Using Biometrics to Design Better Places for People

Please take a piece of paper

Draw a house as if you were 5

CIP • ICU
CANADIAN INSTITUTE OF PLANNERS
INSTITUT CANADIEN DES URBANISTES

PIBC PLANNING INSTITUTE OF BRITISH COLUMBIA

ELEVATION 2.0

SS-28: Using Biometrics to Design Better Places for People

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Learning Objectives

1. Grasp the potential of biometric tools to better understand the human experience of the built environment.
2. Appreciate the human face-bias, how it is hard-wired into our brain, right-side-up, before birth, and how this imprint impacts everything we relate to;
3. Gain familiarity with Galvanic Skin Response (GSR) and how it works tracking internal emotional arousal states, including stress from external stimuli.
4. Understand how human perception is relational, meant for one-on-one interaction and why this matters for sustainable development, influencing well-being overall.

Devens, MA

- Former military base outside Boston
- Superfund Site
- Sustainable Redevelopment mission
    - Business Development
    - Open Space Protection
    - Residential Development
    - Social Equity

Neighborhood Design with Attention to Public Realm

- Compact, energy efficient, healthy, connected and accessible
- 130 units of mixed housing types
- Biometrics as a tool to assess project form and function (walkability);

Using Biometrics to Design Better Places for People

Please take a piece of paper

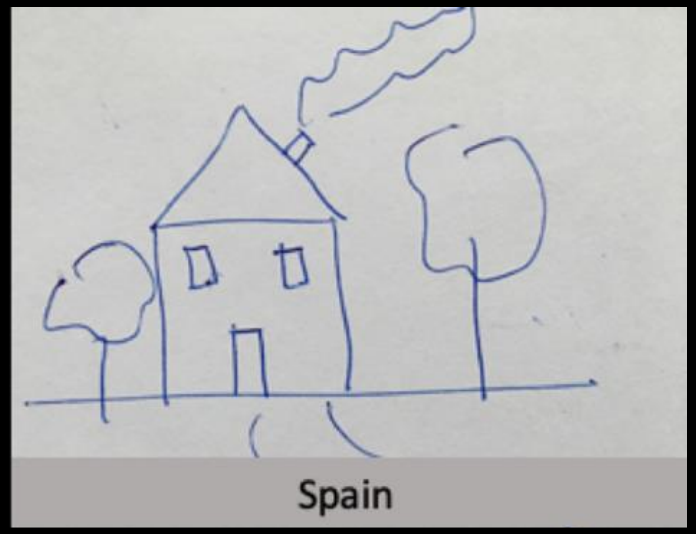
Draw a house as if you were 5

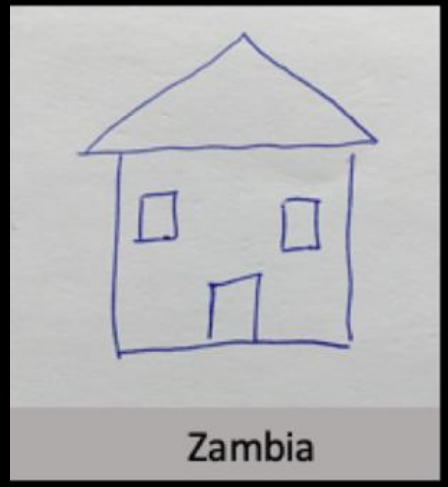
The House Experiment

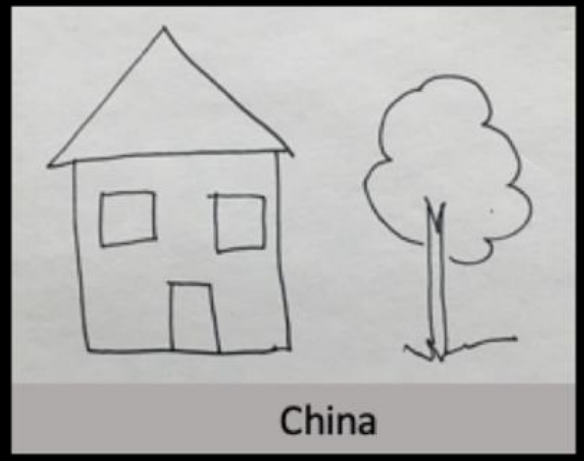

Turkey


India


Italy


Spain


Zambia


China


Serbia


Russia

The Postcard Experiment

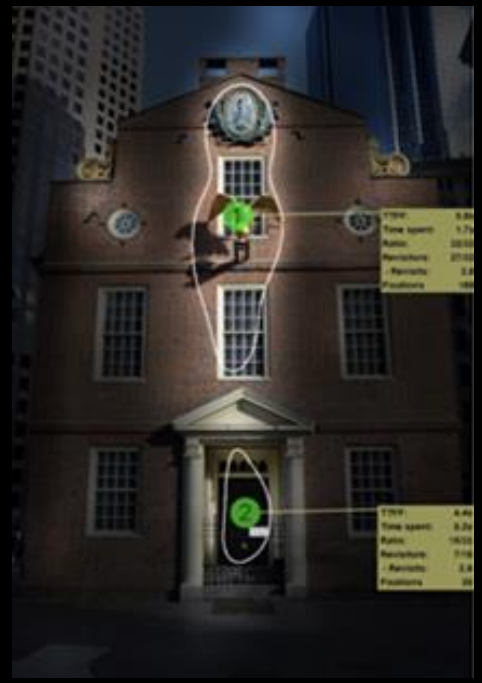
Which building do you think would most likely be on a postcard of Boston?

Boston City Hall

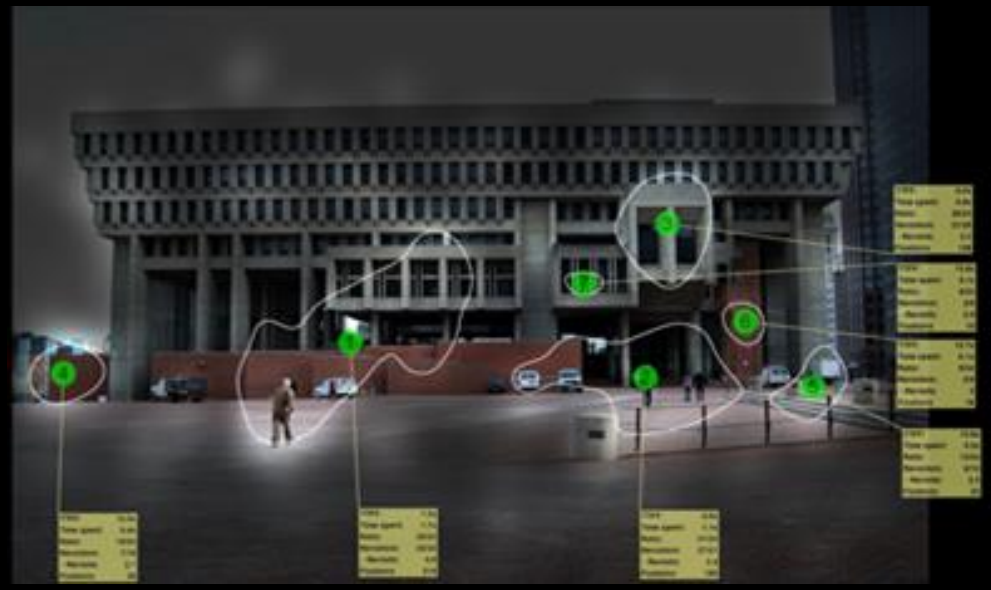
Boston’s Old State House

The Postcard Experiment

Your brain directs your eye to look at the Old State House, “approachable” architecture in under a second;

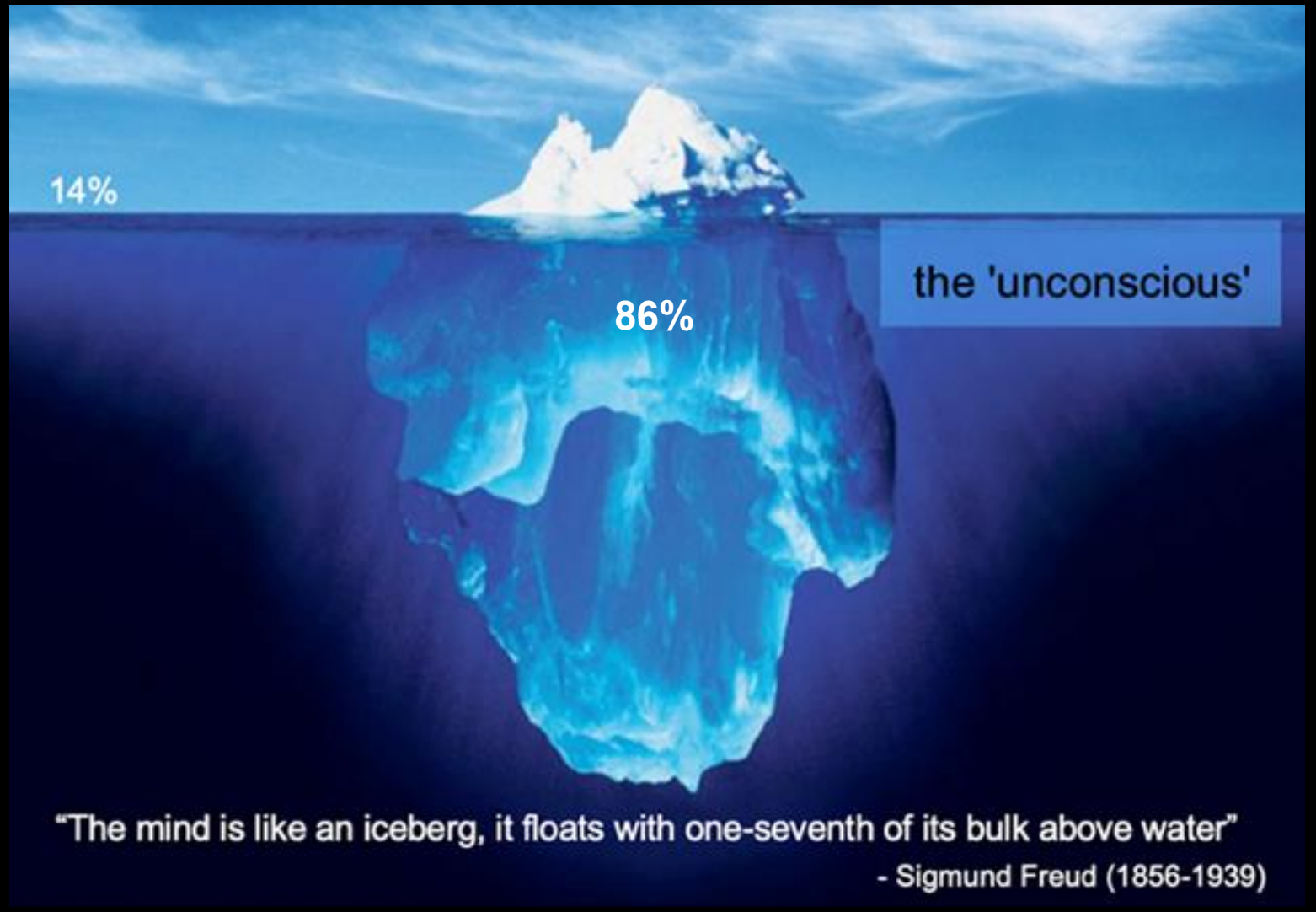


Boston City Hall is “avoidant”; the brain directs you to look away from most of the structure in first 6 seconds...



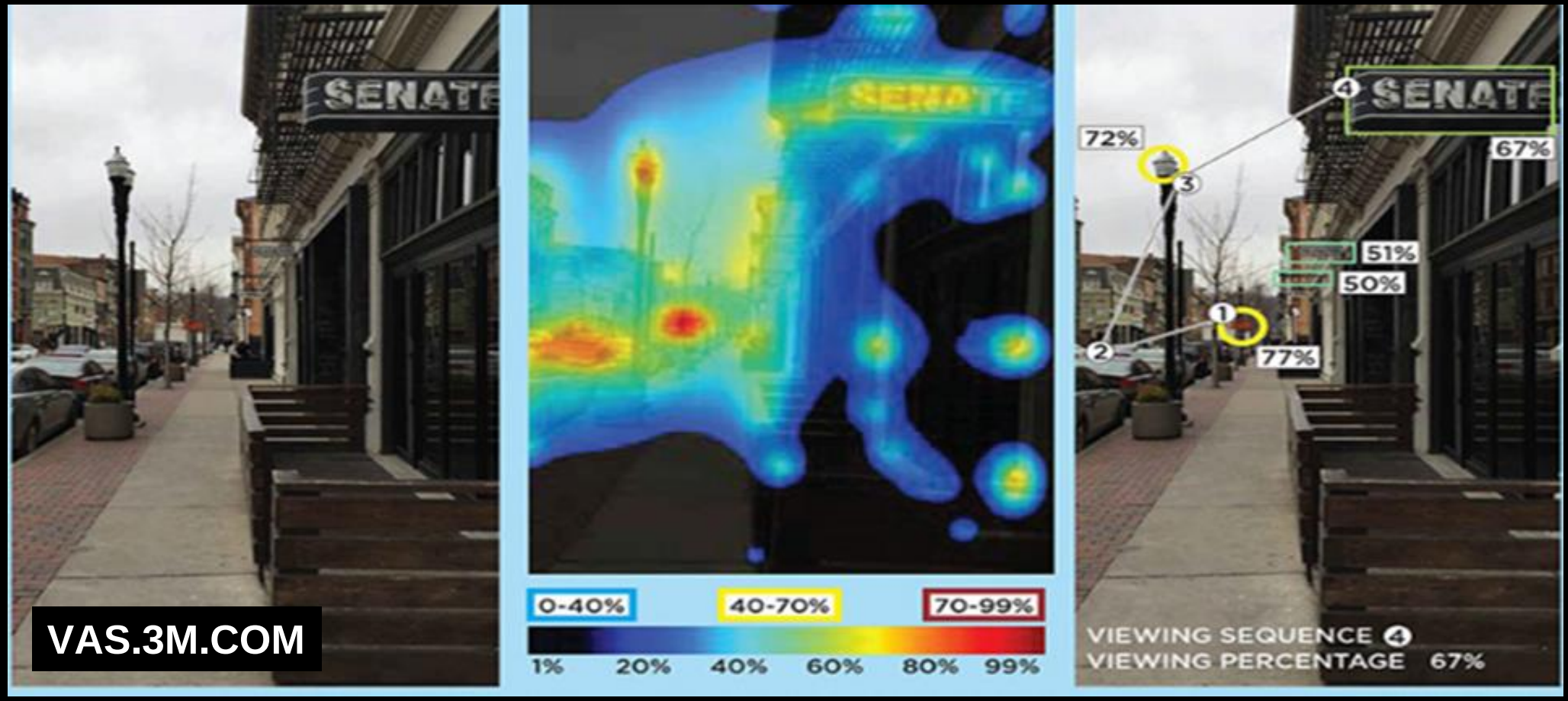
Some places create implicit memory and others don't

Your brain makes walking decisions in fractions of a second
How can this happen ?

