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Urban Mind

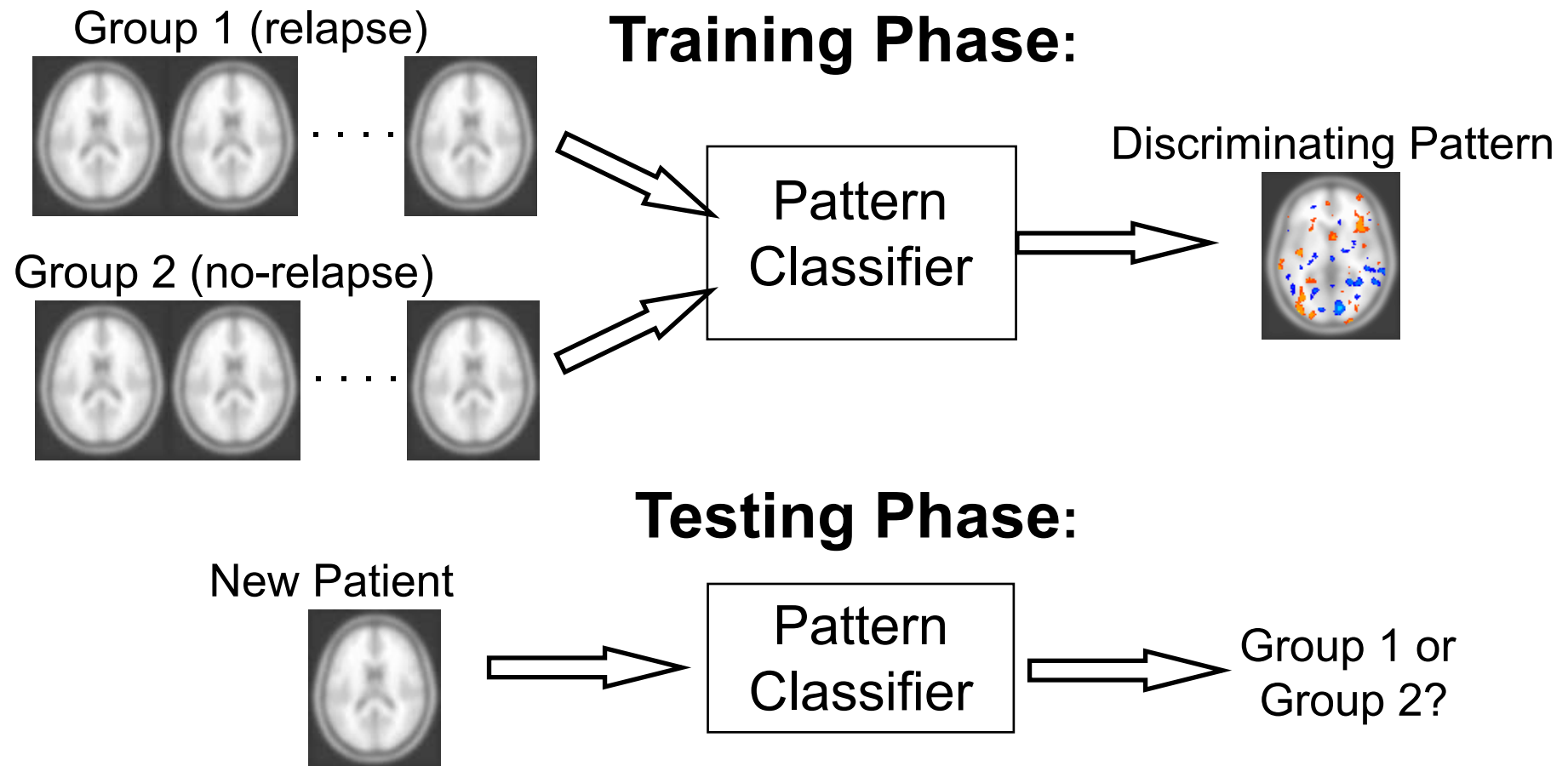
Urban Mind: Using Smartphone Technologies to Investigate the Impact of the Urban Environment on Mental Health in Real Time

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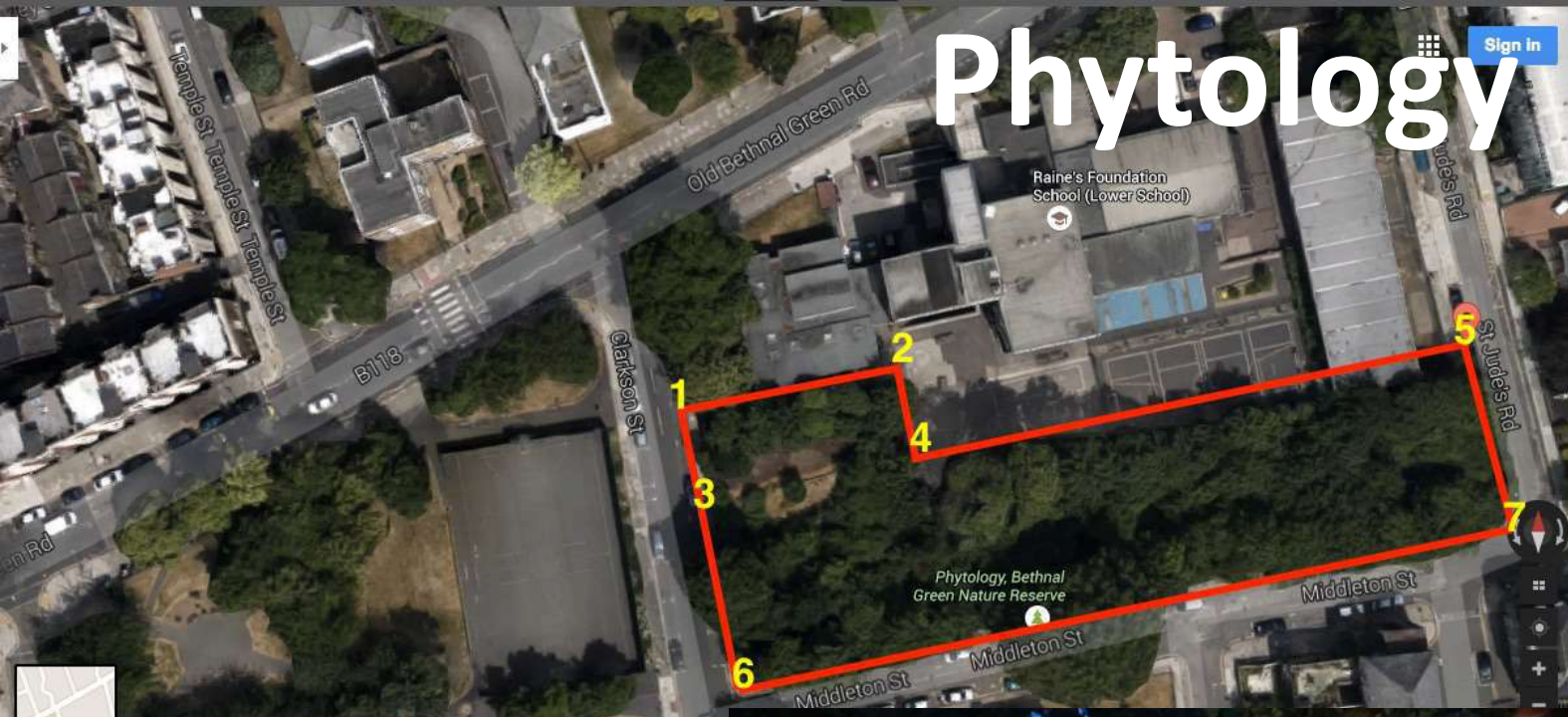


