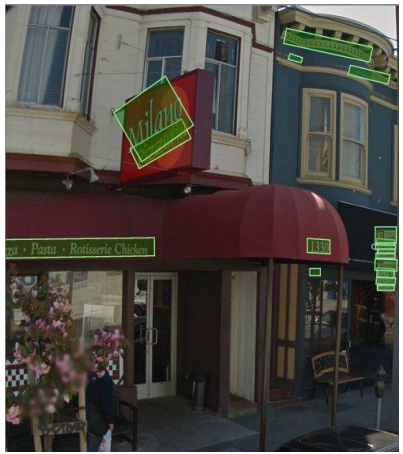
Unique Opportunity to Understand the Physical World

Object Detection Generalization

- NN for binary pixel labeling
- Trained separately for each object of interest
- Architecture is commmodelon to pipelines of all objects
  - currently text, traffic signs, license plates, roads, buildings, etc.



Confidence map



Boxes from post-processing

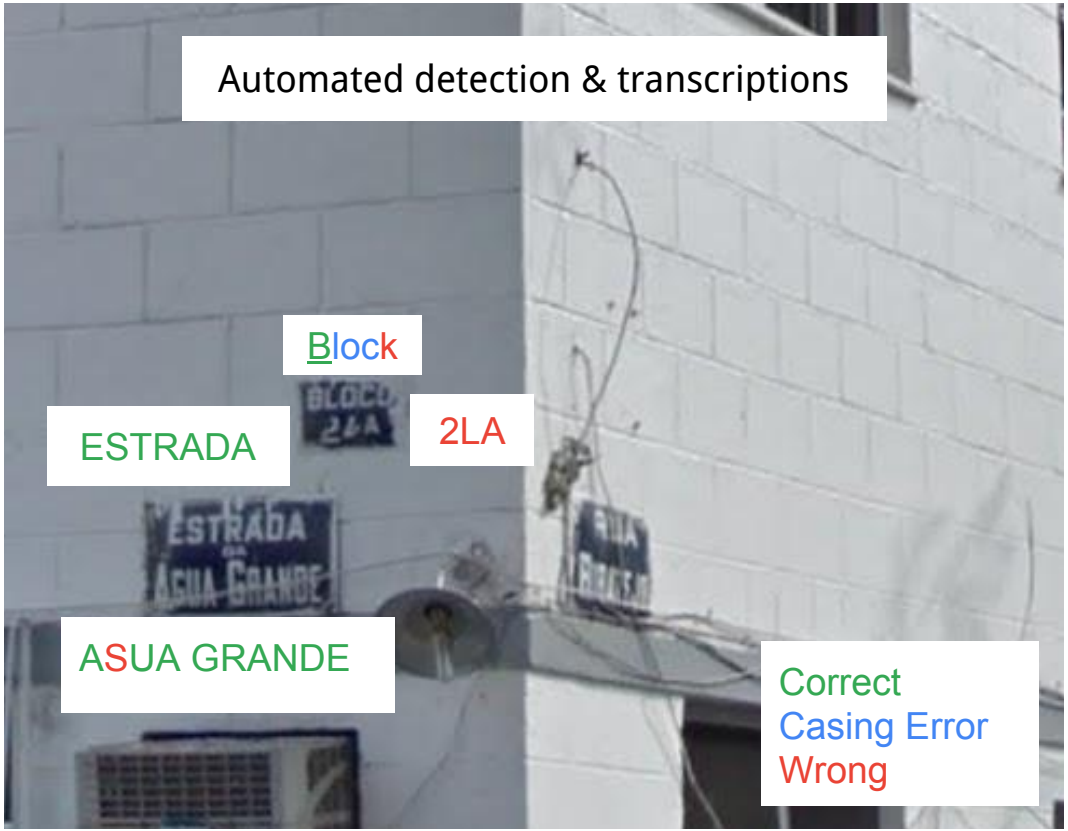
Automating Transcription

The Problem

1. Take roughly localized patch