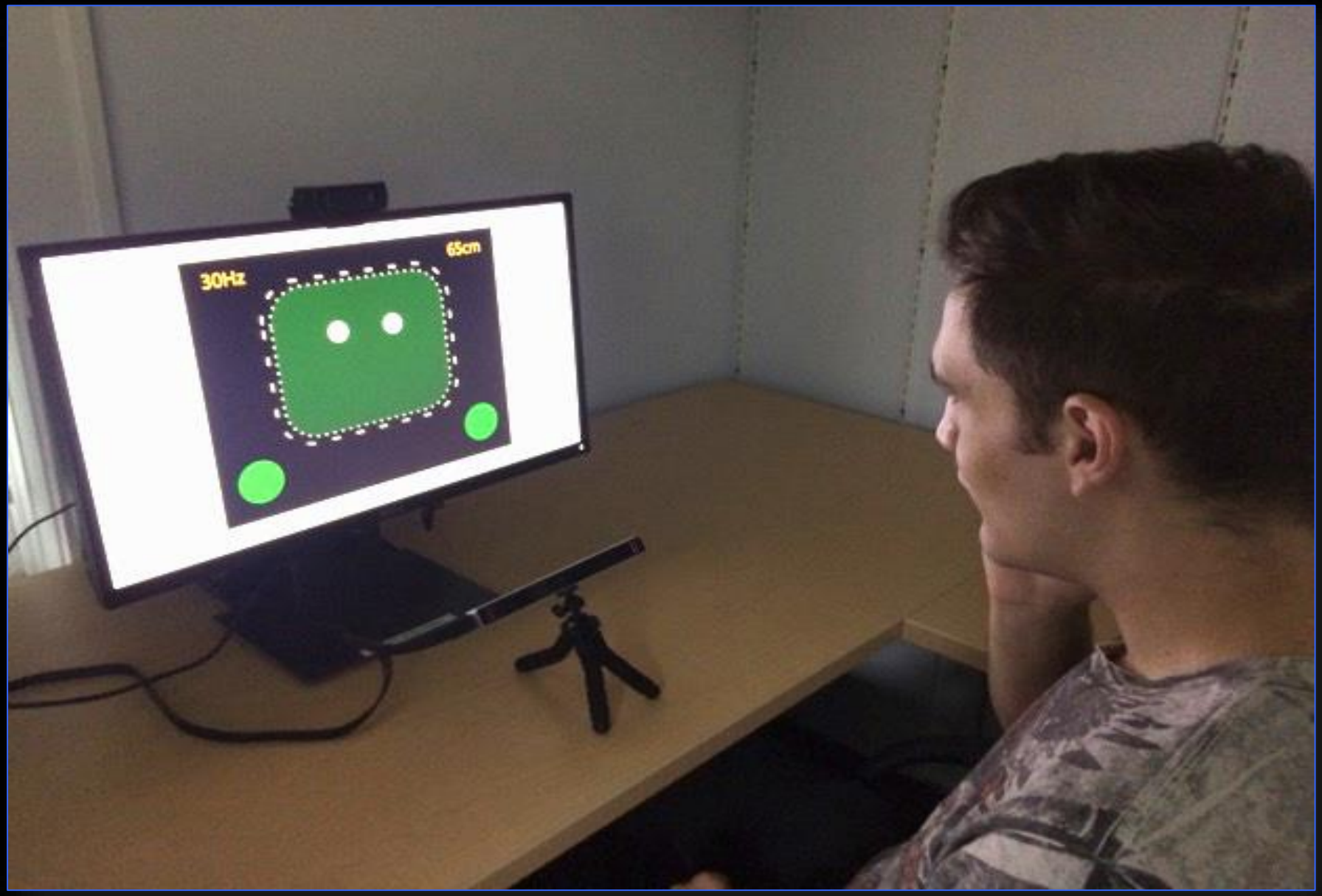


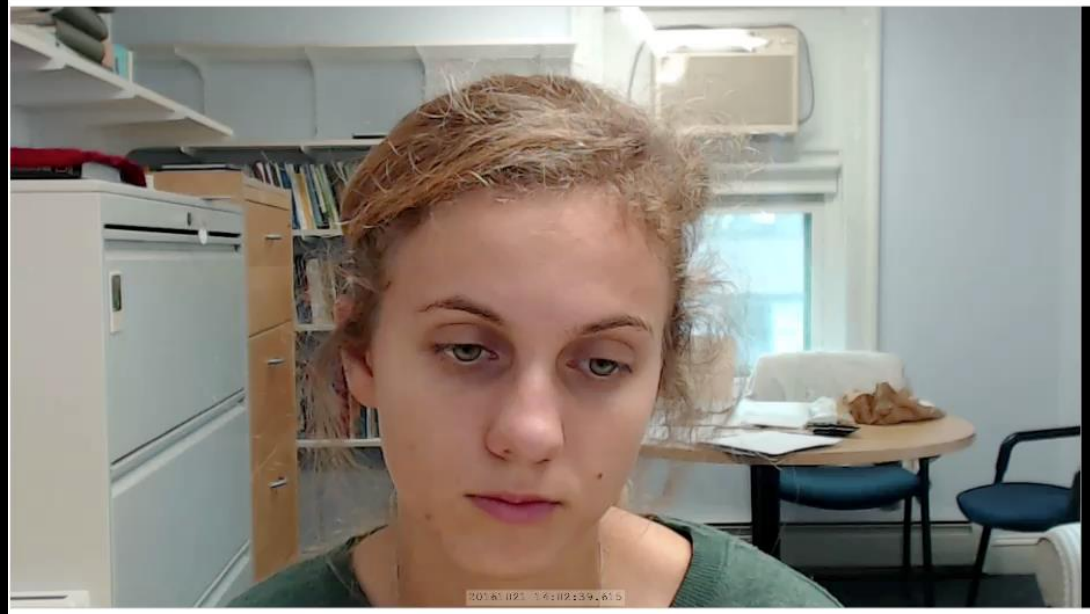
Biometrics?

- Objective measurement and analysis of places
  - understand unconscious reactions to various physical forms
  - help understand how development patterns impact our mental, emotional, and social health and well-being



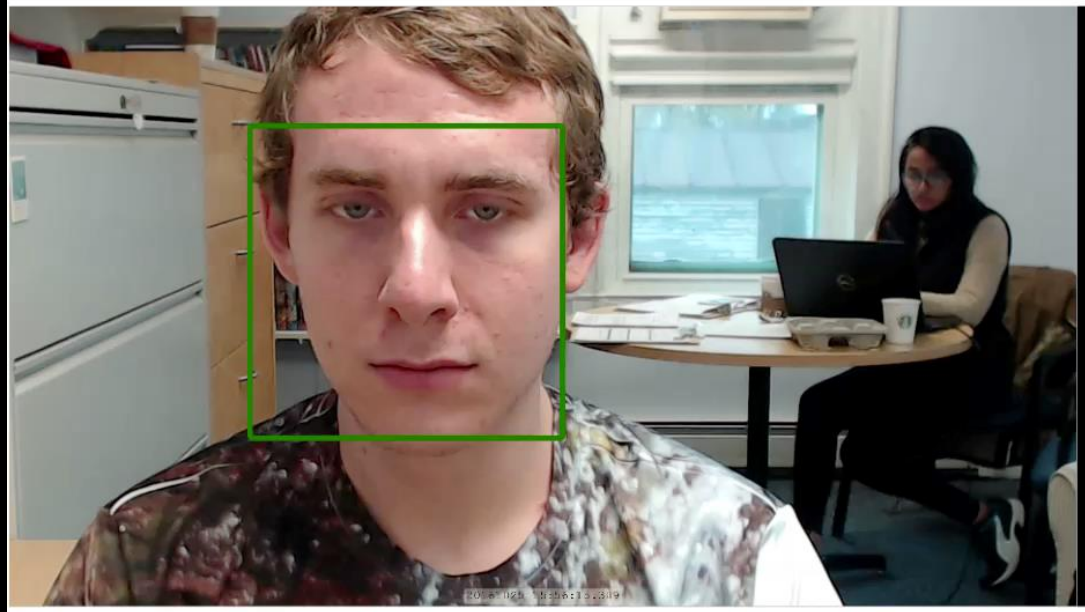
Eye tracking lab set-up





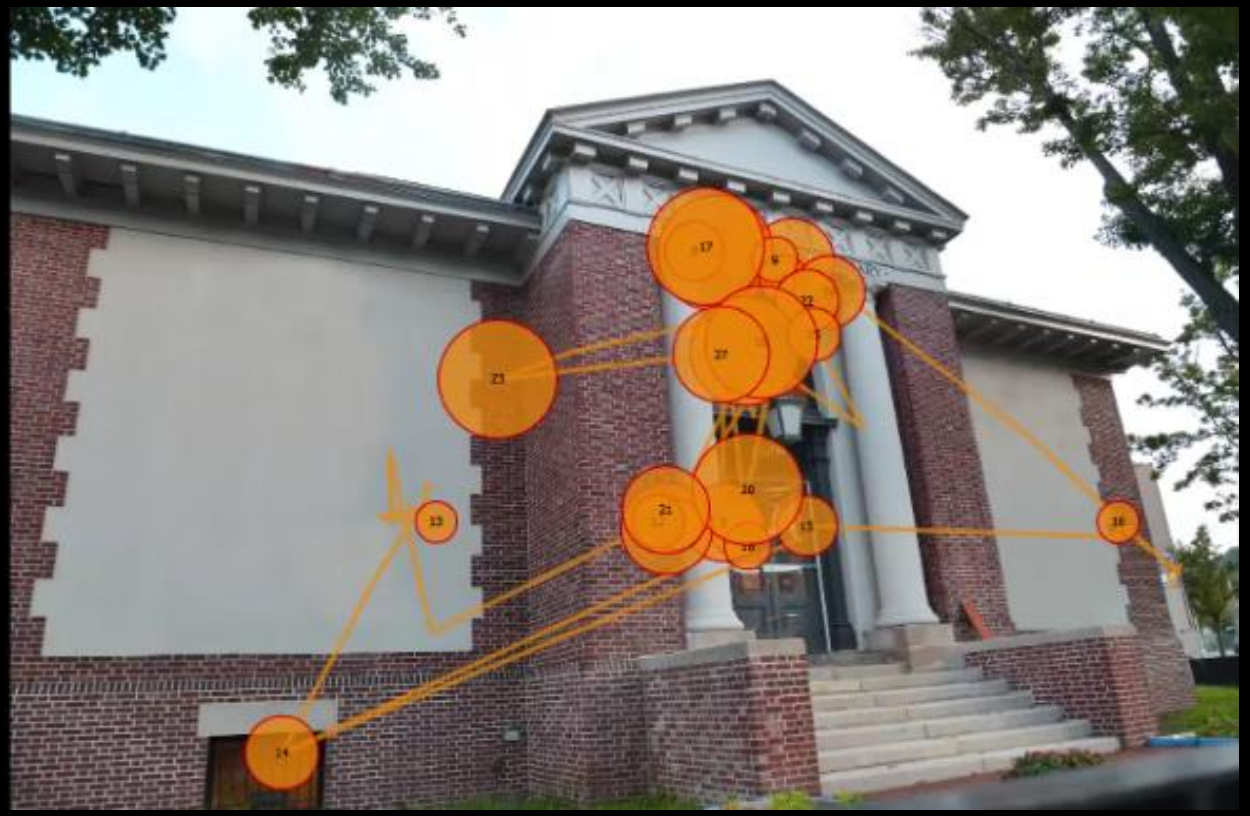
5 10

Stimulus: Stapleton Public Library 10 **Exposure time:** 00:15 20 Anonymous 21-10-16 13h52m 41b JH 00:00:000 **Speed** 1x



5 10

Stimulus: 10StapletonLibraryPhSp | Exposure time: 00:15 | 20 Anonymous 25-10-16 15h45m ZG | 00:00:000 Speed 1x