Using machine learning to optimise treatment in individual patients



Vision Quest: a Ritual for Elephant & Castle







- In 2014, 50% of the global population resided in urban areas.
- 66% of people will live in cities by 2050

LETTER

doi:10.1038/nature10190

City living and urban upbringing affect neural social stress processing in humans

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More than half of the world's population now lives in cities, making the creation of a healthy urban environment a major policy priority¹. Cities have both health risks and benefits¹, but mental health is negatively affected: mood and anxiety disorders are more prevalent in city dwellers² and the incidence of schizophrenia is strongly increased in people born and raised in cities^{3–4}. Although these findings have been widely attributed to the urban social environment^{2,3,7,8}, the neural processes that could mediate such associations are unknown. Here we show, using functional magnetic resonance imaging in three independent experiments, that urban upbringing and city living have dissociable impacts on social evaluative stress processing in humans. Current city living was associated with increased amygdala activity, whereas urban upbringing affected the perigenual anterior cingulate cortex, a key region for regulation of amygdala activity, negative affect⁹ and stress¹⁰. These findings were regionally and behaviourally specific, as no other brain structures were affected and no urbanicity effect was seen during control experiments invoking cognitive processing without stress. Our results identify distinct neural mechanisms for an established environmental risk factor, link the urban environment for the first time to social stress processing, suggest that brain regions differ in vulnerability to this risk factor across the lifespan, and indicate that experimental interrogation of epidemiological associations is a promising strategy in social neuroscience.

Urbanization, a process that started in North America and Western Europe but is now mainly occurring in developing nations, is a major socio-ecological change confronting mankind. By 2050, 69% of humans will live in urban areas¹. Although city dwellers, on average, are wealthier and receive improved sanitation, nutrition, contraception and health

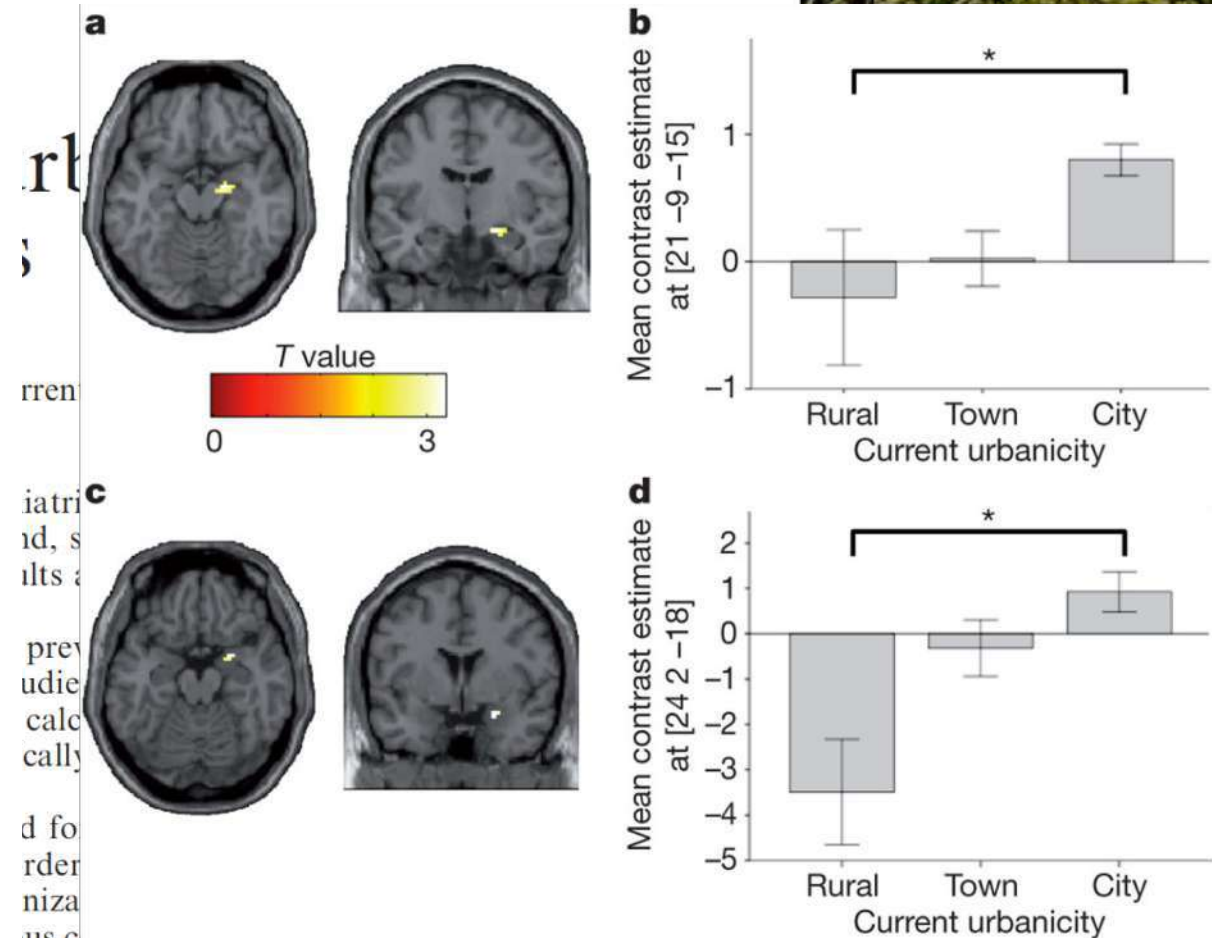
including social defeat and chronic social stress, might constitute such a factor⁹. Consequently, many authors have proposed that social stress processing in the urban environment underlies the greater risk for mental illness^{2,3,7,8}, and contributes to the manifestation of these disorders in adults. To test experimentally the hypothesis that urban living and upbringing modulate neural processing of acute social evaluative stress, we studied the neural responses of healthy German volunteers undergoing such stress during functional magnetic resonance imaging (fMRI). We confirmed our findings in a second study using a different social stress paradigm and then tested for cognitive specificity by ascertaining the effect of urbanicity on brain activation during cognitive processing without stress. Importantly, our subjects did not have a mental disorder nor were they at high risk for one; the link to these illnesses from the environmental risk factor that we studied is established by the epidemiological evidence discussed earlier.

In our first (discovery) study, we used the Montreal Imaging Stress Task (MIST)¹⁴, a social stress paradigm where participants solve arithmetic tasks under time pressure. Difficulty was varied adaptively to keep success rates—visually presented on a 'performance scale'—at between 25–40%. Study investigators provided further negative feedback after each test segment through headphones. Subjective stress levels were measured before and after the session using a visual analogue scale, and effects of the MIST on salivary cortisol, heart rate and blood pressure were recorded repeatedly. Urbanicity was quantified as follows⁴: city with more than 100,000 inhabitants (3); town with more than 10,000 inhabitants (2); and rural area (1). For urban upbringing, these numbers were multiplied by the number of years living in the area up to age fifteen and added. Thirty-two participants with rural as well as urban upbringing and habitation entered the final analysis (Sup-

CONCLUSION


of mental health services.