2. Read digits in order

reCAPTCHA to the rescue

Street View images have a lot of useful text

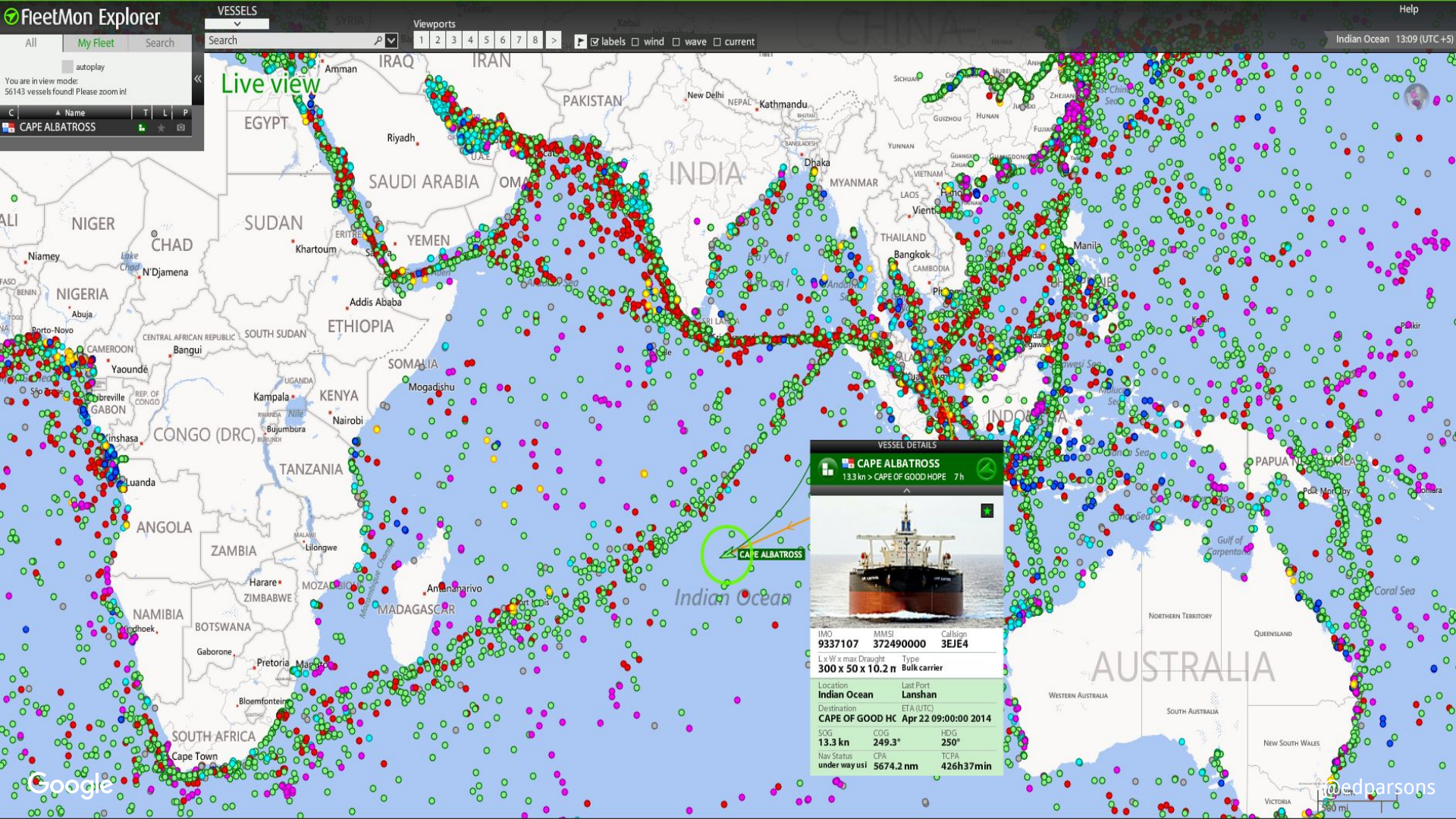


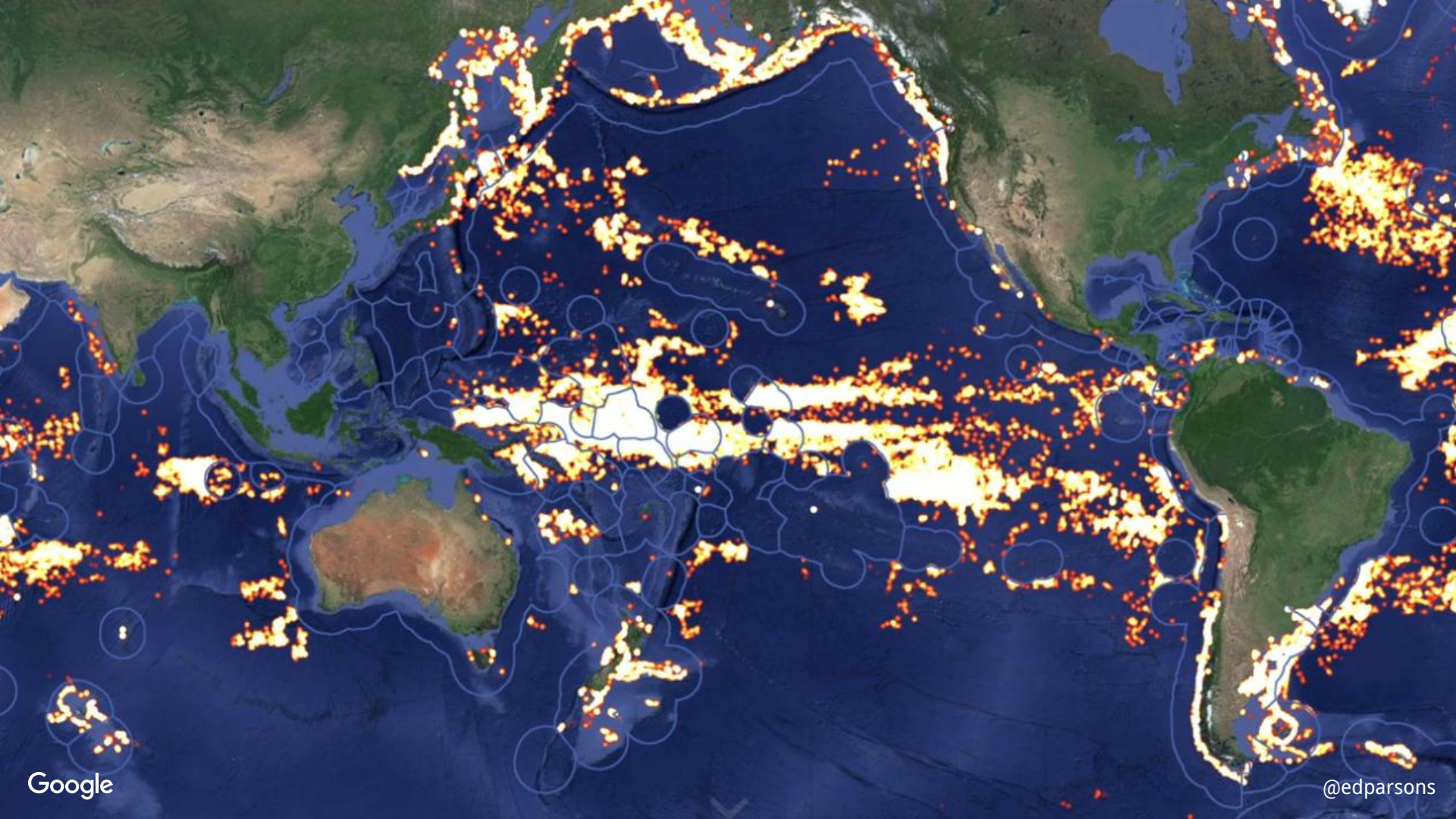
bizview: 2.841
bizview: 1.317
bizview: 2.85
bizview: 1.437