1 TTFF: 0.9 s
Time spent: 2.6 s
Ratio: 30/30
Fixations: 371

2 TTFF: 12.6 s
Time spent: 0.1 s
Ratio: 12/30
Fixations: 18

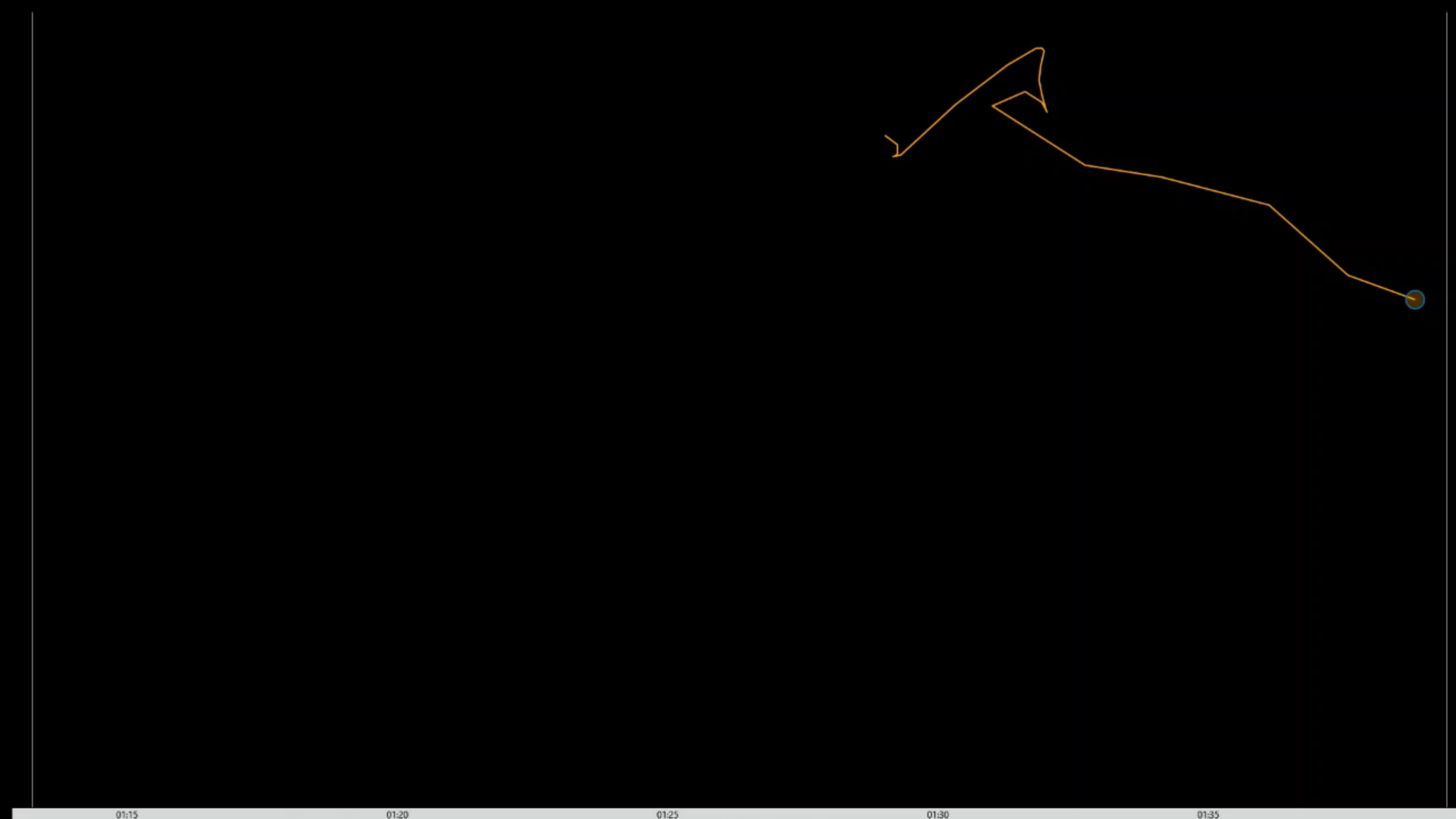
1 TTFF: 1.2 s
Time spent: 2.6 s
Ratio: 32/33
Fixations: 382

4 TTFF: 10.8 s
Time spent: 0.1 s
Ratio: 17/33
Fixations: 34

Mobile Eye Tracking with Tobii glasses

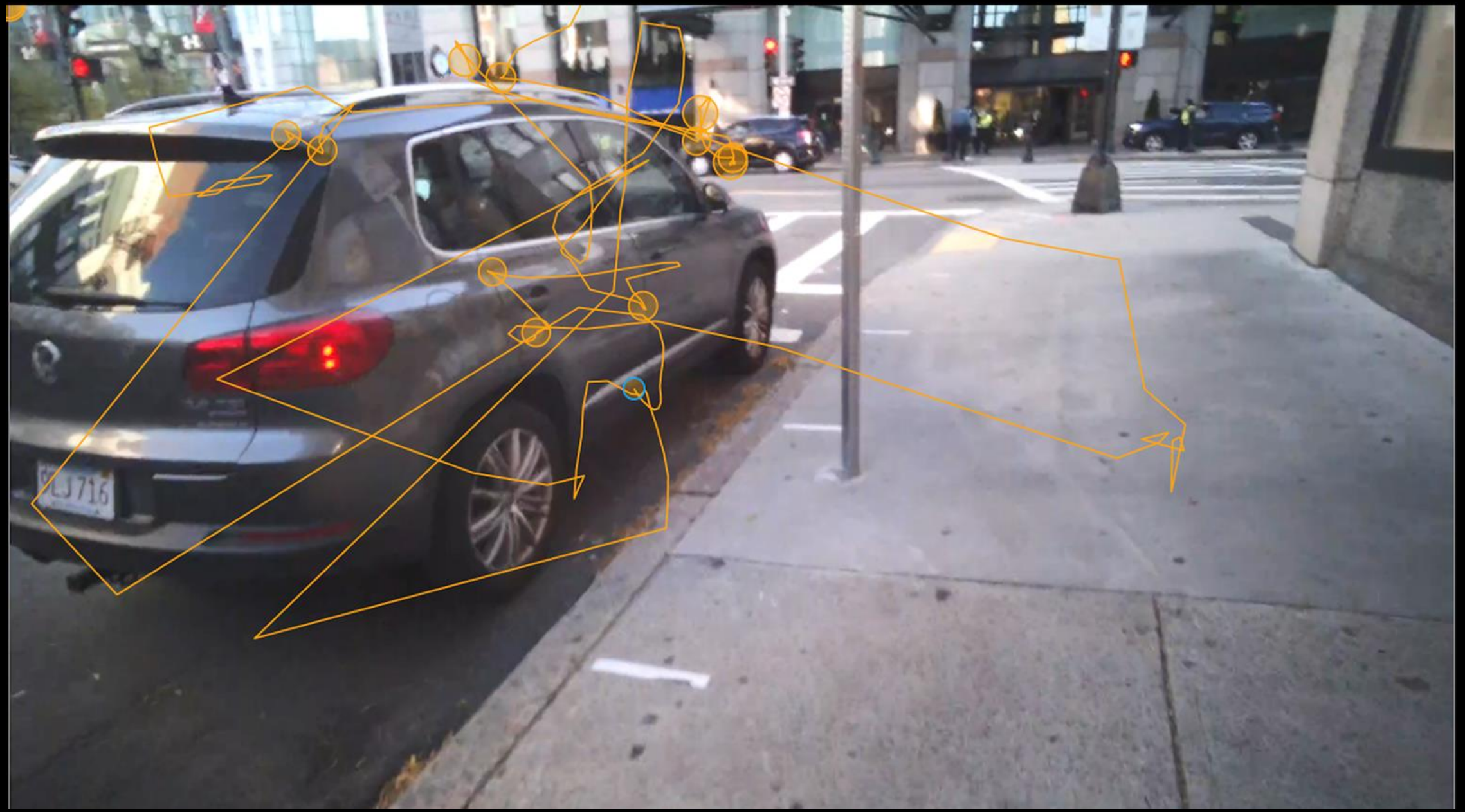
Photos courtesy iMotions and Mengfei Wang

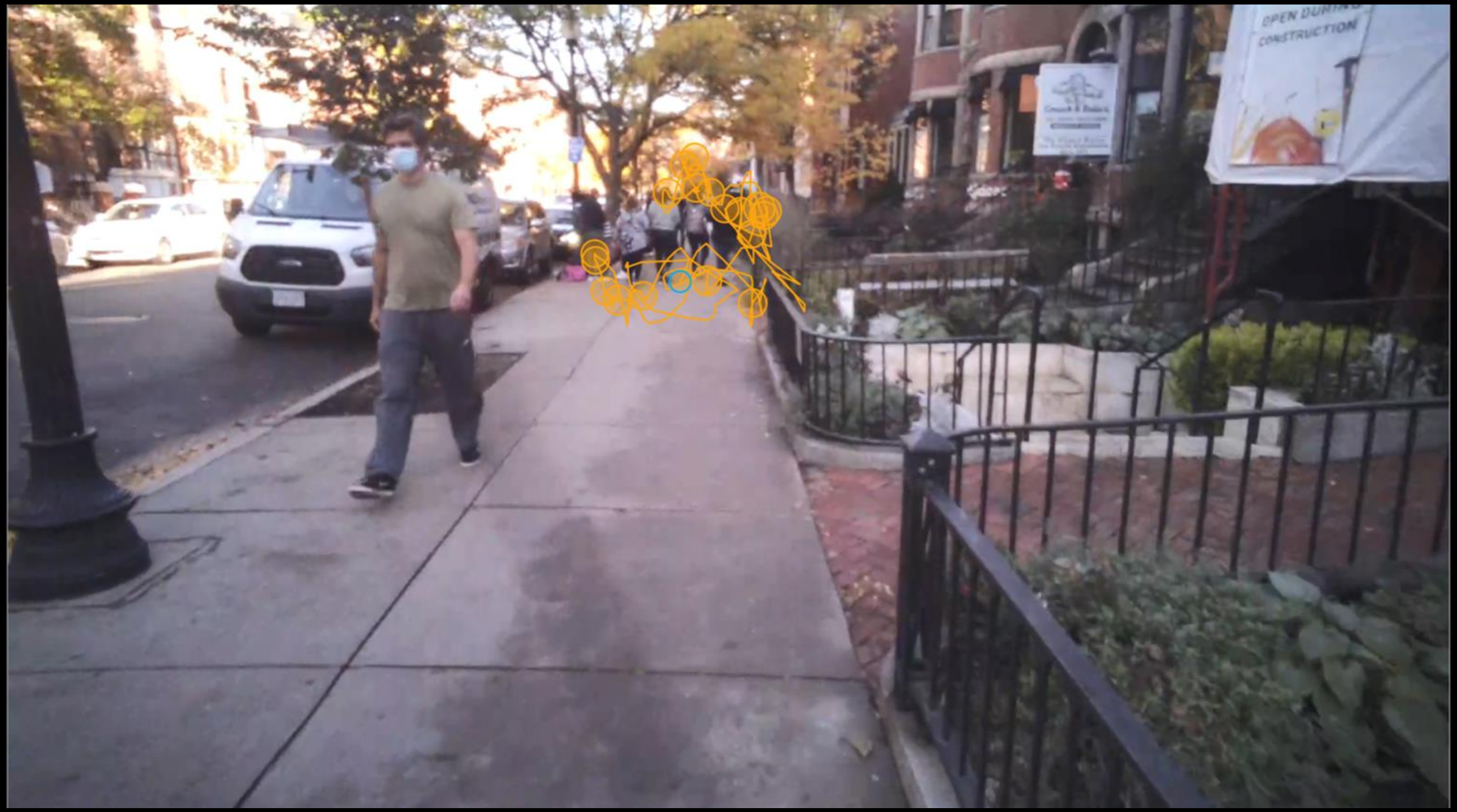
Sensing-Streetscape, Fall 2020 - Boston, MA


01:15
01:20
01:25
01:30
01:35

10-second Gaze Path

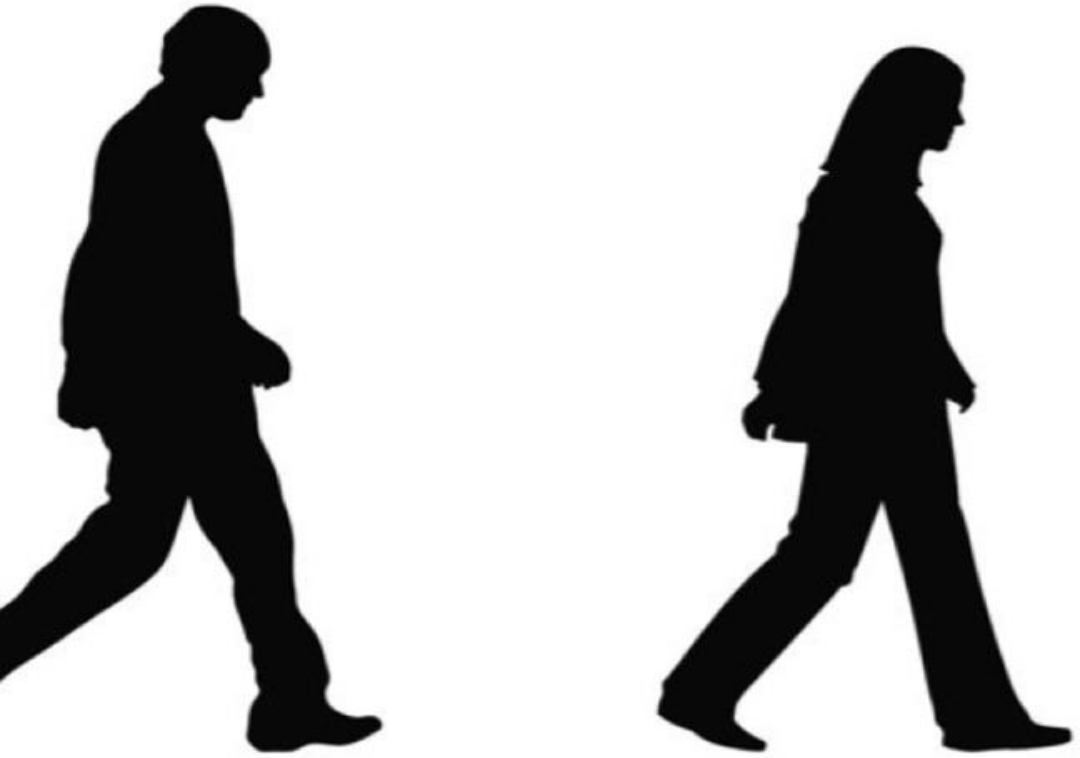
showing subliminal focus on cars and people




OPEN DURING
CONSTRUCTION

To improve human health + well-being, we need to make places walkable.

We evolved to walk upright…



"In the Pleistocene…a woman walked an average of 9 miles a day; a man,12."