Urbanization may be taken into account in the allocation



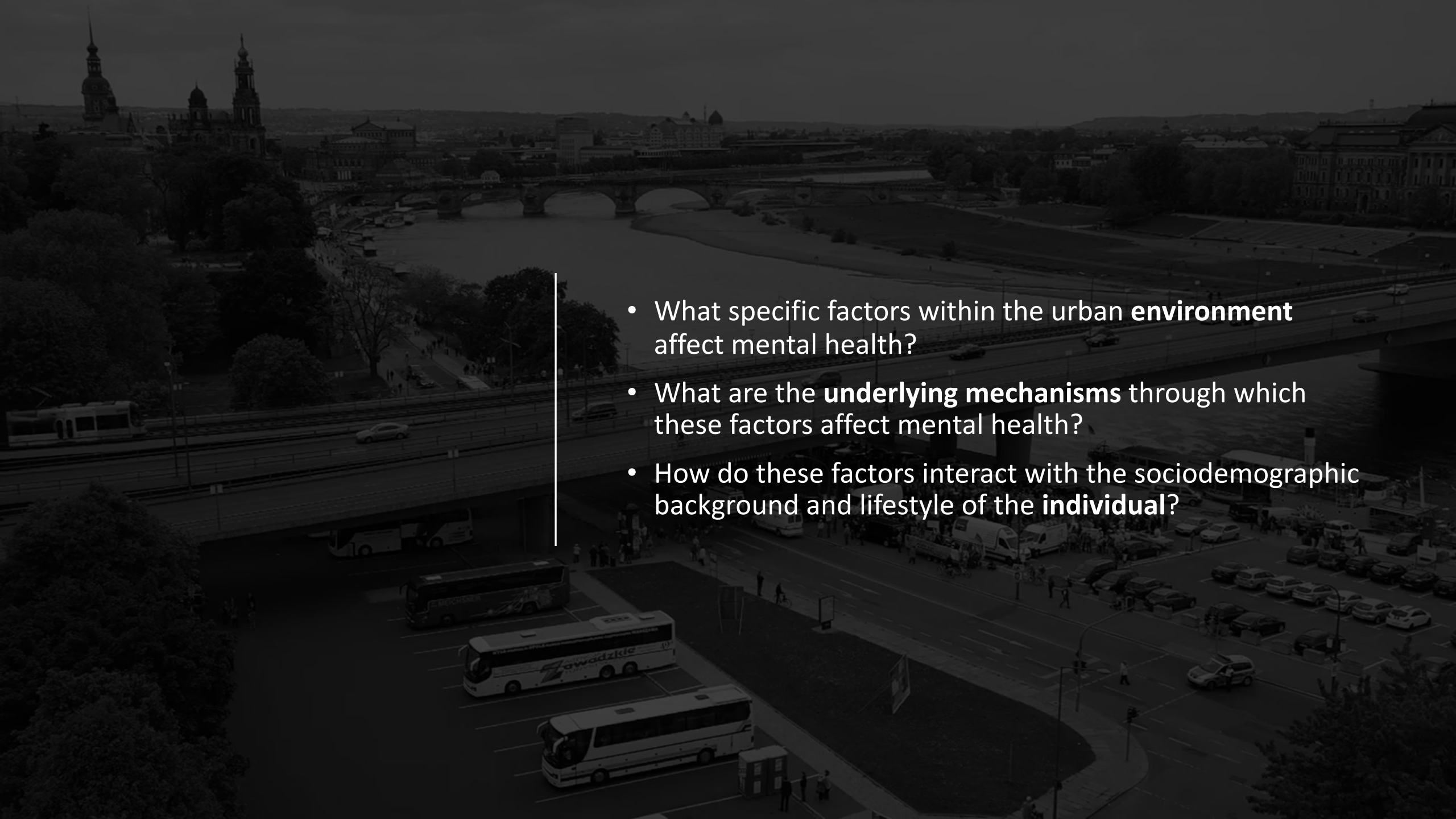
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Tendency to view
...but cities may also have
urbanisation as a mental
beneficial factors
health challenge...