TensorFlow ™

Google

@edparsons


FleetMon Explorer
All
My Fleet
Search
autoplay
You are in view mode:
56143 vessels found! Please zoom in!
C
Name
T
L
P
CAPE ALBATROSS
VESSELS
Search
Viewports
1 2 3 4 5 6 7 8
labels
wind
wave
current
Help
Indian Ocean 13:09 (UTC +5)
Live view
VESSEL DETAILS
CAPE ALBATROSS
13.3 kn > CAPE OF GOOD HOPE 7 h
IMO
9337107
MMSI
372490000
Callsign
3EJE4
L x W x max Draught
300 x 50 x 10.2 m
Type
Bulk carrier
Location
Indian Ocean
Last Port
Lanshan
Destination
CAPE OF GOOD HO
ETA (UTC)
Apr 22 09:00:00 2014
SOG
13.3 kn
COG
249.3°
HDG
250°
Nav Status
under way usi
CPA
5674.2 nm
TCPA
426h37min
CAPE ALBATROSS
Indian Ocean
AUSTRALIA
INDIA
PAKISTAN
IRAN
IRAQ
SAUDI ARABIA
EGYPT
SUDAN
ETHIOPIA
SOMALIA
KENYA
TANZANIA
CONGO (DRC)
ANGOLA
NAMIBIA
BOTSWANA
SOUTH AFRICA
ZAMBIA
ZIMBABWE
MADAGASCAR
MYANMAR
THAILAND
Google
@edparsons