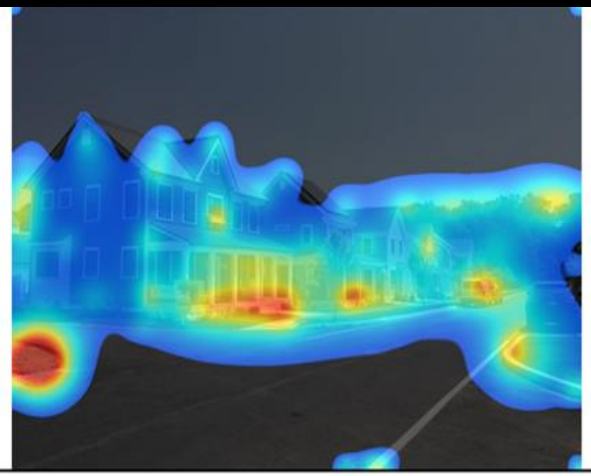
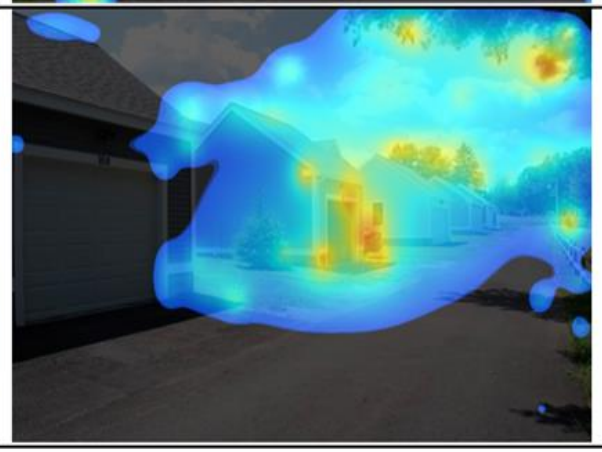
- D. Lieberman, 2013

Our ancient brain architecture sets the parameters for our modern built-architecture…

Intensity Maps

aggregate fixations + saccades, or gaze paths, over time to see how we take in surroundings

Results: Insights around walkability…

IMG_2240(2) 28 Chance St			
DSC_0016(2) 18B Chance St View of Garages			

- Data helps us understand why some areas are easier to walk in than others.
- Predicts ease of walkability.
- How unconscious fixations underlie simple behaviors, like strolling down a street + making the conscious decision to do so.

CNU

PUBLIC SQUARE
A CNU Journal

GOT A MINUTE

Your brain on streets

https://www.cnu.org/publicsquare/2019/08/09/your-brain-streets

ROBERT STEUTEVILLE AUG. 9, 2019

Walking and Design

Consistent edge conditions create interest in public spaces. Features include:

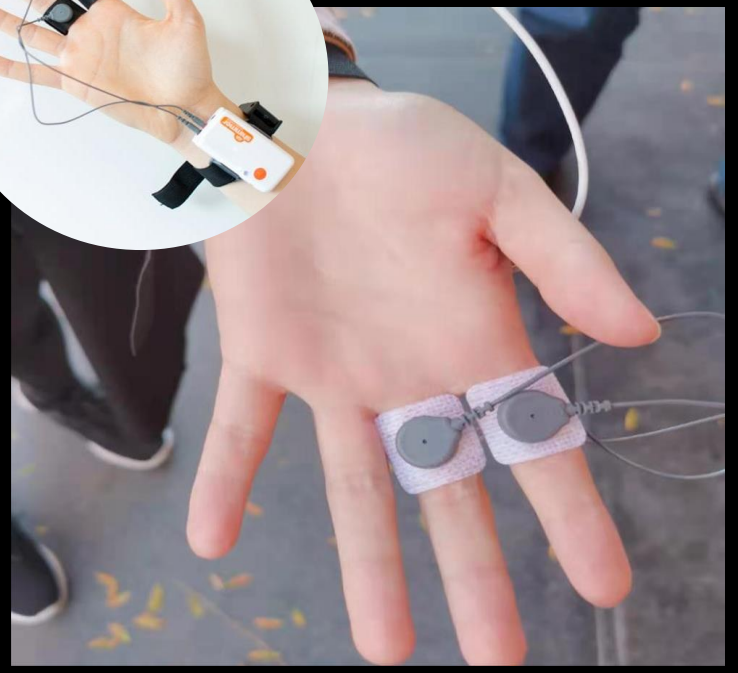
1) Non-blank walls (doors, windows, arches)
2) varied materials (changing every 30’-50’)
3) Overhanging features (awnings)

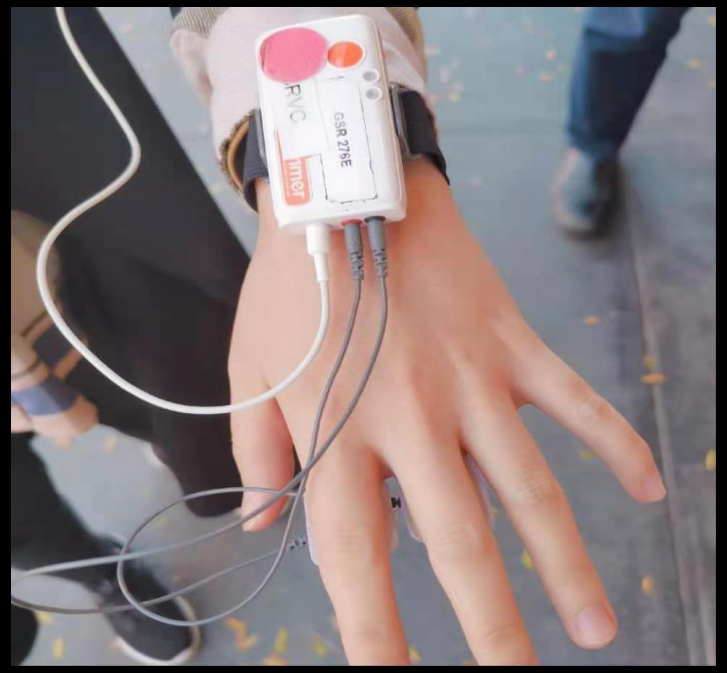
- Promotes social interaction, less anxiety, better mental health
- *If you have to consciously think of where you are walking it contributes to you feeling uncomfortable and discourages walking*

GSR (Galvanic Skin Response)

- tracks nervous system arousal
- helps us understand ‘ unconscious’ responses to visual stimuli