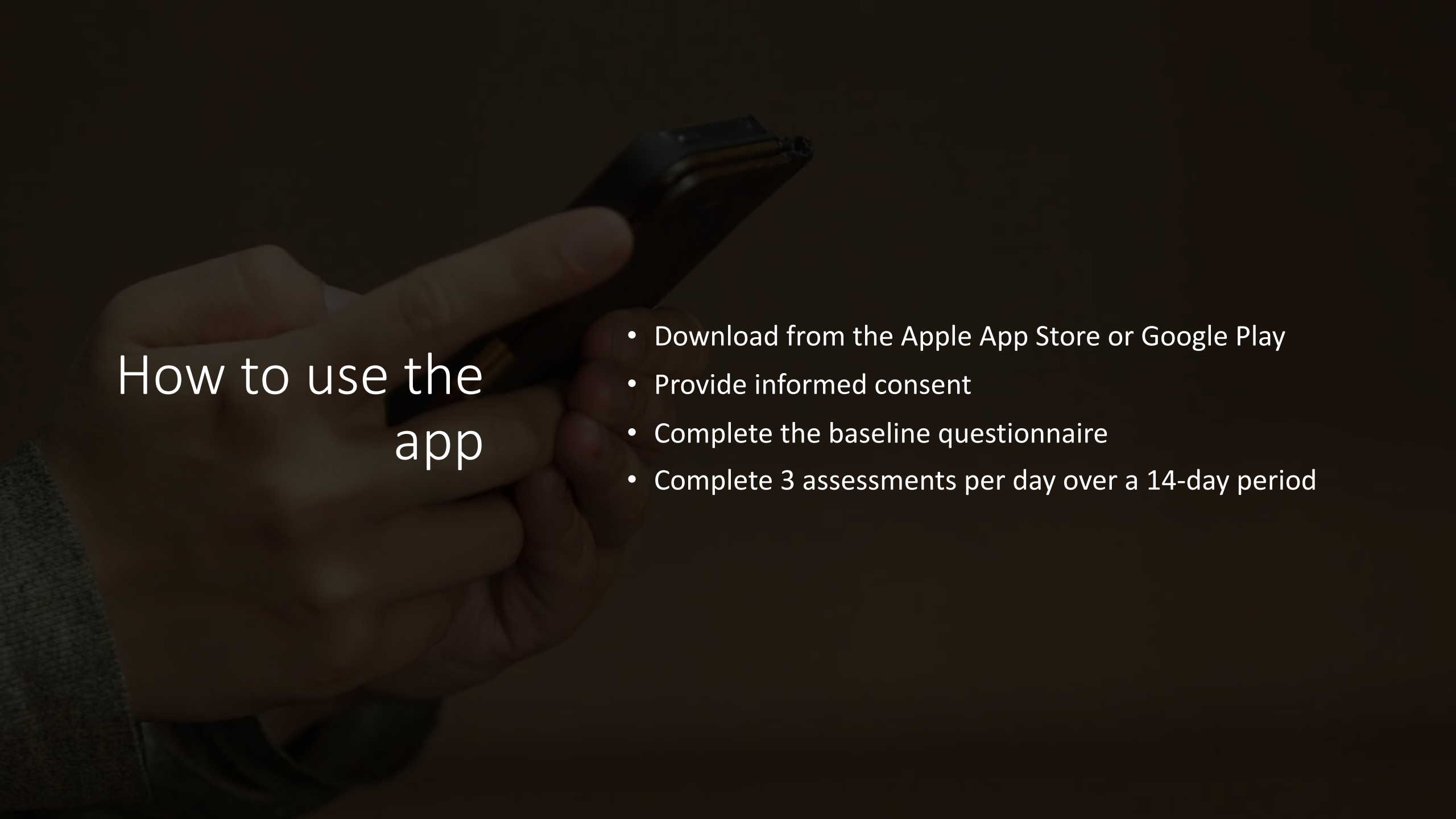


- 
- What specific factors within the urban **environment** affect mental health?
 - What are the **underlying mechanisms** through which these factors affect mental health?
 - How do these factors interact with the sociodemographic background and lifestyle of the **individual**?

Using smartphone technologies: The Urban Mind app

- Addresses the issues of previous environmental research
- 2.1 billion smartphone users in 2016
- Flexible and accessible research tool



A hand holding a smartphone against a dark background. The phone is held in a way that the screen is facing towards the right. The background is dark and slightly textured.

How to use the app

- Download from the Apple App Store or Google Play
- Provide informed consent
- Complete the baseline questionnaire
- Complete 3 assessments per day over a 14-day period



Ecological Momentary Assessment (EMA)

- Sensory
- Nature
- Safety
- Social inclusivity
- Planning inclusivity
- Deprivation
- Mental wellbeing





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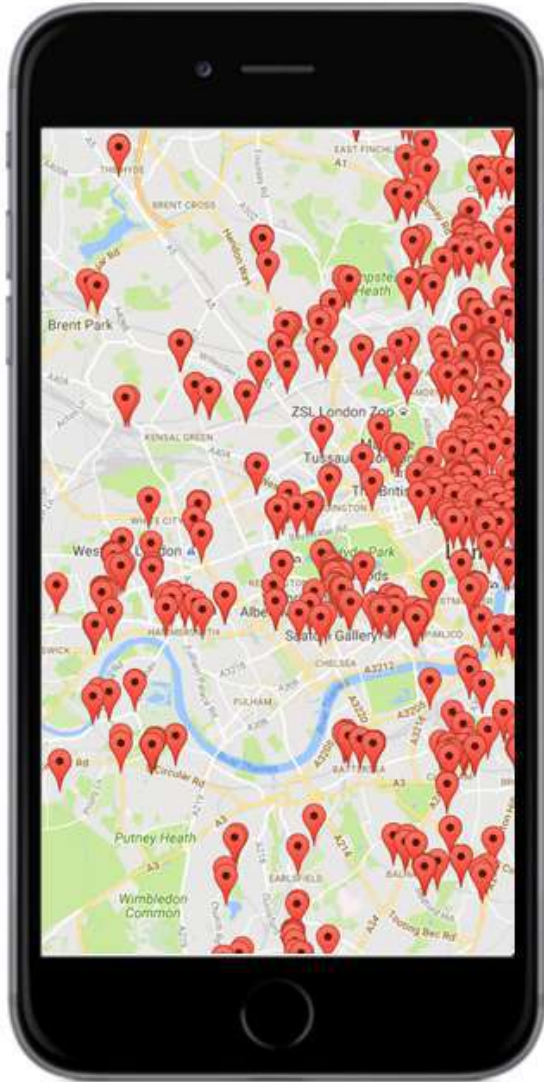




Photograph

- Photograph of the ground

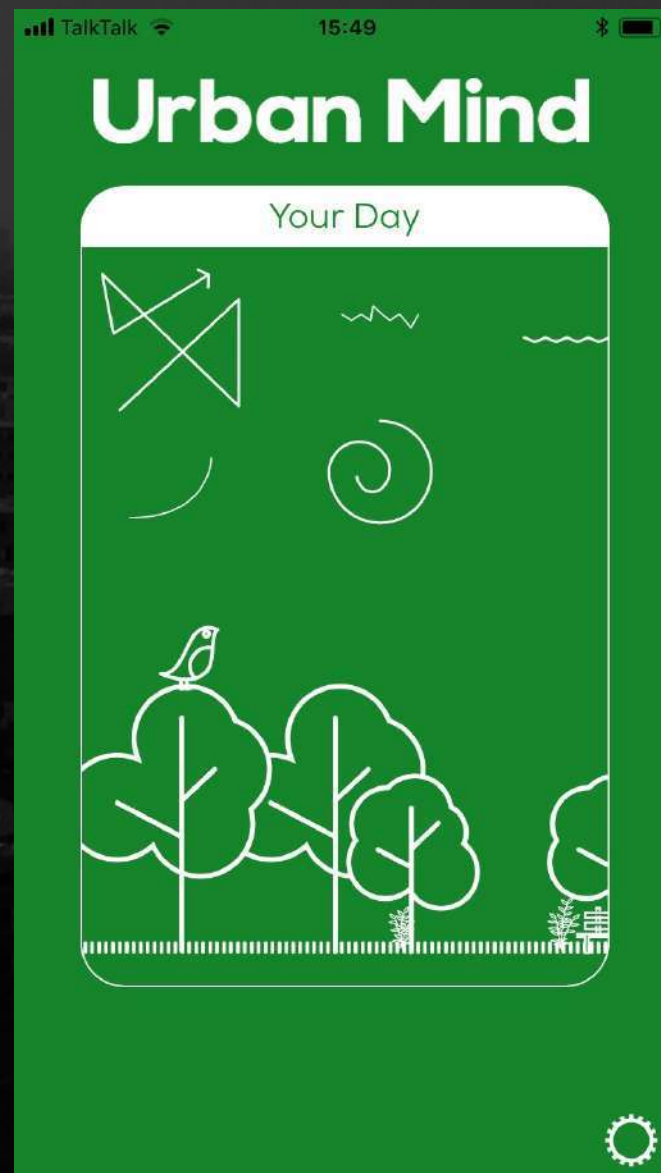
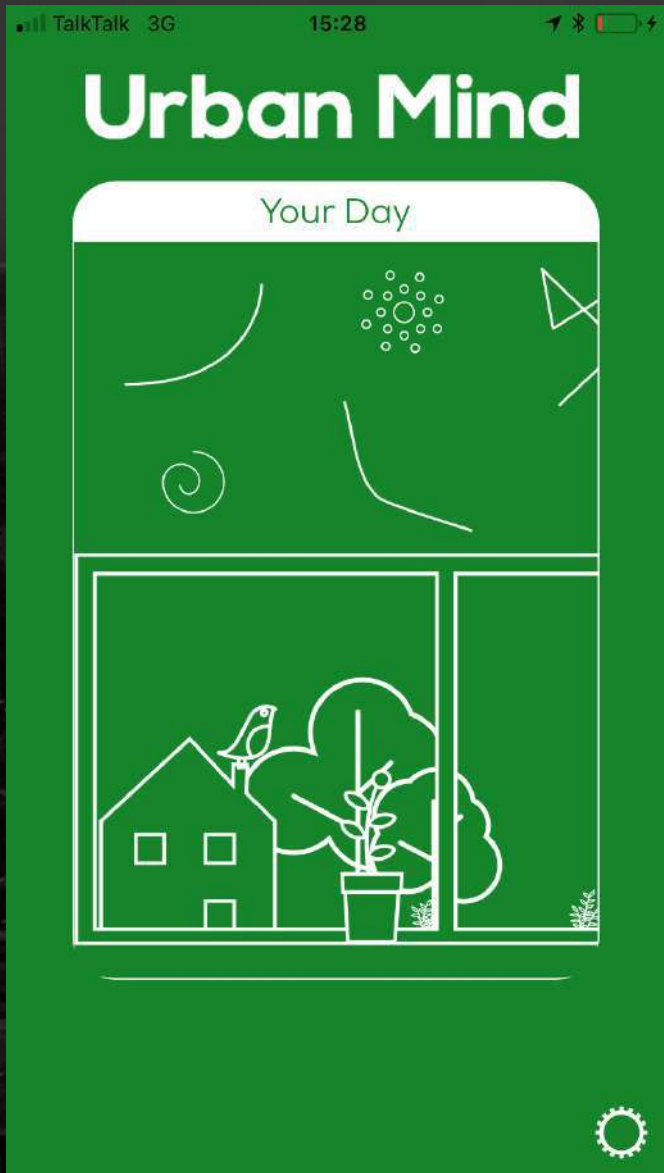