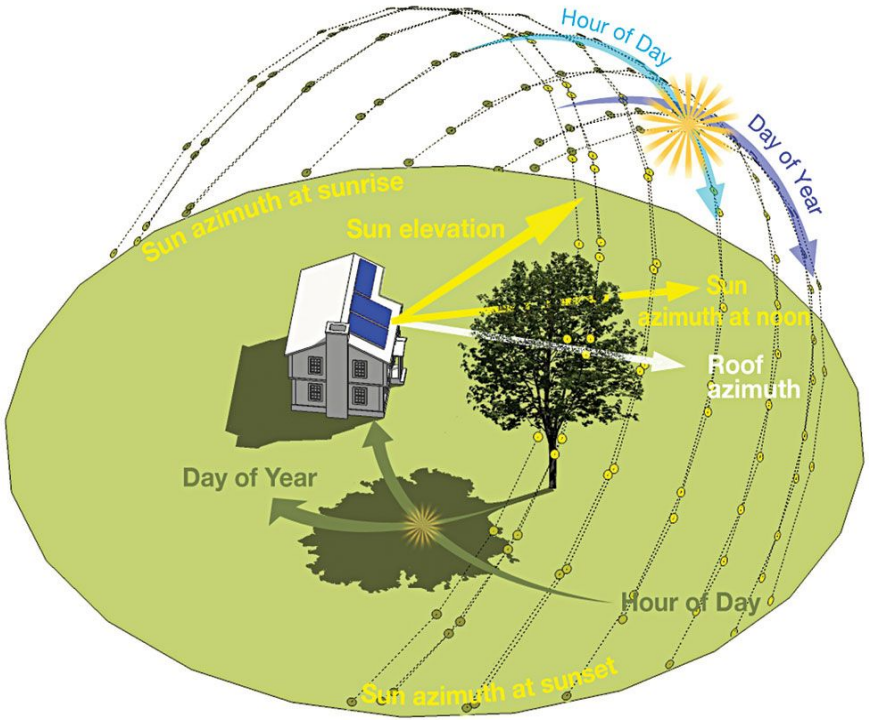

Google
@edparsons

Project Sunroof

Every Roof

Every Pixel

Every Hour



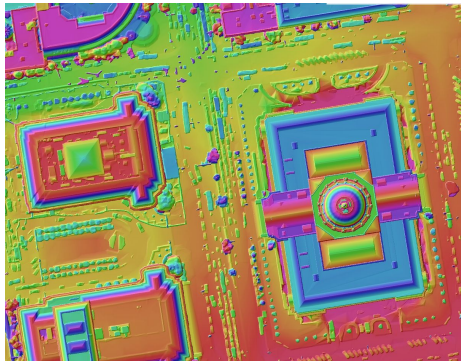
Sun location

Light Intensity

Roof Angle

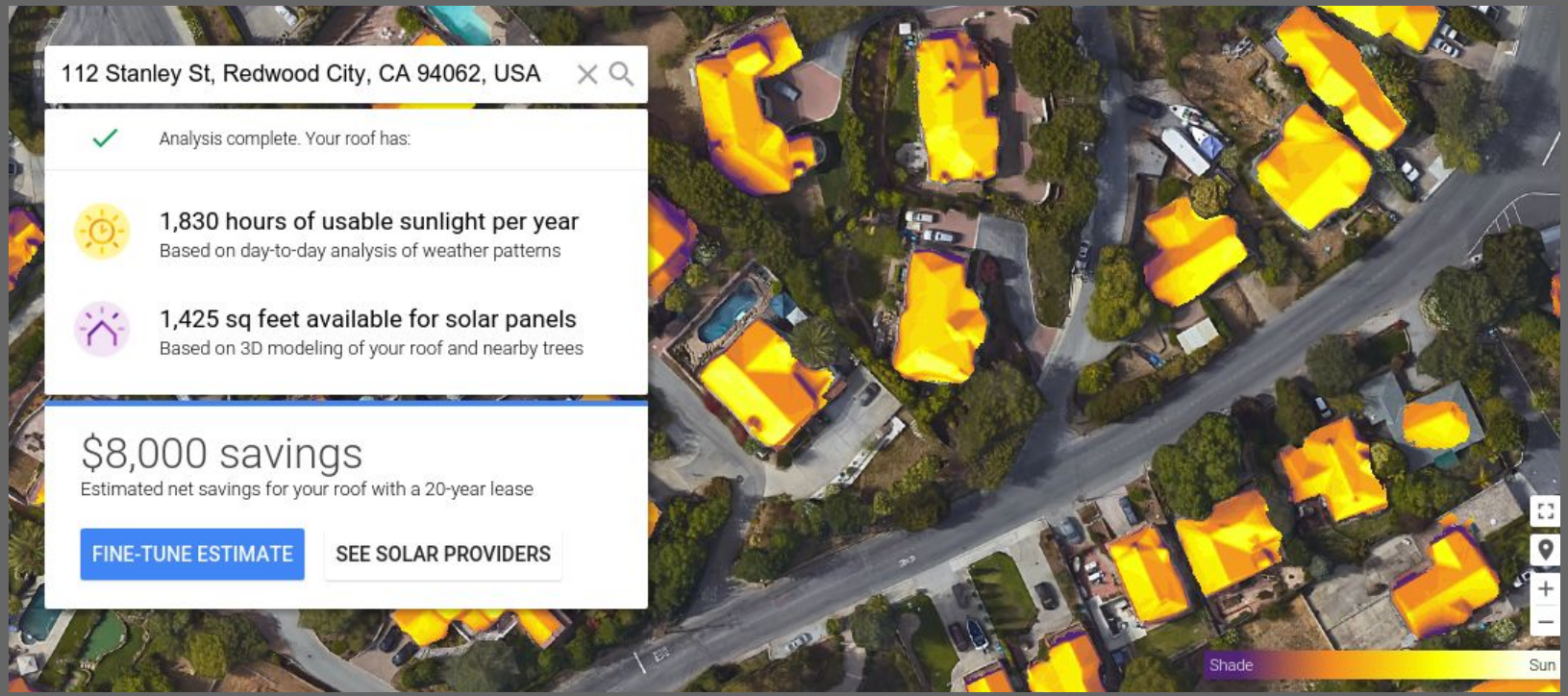
Shadows

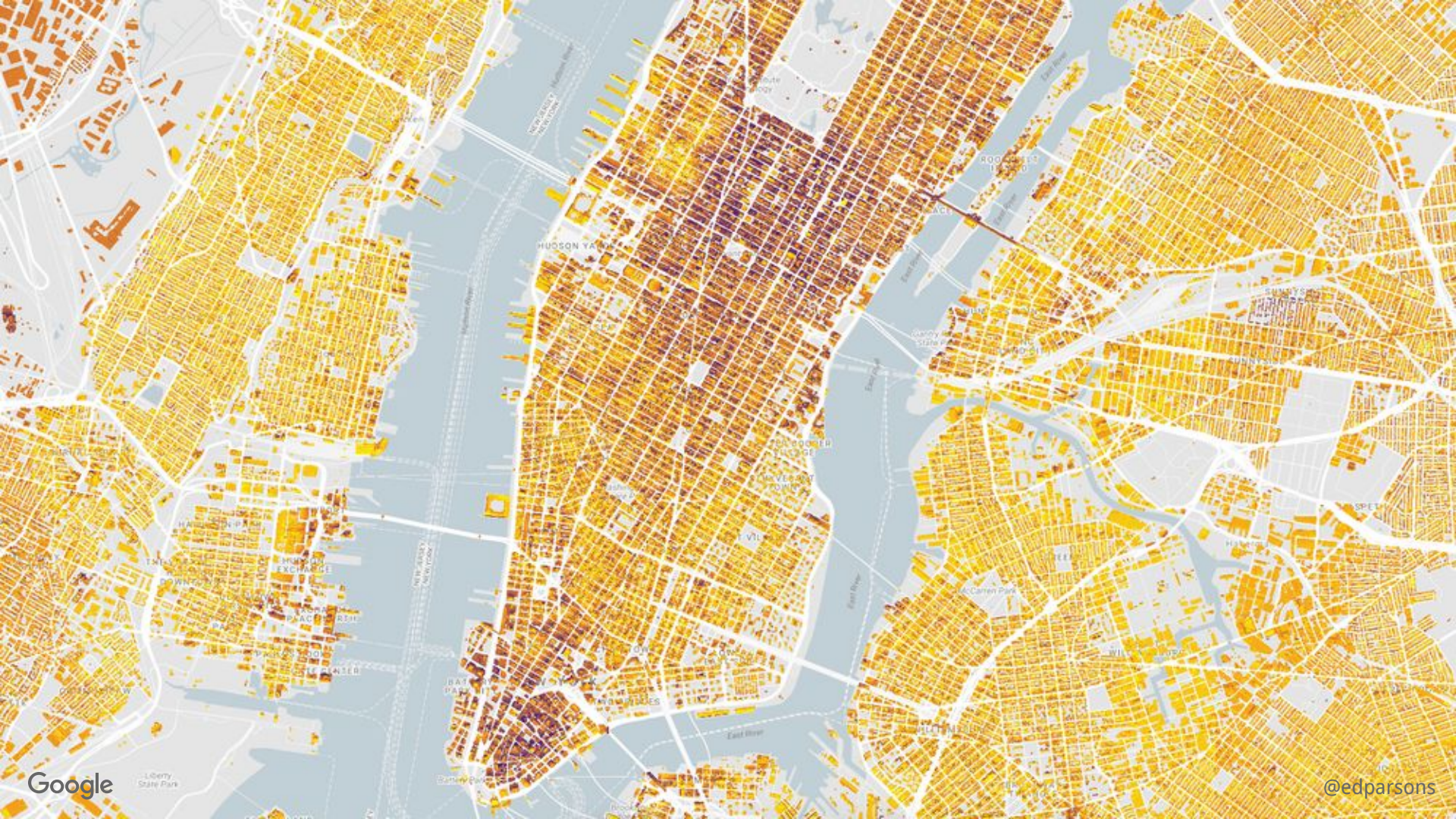