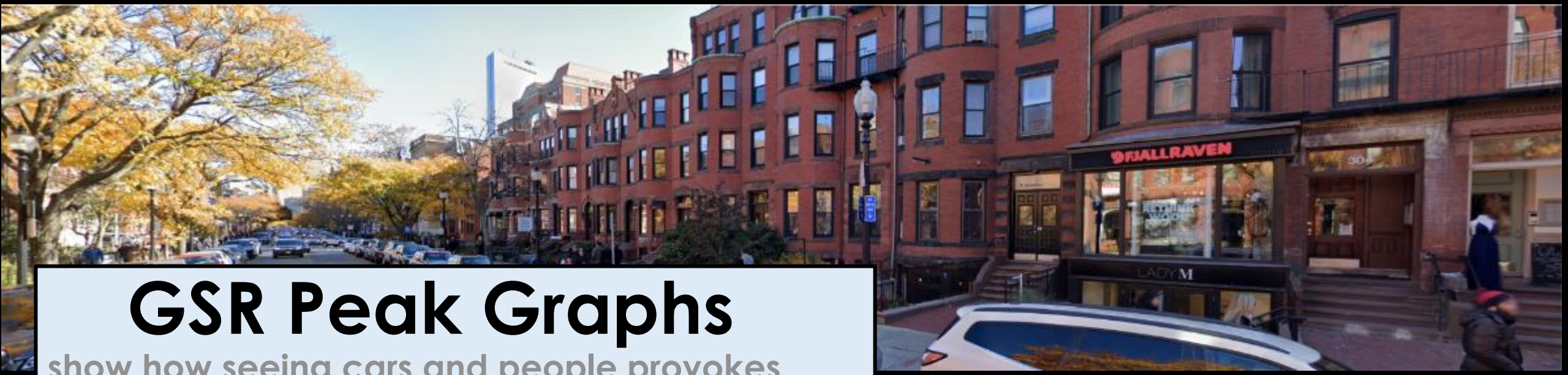
+





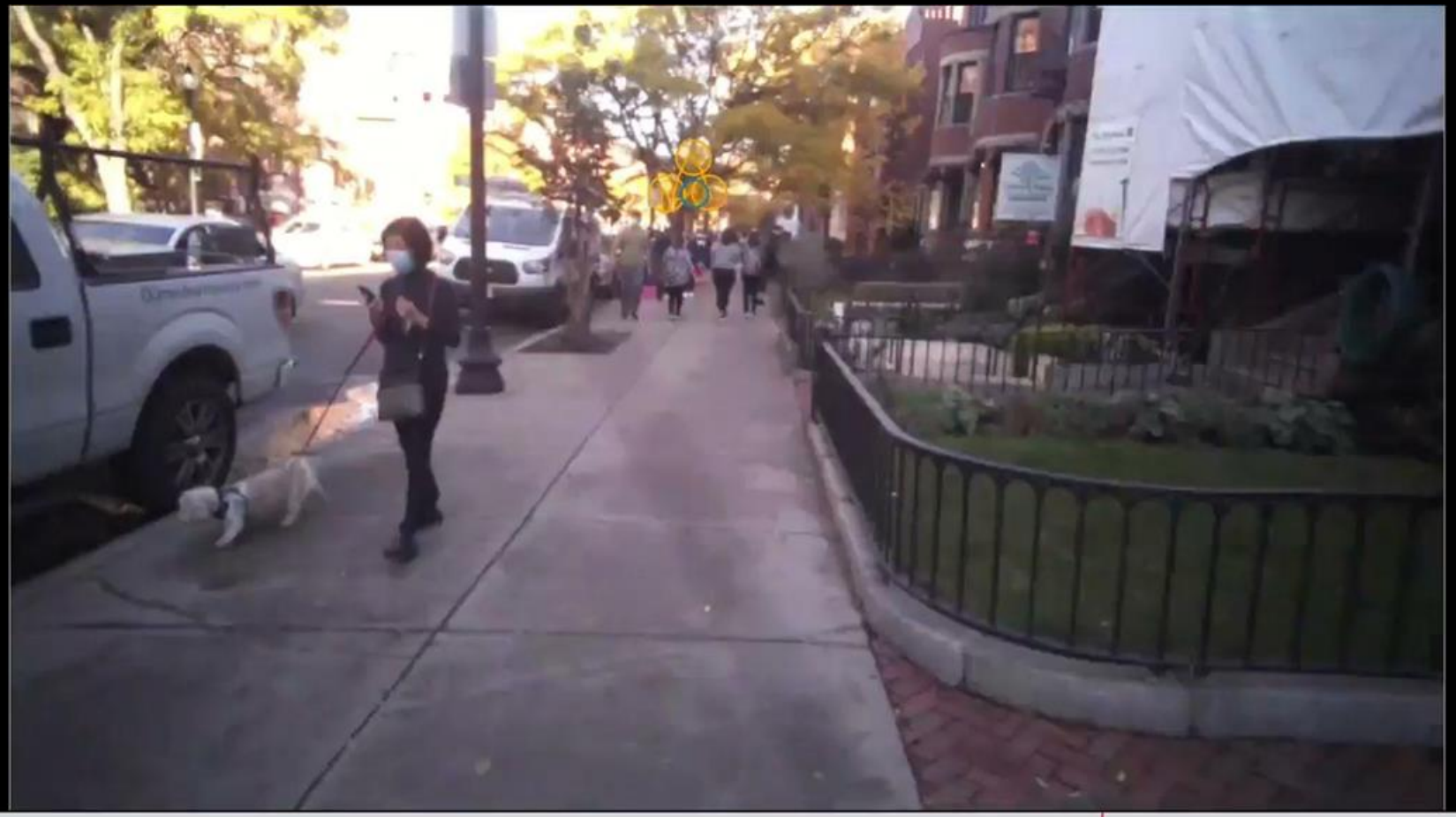
Eye-tracking glasses

GSR



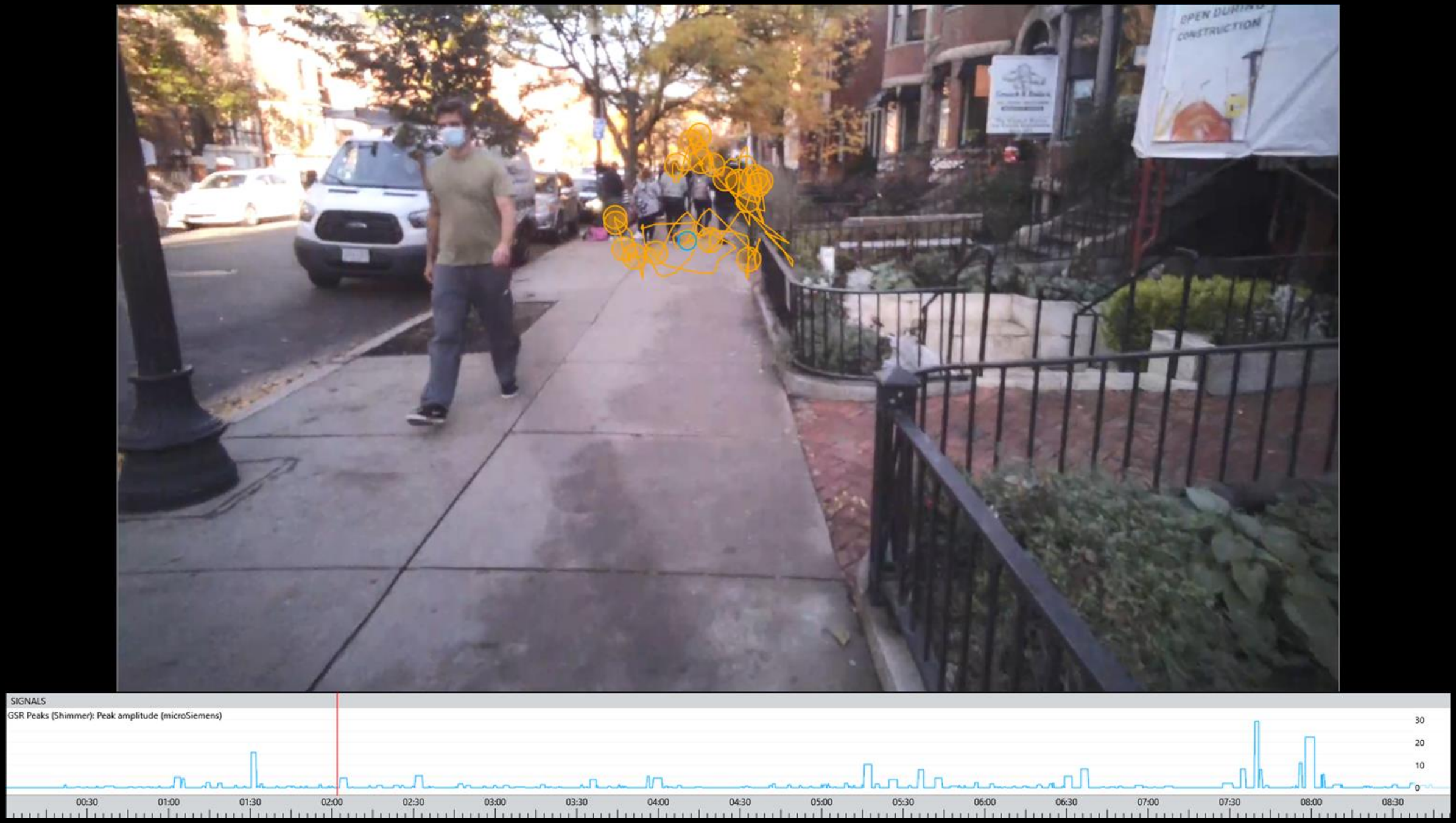
GSR Peak Graphs

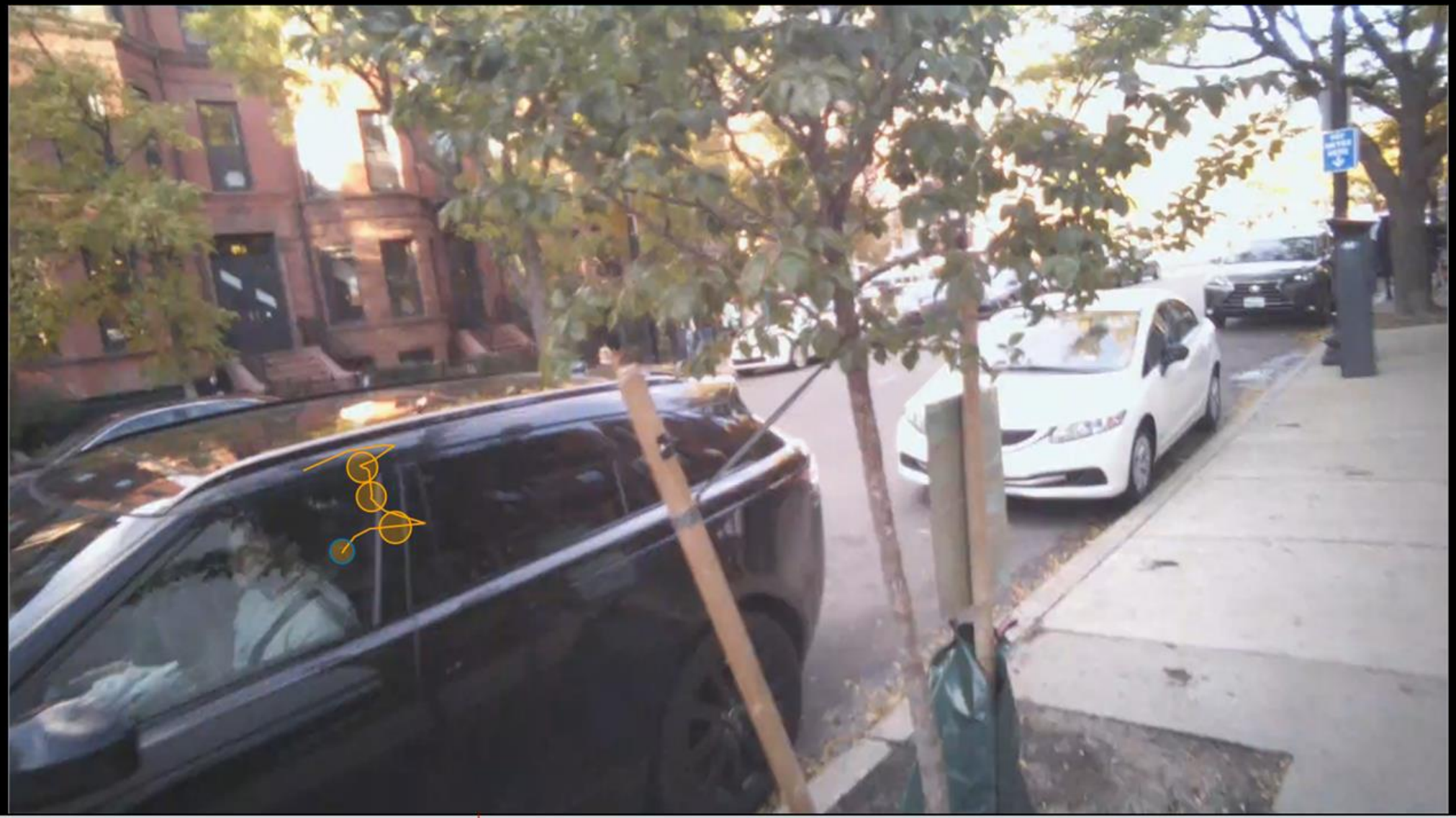
show how seeing cars and people provokes instant emotional arousals

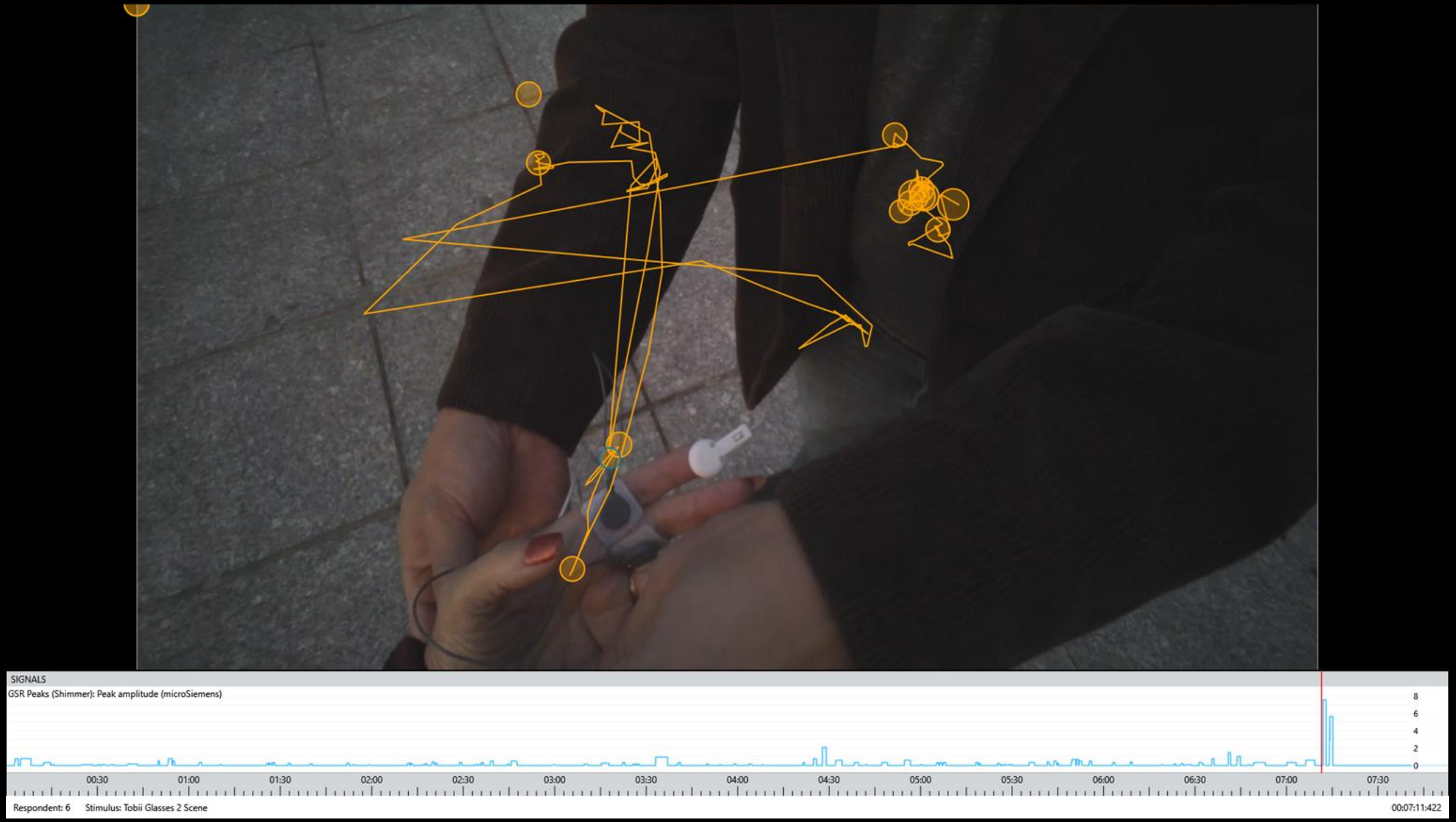


SIGNALS

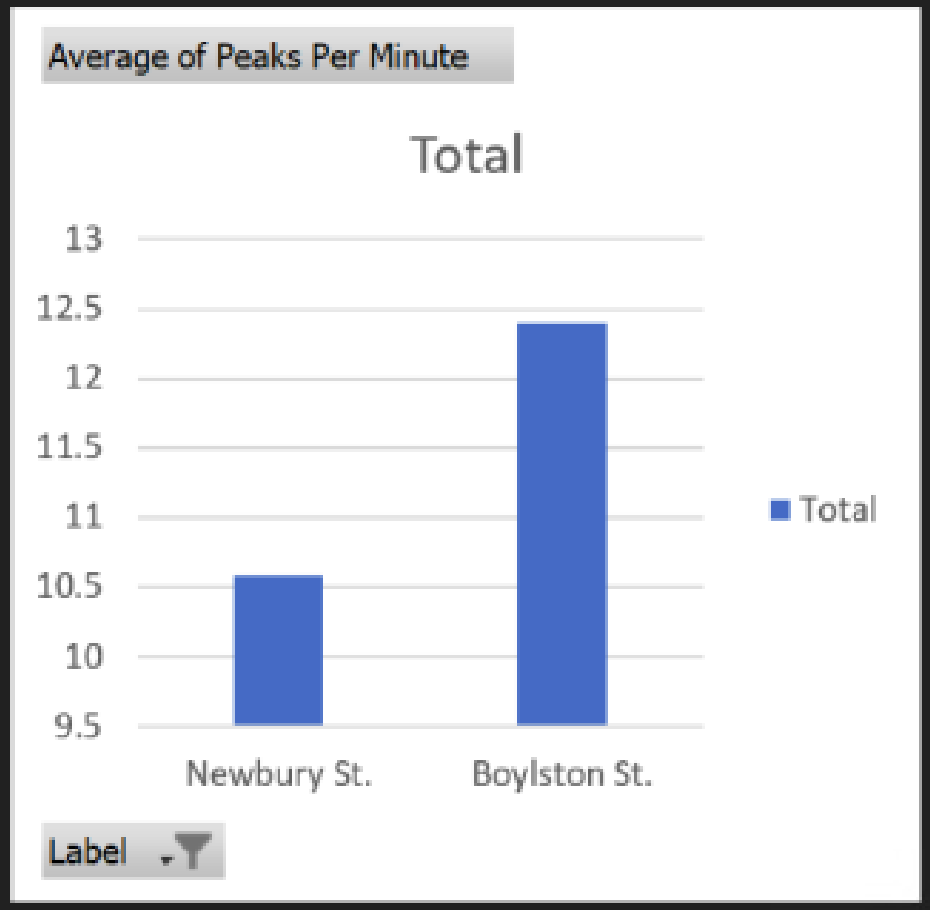
GSR Peaks (Shimmer): Peak amplitude (microSiemens)


SIGNALS
GSR Peaks (Shimmer): Peak amplitude (microSiemens)
30
20
10
0
00:30
01:00
01:30
02:00
02:30
03:00
03:30
04:00
04:30
05:00
05:30
06:00
06:30
07:00
07:30
08:00
08:30


SIGNALS
GSR Peaks (Shimmer): Peak amplitude (microSiemens)
0.6
0.4
0.2
0
00:30
01:00
01:30
02:00
02:30
03:00
03:30
04:00
04:30
05:00
05:30
06:00
06:30
07:00
07:30
08:00
Respondent: 7
Stimulus: Tobii Glasses 2 Scene
00:02:59:160