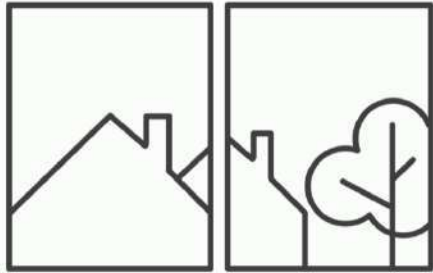


Location Data

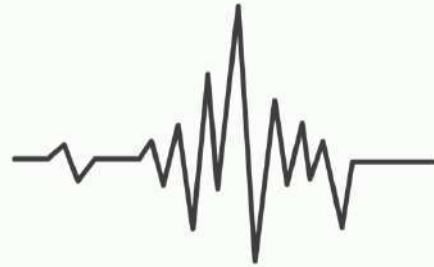
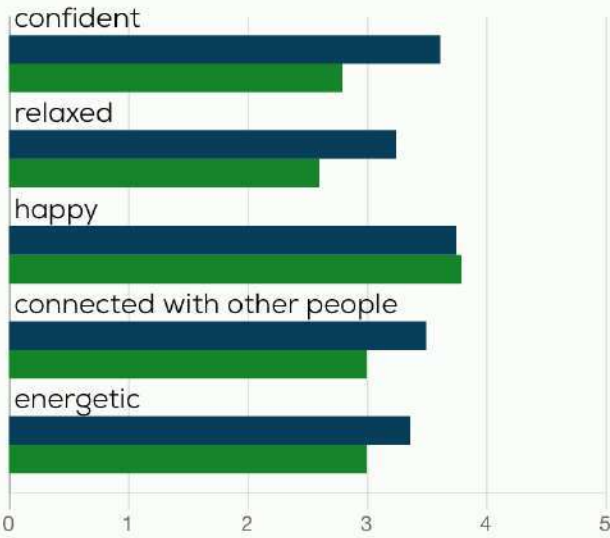
- Background location tracking
- Foreground location tracking



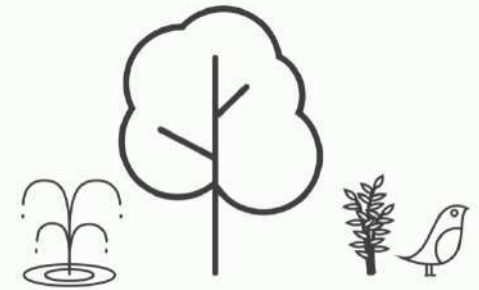
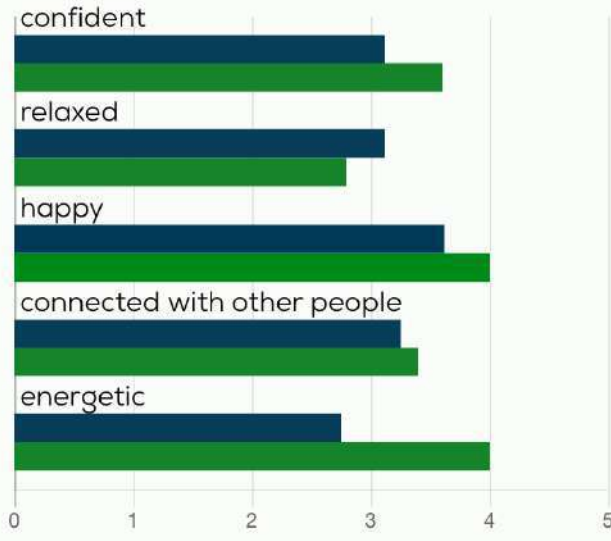




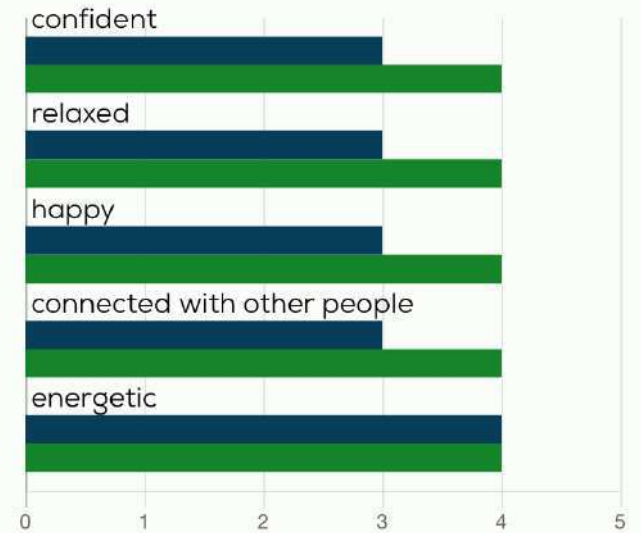
How your mental wellbeing differed for **indoors / outdoors.**