Aerial Imagery



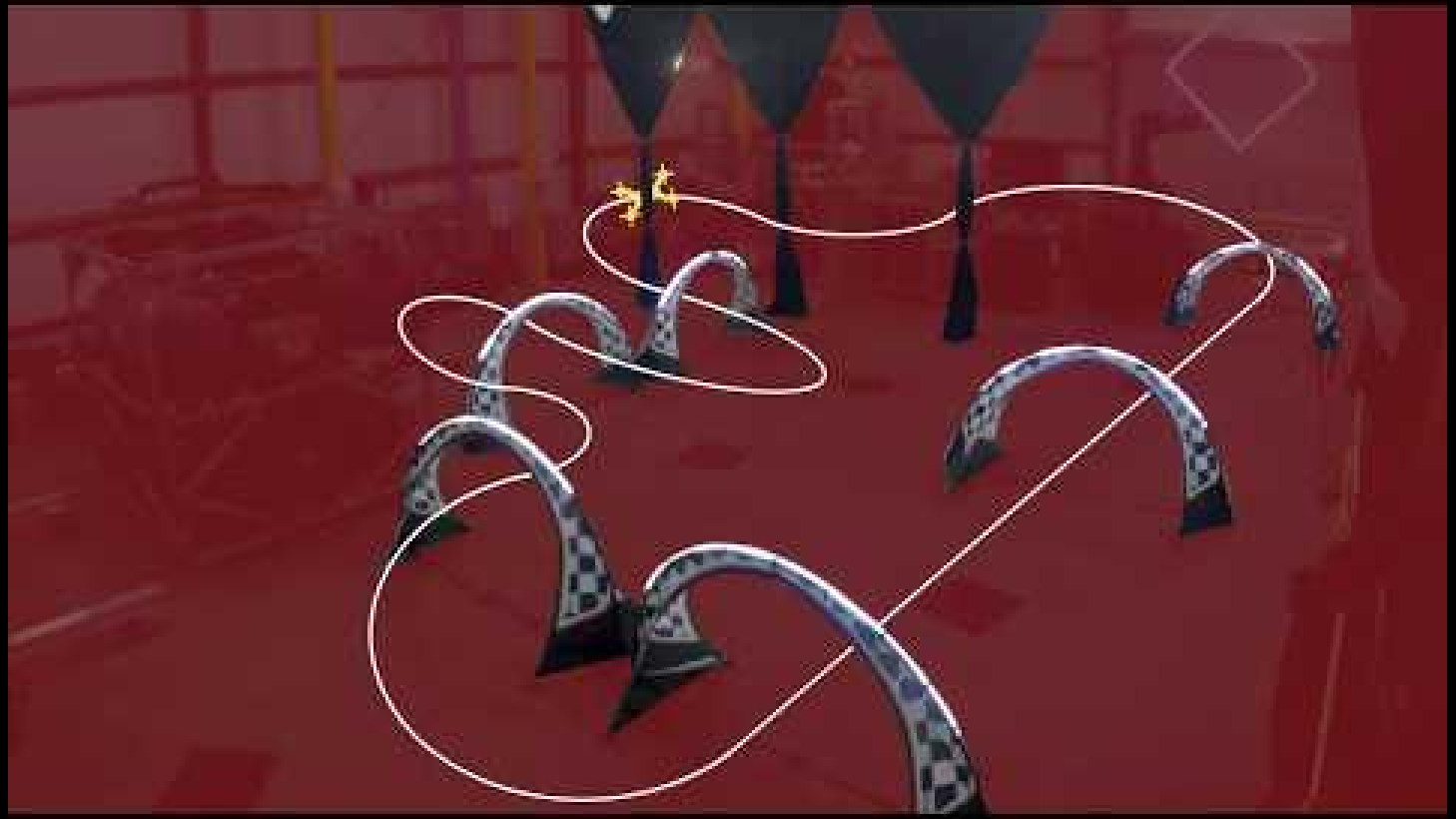
Digital Surface Modeling

3-D Modeling


112 Stanley St, Redwood City, CA 94062, USA
Analysis complete. Your roof has:
1,830 hours of usable sunlight per year
Based on day-to-day analysis of weather patterns
1,425 sq feet available for solar panels
Based on 3D modeling of your roof and nearby trees
$8,000 savings
Estimated net savings for your roof with a 20-year lease
FINE-TUNE ESTIMATE
SEE SOLAR PROVIDERS
Shade
Sun


Google
@edparsons

And finally..



Thank you !

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