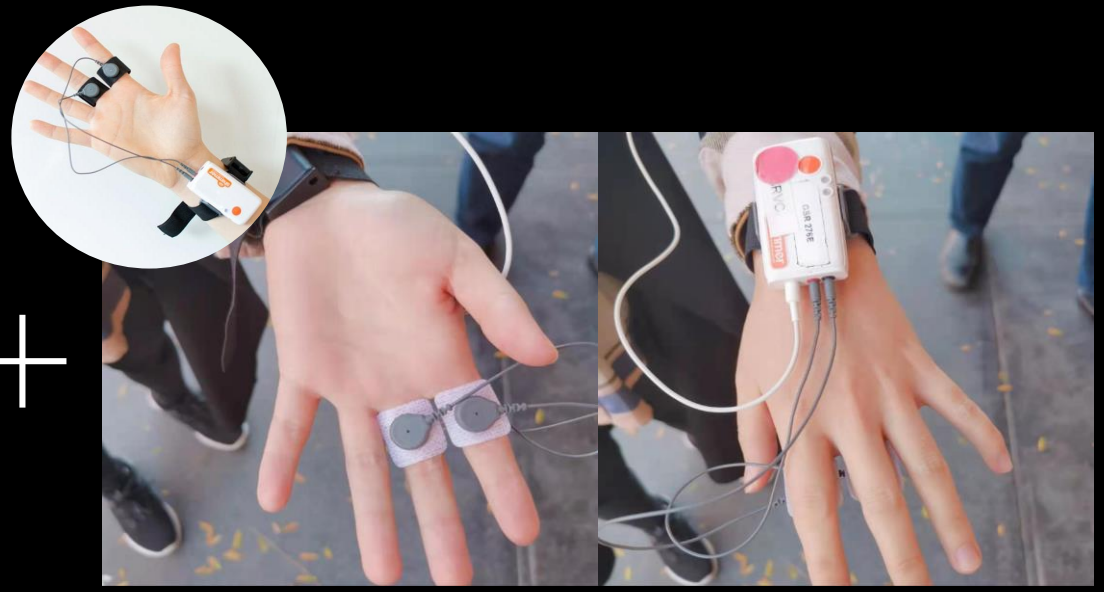

SIGNALS
GSR Peaks (Shimmer): Peak amplitude (microSiemens)
8
6
4
2
0
00:30
01:00
01:30
02:00
02:30
03:00
03:30
04:00
04:30
05:00
05:30
06:00
06:30
07:00
07:30
Respondent: 6
Stimulus: Tobii Glasses 2 Scene
00:07:11:422

GSR Peaks for Newbury vs Boylston Street



Eye-tracking glasses

+



GSR

+

Pre- & Post-Surveys

Name #1

Sensing Streetscapes – Boston

Questionnaire #2_1

1) Rate your mood on Newbury Street:

2) Rate your mood on Boylston Street:

3) Newbury Street appears to me:

1 ..... 2 ..... 3 ..... 4 ..... 5 ..... 6 ..... 7 ..... (8) 9

unpleasant ..... ⇨ pleasant

4) Boylston Street appears to me:

1 ..... 2 ..... 3 ..... 4 ..... (5) ..... 6 ..... 7 ..... 8 9

unpleasant ..... ⇨ pleasant

#1

Sensing Streetscapes – Boston

Questionnaire #2_2

5) Newbury Street arouses me:

1 ..... 2 ..... 3 ..... 4 ..... 5 ..... 6 ..... (7) 8 9

a little ..... ⇨ much

6) Boylston Street arouses me:

1 ..... 2 ..... 3 ..... 4 ..... (5) ..... 6 ..... 7 ..... 8 9

a little ..... ⇨ much

7) What street did you enjoy the most?

- [x] Newbury Street
- [ ] Boylston Street

8) Did you find the eye-tracking glasses comfortable?

- [x] Yes
- [ ] No

9) Anything else you would like us to know about the Sensing-Streetscape Experience?

With there was more activity on Newbury Street, with fewer buildings boarded up.

Biometrics: Implications for Planning

- Biometrics tools give insight into which elements capture attention and stimulate us:
  - Changing the way we think about planning spaces and places
- New tools for assessing + improving walkability and wayfinding (not just signs!)
- Reinforcing the importance of some existing planning concepts (form vs. function).

Form-Based Codes:

Plan Policy Statement: *Infill and develop in existing urbanized areas. Build affordable, multi-family housing near transportation and retail corridors:*

Form-Based Codes:

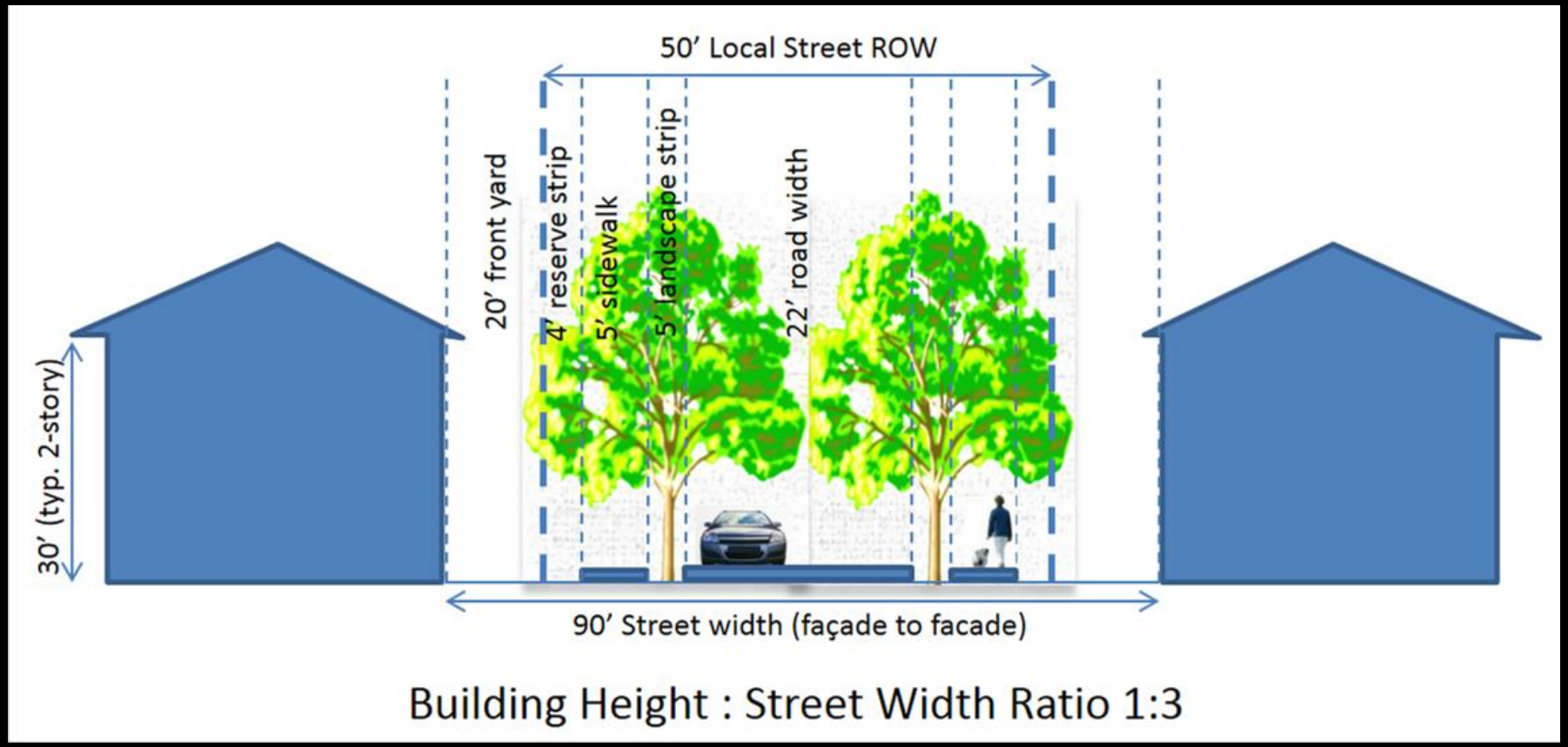
Same Policy Statement: *Infill and develop in existing urbanized areas. Build affordable, multi-family housing near transportation and retail corridors:*

- This design prioritizes people, while the other prioritizes the car.
- FBC’s help avoid this ambiguity and create spaces with more positive stimuli (fixations/walkability)

Tools for Planning

- DEC IRD and LEED ND - regulations focusing on built form:

NPD Walkable Streets Prerequisites and Credits:



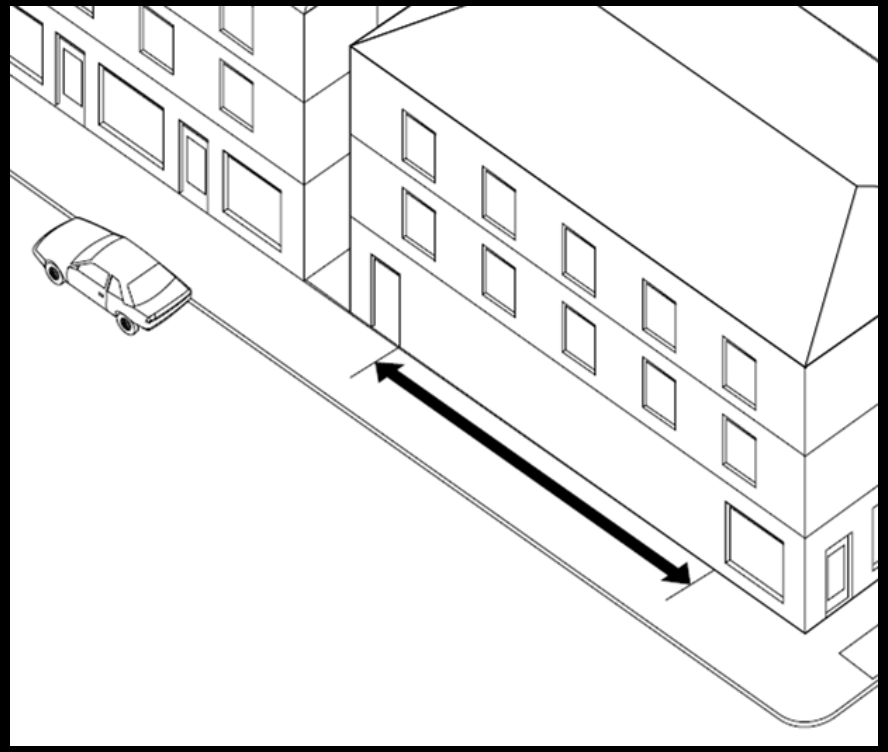
Build-To Zones instead of setbacks - framing the street and creating that edge environment that draws unconscious attention.

Tools for Planning

- NPD Walkable Streets Prerequisites and Credits:

  Avoid blank facades:

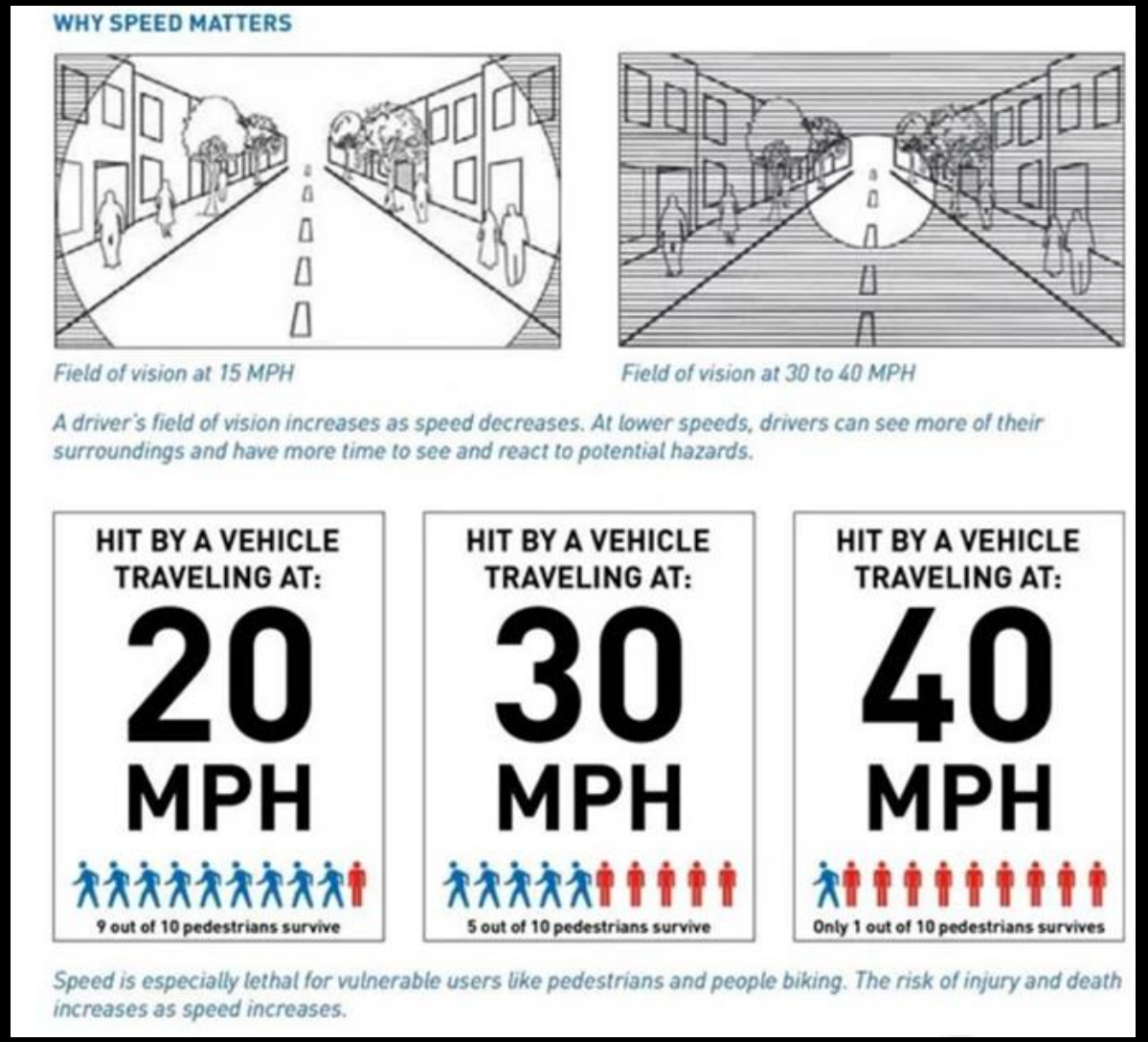
  Reduce driveway/garage door crossings:

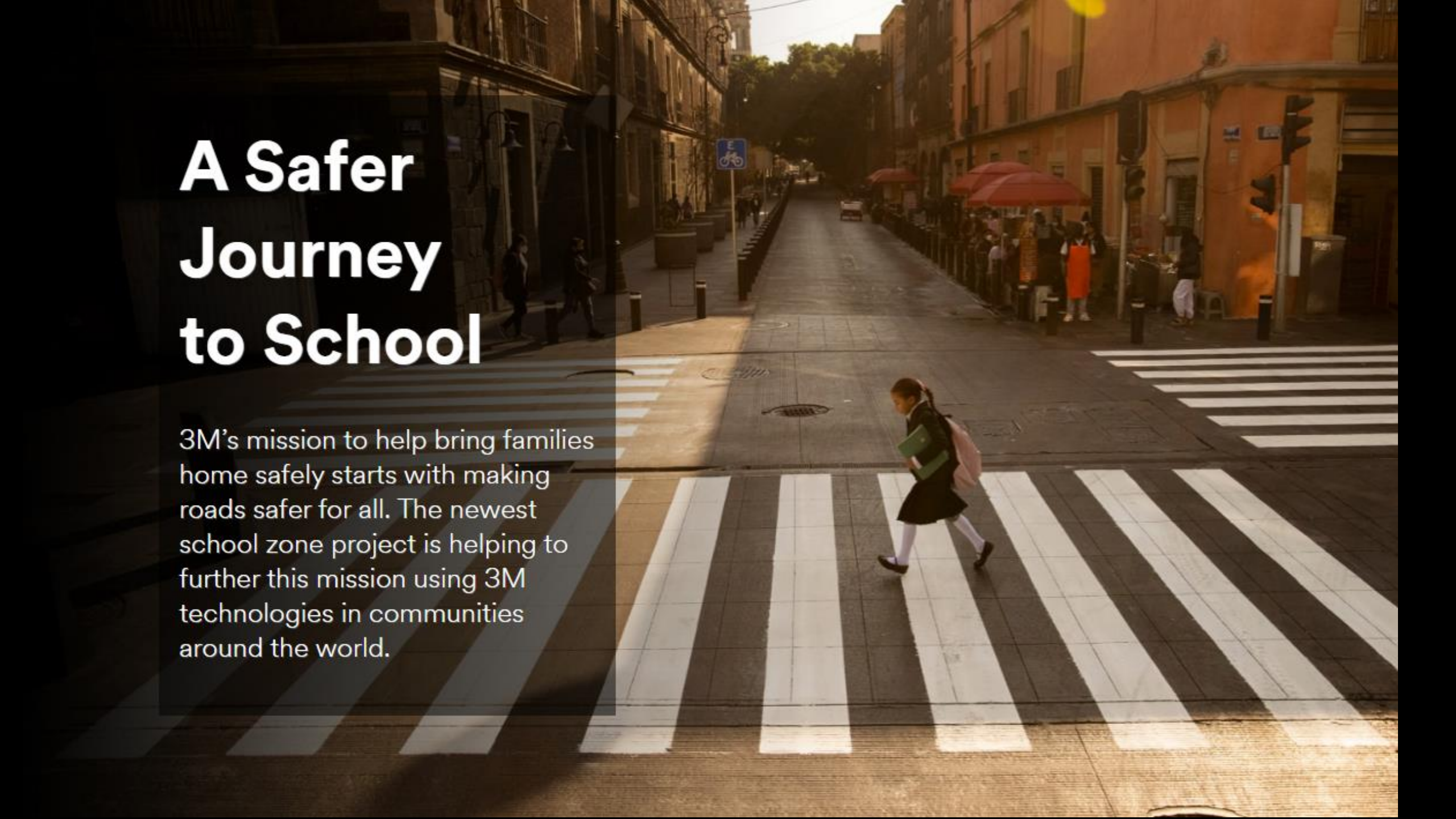


  - providing unobstructed fixations to invite safe exploration and walkability

Context Sensitive Design:

- Complete Streets concepts
- More socially engaging;
- Visually stimulating/less stress;
- Safer streets (for people and drivers!)!
- Encourages walking - promoting public health





A Safer Journey to School

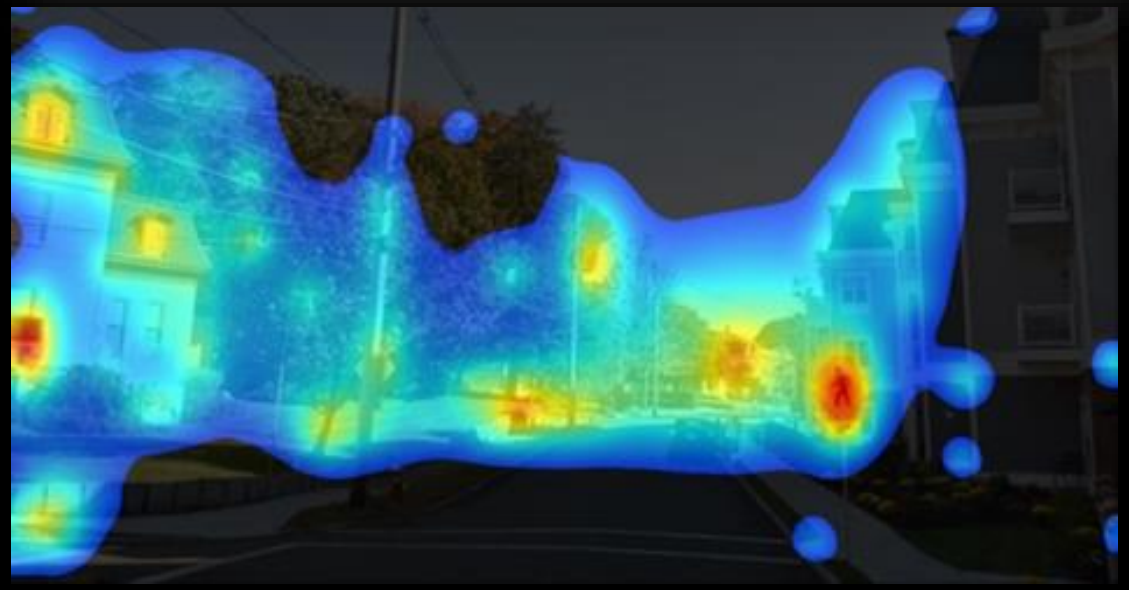
3M's mission to help bring families home safely starts with making roads safer for all. The newest school zone project is helping to further this mission using 3M technologies in communities around the world.

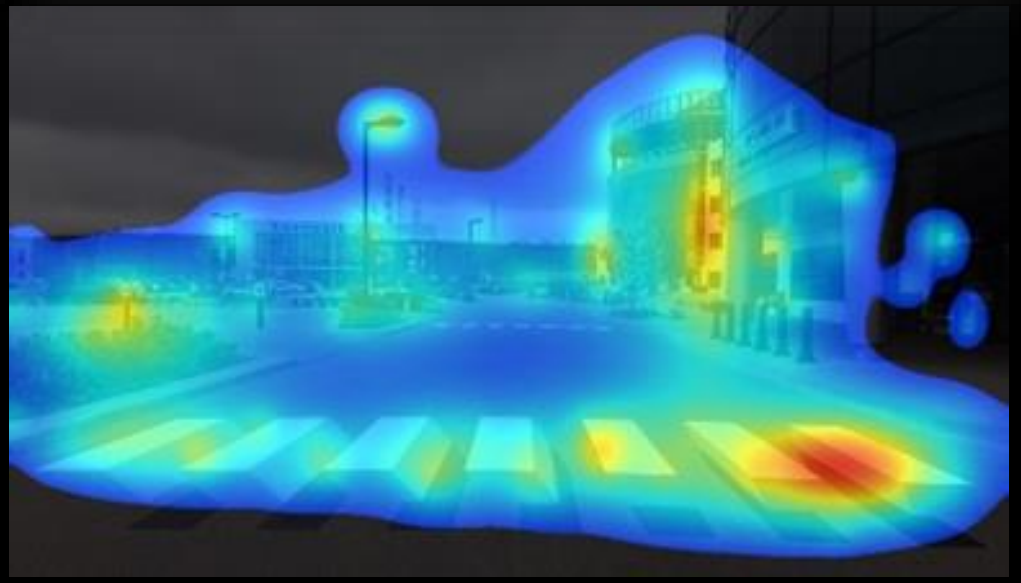
School Zone Safety

https://bit.ly/3Mschoolzone


Wakefield, MA

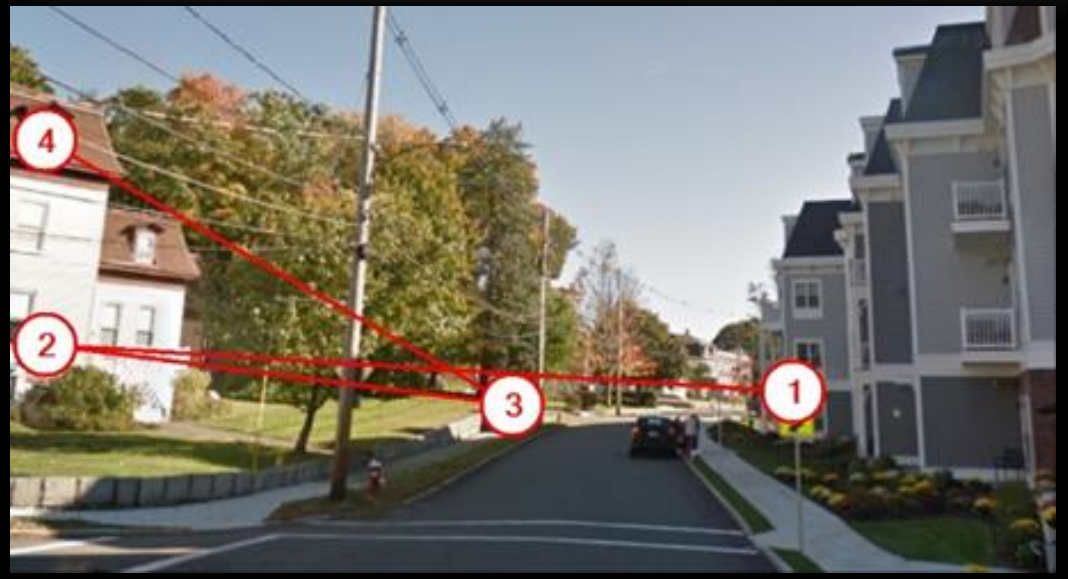

Waterloo, Ont.

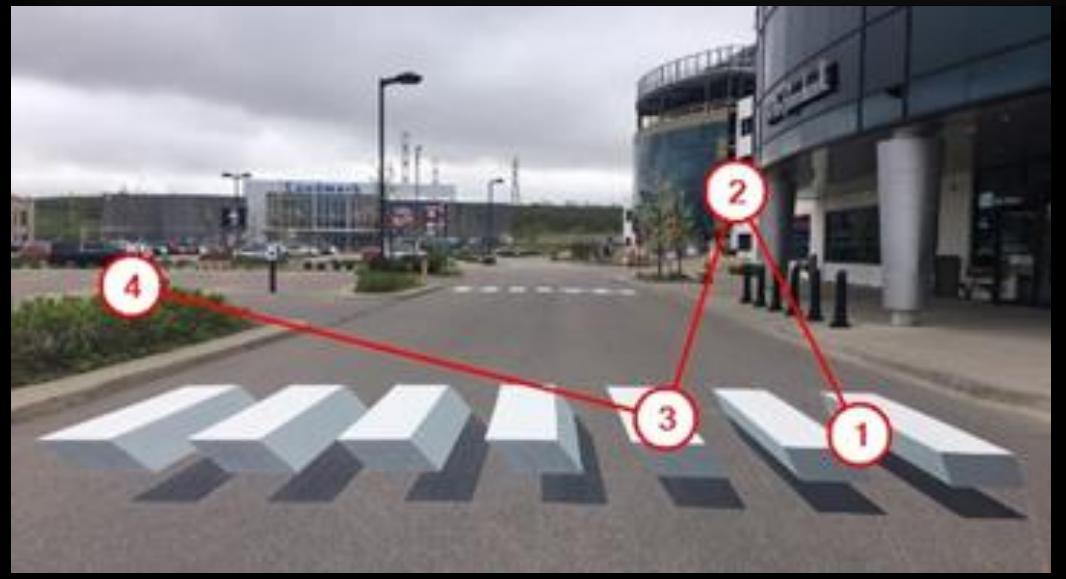





Wakefield, MA


Waterloo, Ont.