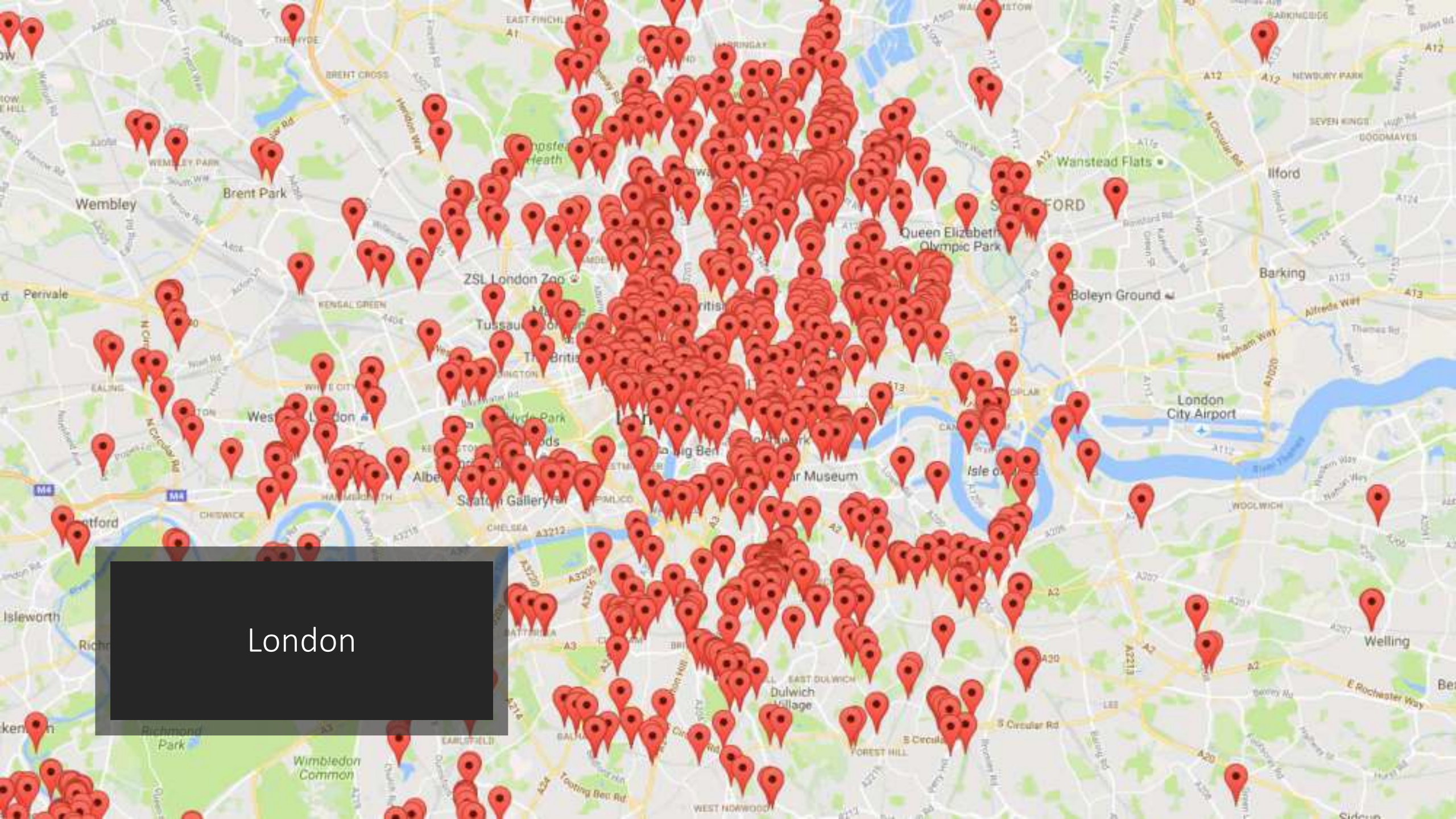


How your mental wellbeing differed for **noisy / not noisy.**

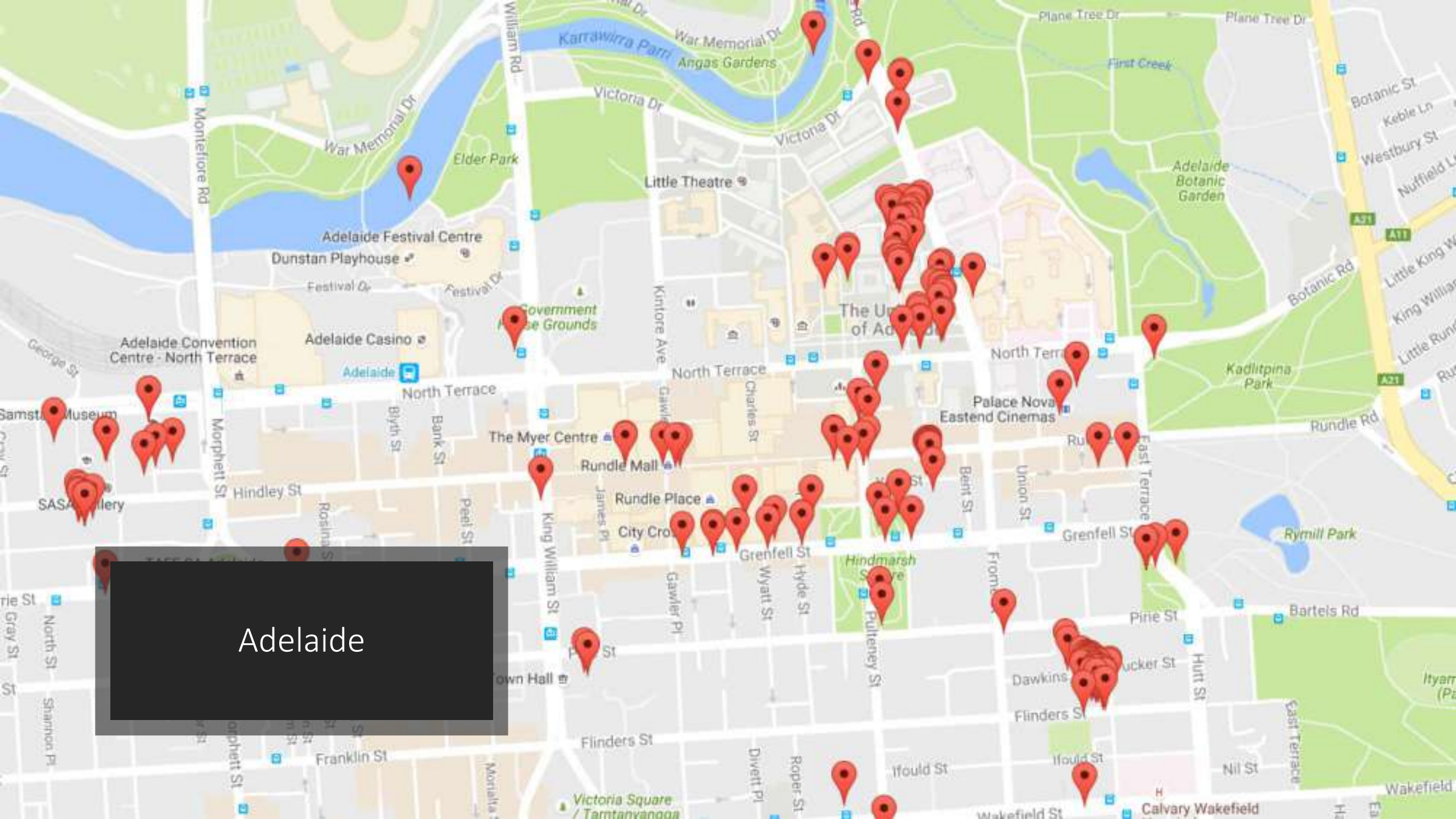


How your mental wellbeing differed for **contact with nature / not in contact with nature.**



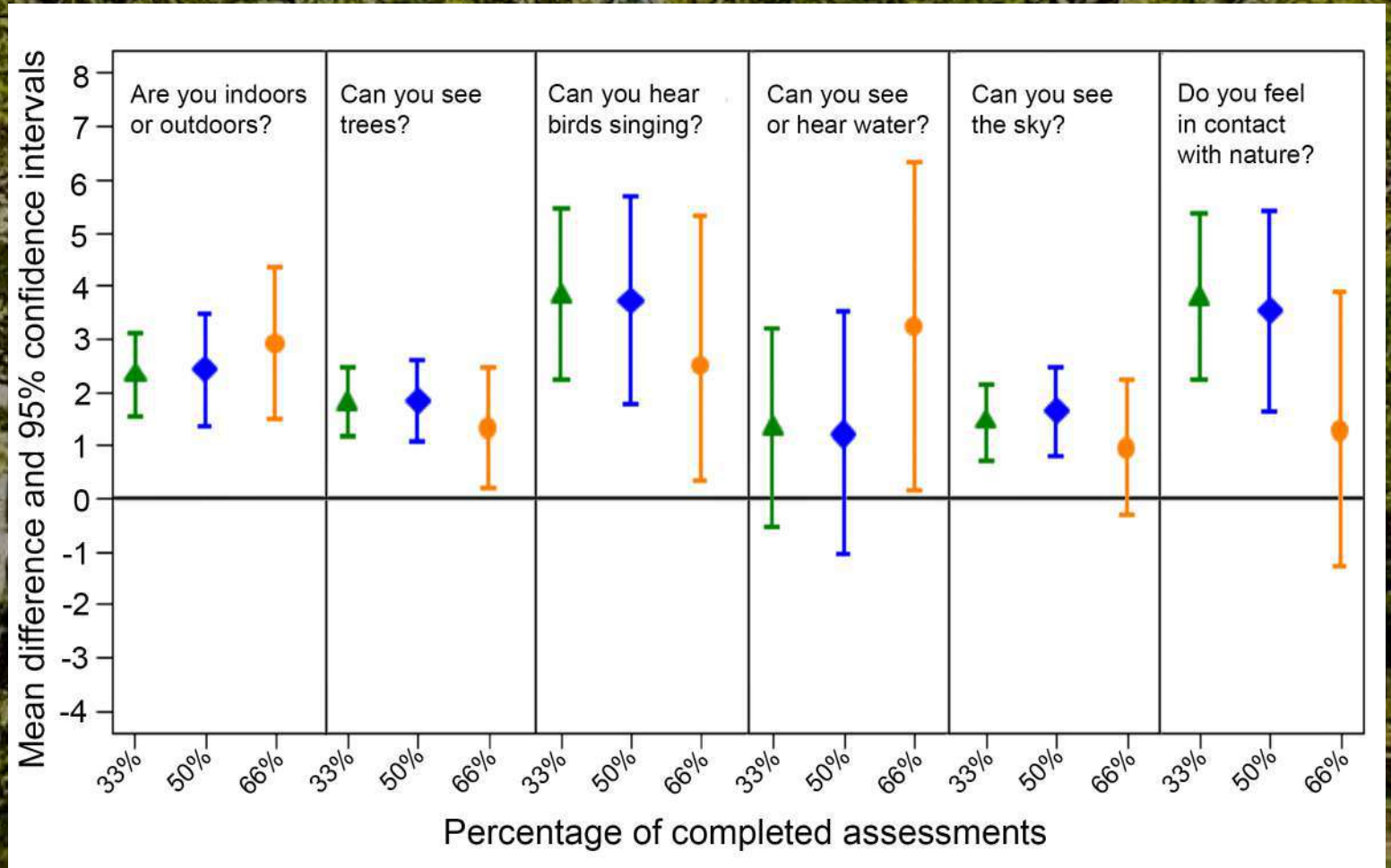


London



Adelaide

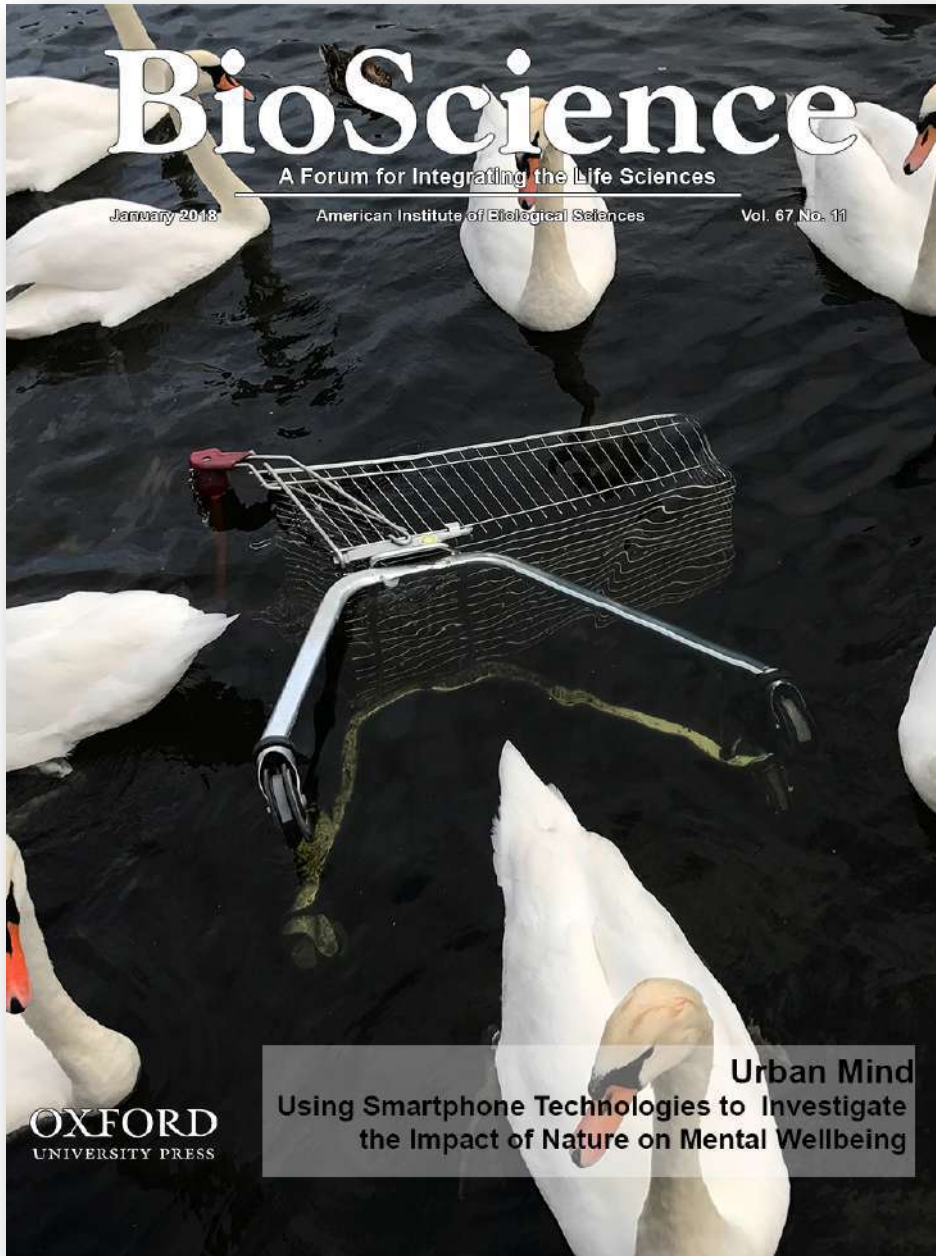
Effects of natural features on mental wellbeing