4
2
3
1

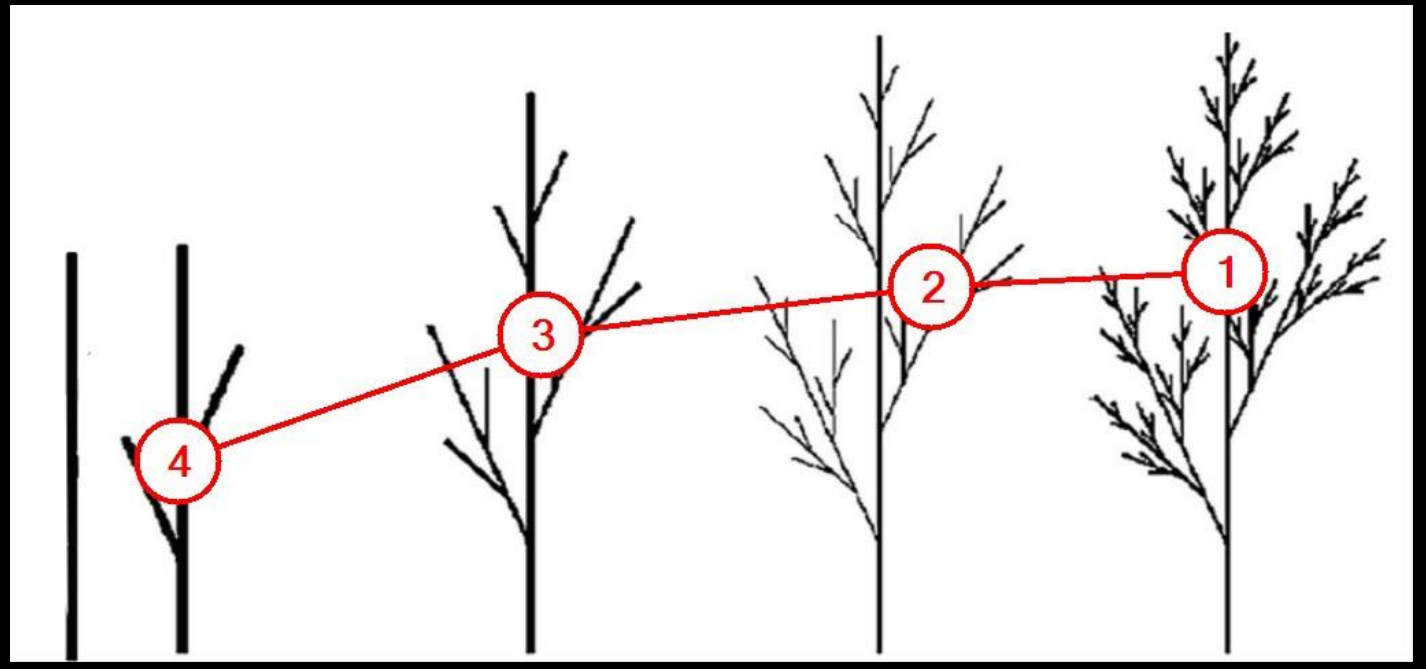

2
4
3
1

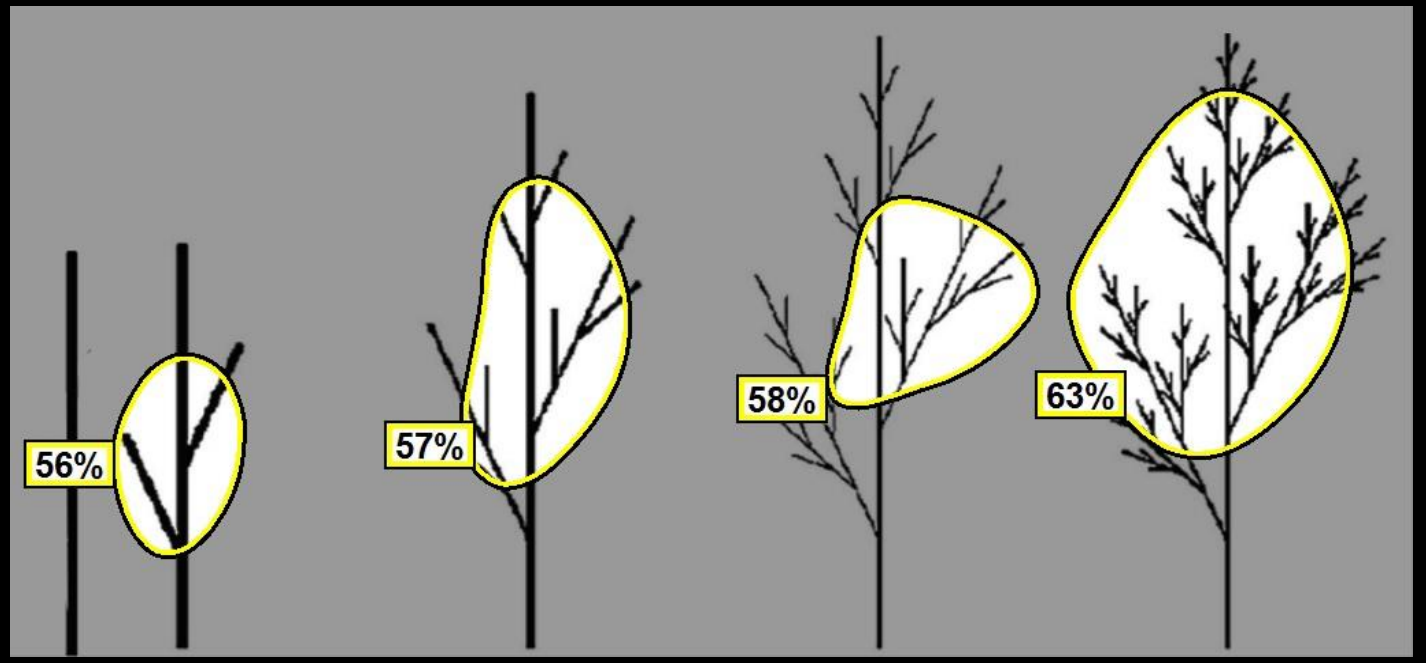
Biophilic Design:

- **Reinforces our evolutionary biology**
- **Design with nature (NBS) &GI**

Biophilic Design/Biomimicry: design with nature

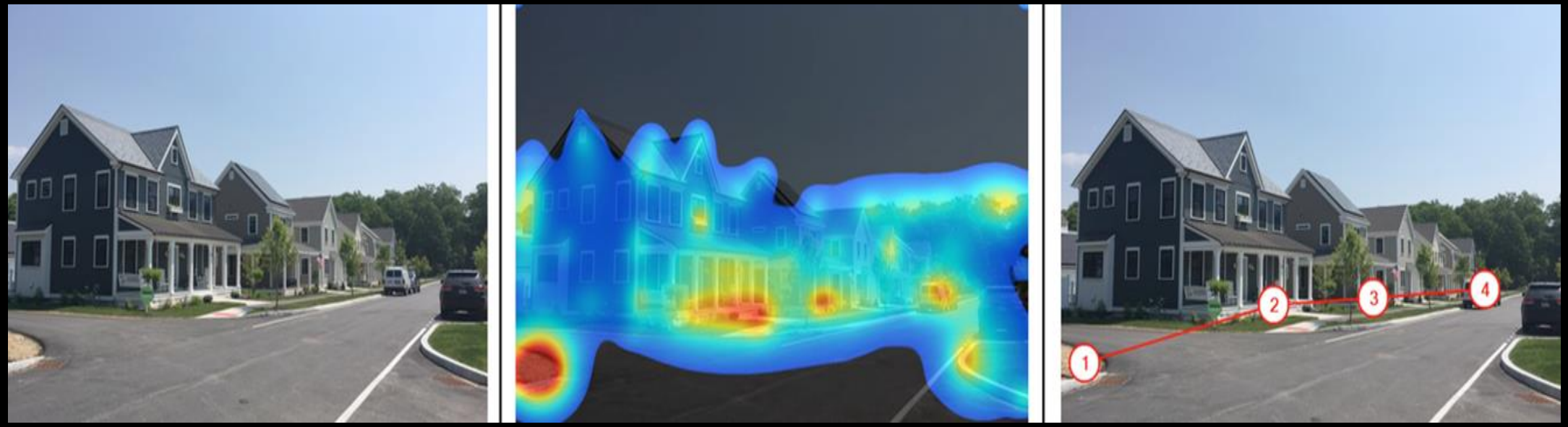
- Unconscious attraction to fractal patterns
- Reinforcing human connection to nature
- Edge species
- ILFI Living Building and Living Community Challenge





3M VAS study by Nallely Salazar, BAC

Biometrics: Implications for Planning



- Helping us uncover unconscious and conscious responses to our built env.
- Possible new standards? (LOH instead of LOS)
- Metrics for assessing + creating a sense of place (POD)
- Prioritizing emotion and human feelings (mental health)
- Improving public health & wellness through more informed planning & design

Conclusions:

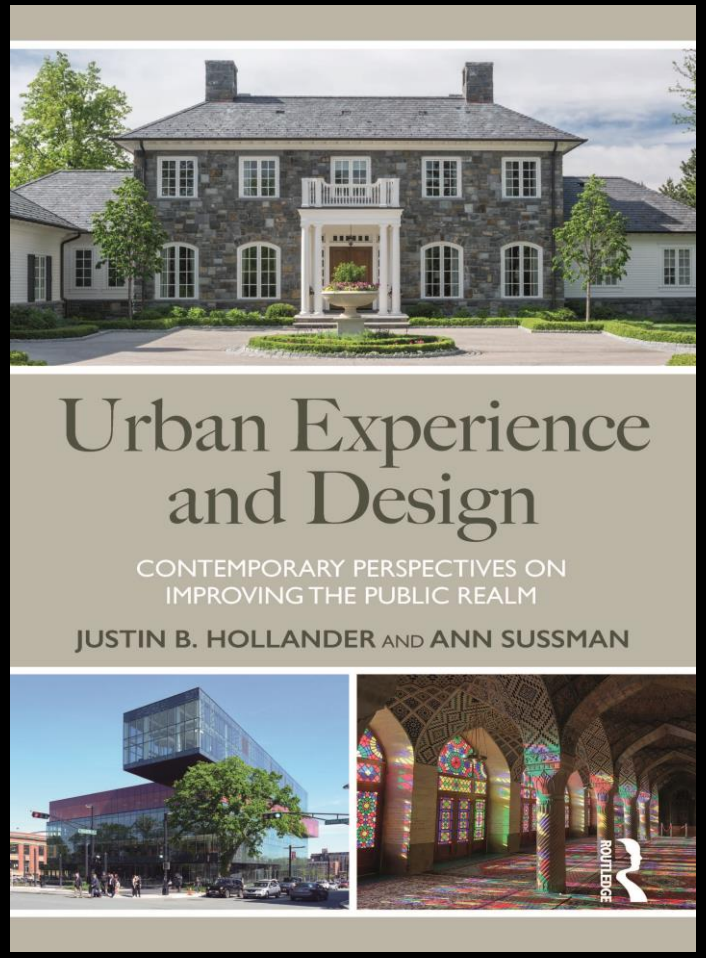
- External environments instantly impact us internally
- Different environments impact us differently (emotionally, physically, mentally)
- Biometric tools like ET+GSR allow us to see how this happens in fractions of a sec.
- Better understand how our experience of the built environment influences how we feel and overall behavior, what we think and do in different places.

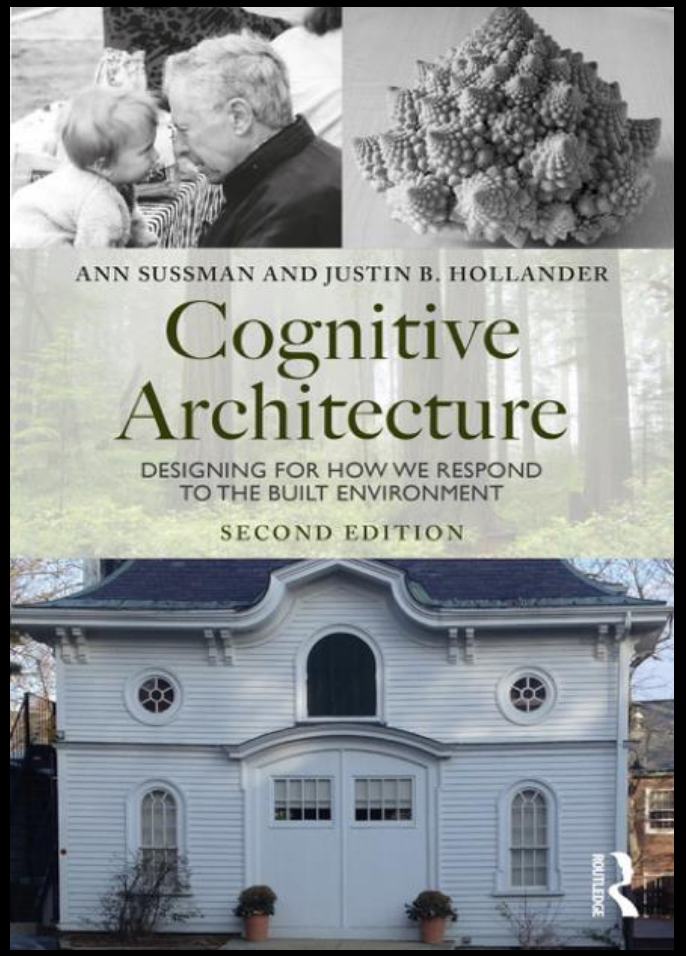
Perception is REALITY; with Biometrics you get a window into another reality: our biological one.

…"When you know the mechanism, you can use that understanding in countless ways to drastically improve the human condition. That is how you spark a revolution. You shift the frame, you change the lens, and all at once the world is revealed, and nothing is the same."

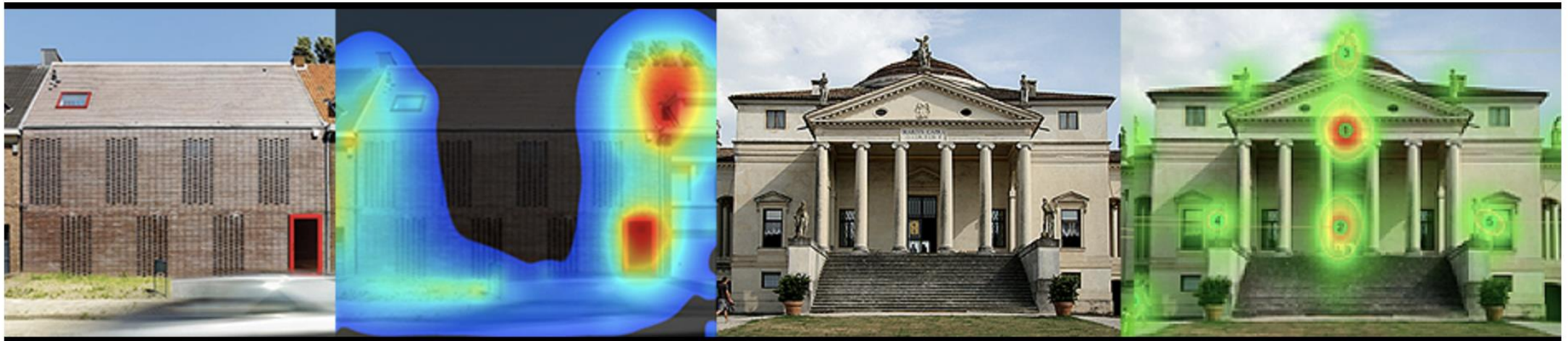
The Deepest Well, (2018) - Nadine Burke Harris, MD

Additional Information/Resources:





https://devensec.com/sustain.html



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https://bit.ly/geneticsofdesign

THANK YOU!

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