Effects of natural features on mental wellbeing

- Were still evident 7.5 hours after a single exposure
- Were more pronounced in people with high trait impulsivity – a psychological characteristic associated with higher vulnerability to a range of mental health disorders
- Interacted with the social environment (e.g. feeling safe / unsafe)



Biologist's Toolbox

Urban Mind: Using Smartphone Technologies to Investigate the Impact of Nature on Mental Well-Being in Real Time

IOANNIS BAKOLIS, RYAN HAMMOUD, MICHAEL SMYTHE, JOHANNA GIBBONS, NEIL DAVIDSON, STEFANIA TOGNIN, AND ANDREA MECHELLI

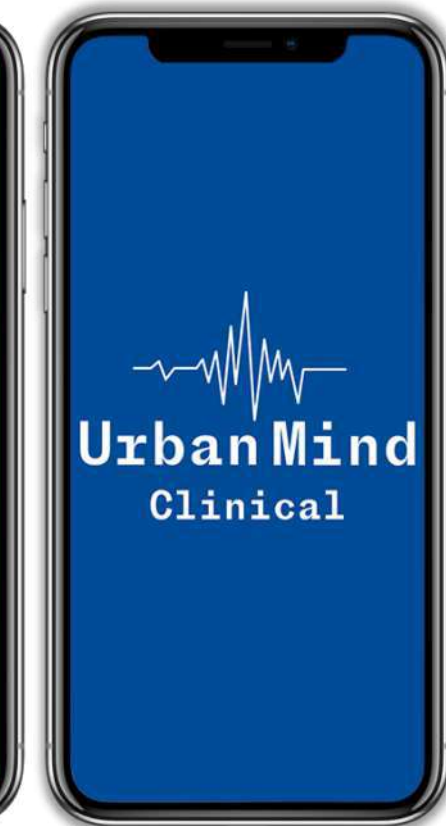
Existing evidence on the beneficial effects of nature on mental health comes from studies using cross-sectional designs. We developed a smartphone-based tool (Urban Mind; www.urbanmind.info) to examine how exposure to natural features within the built environment affects mental well-being in real time. The tool was used to monitor 108 individuals who completed 3013 assessments over a 1-week period. Significant immediate and lagged associations with mental well-being were found for several natural features. These associations were stronger in people with higher trait impulsivity, a psychological measure of one's tendency to behave with little forethought or consideration of the consequences, which is indicative of a higher risk of developing mental-health issues. Our investigation suggests that the benefits of nature on mental well-being are time-lasting and interact with an individual's vulnerability to mental illness. These findings have potential implications from the perspectives of global mental health as well as urban planning and design.

Keywords: nature, mental well-being, mental health, smartphones, ecological momentary assessment

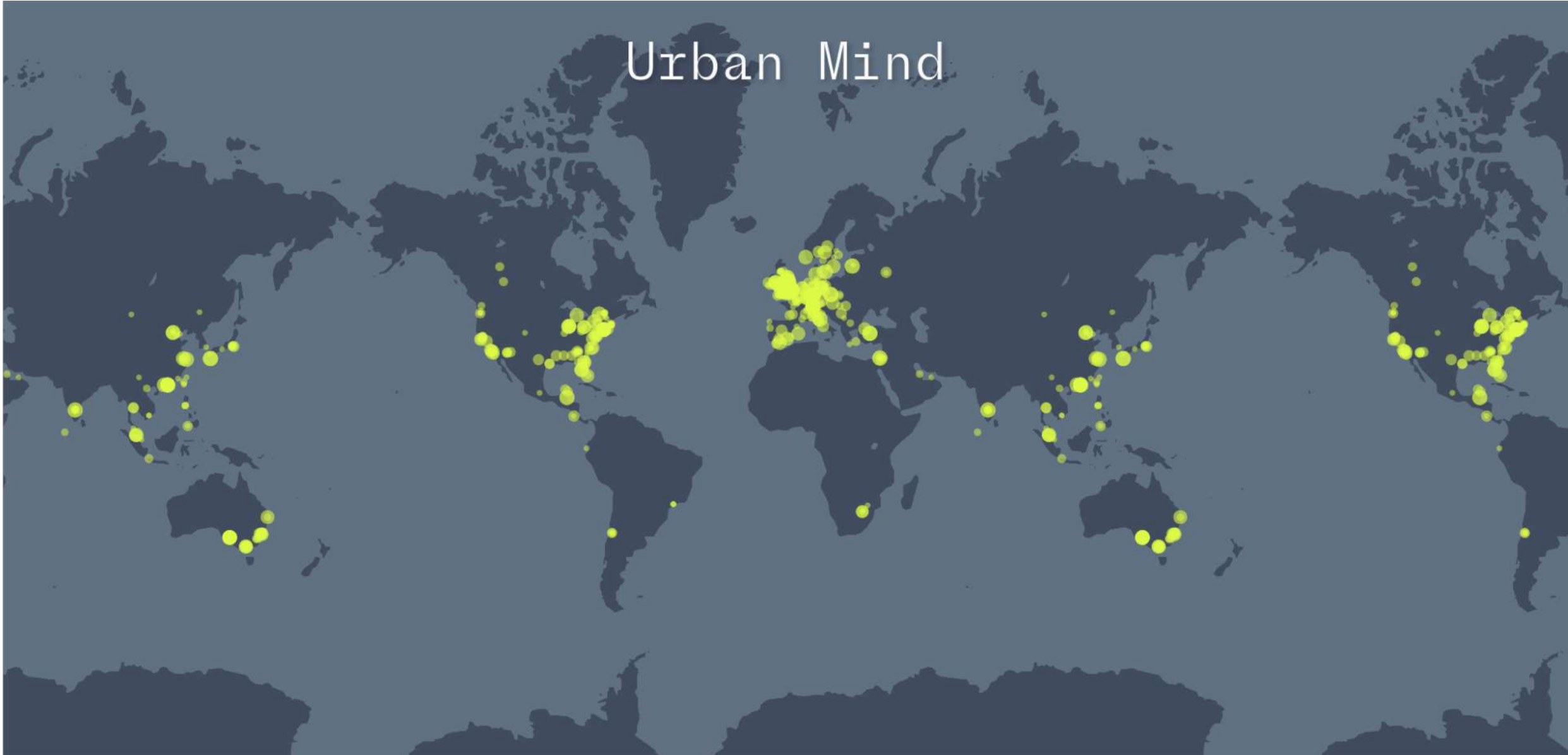
Over three-and-a-half billion people, more than half the world's population, live in urban areas. This number is rising fast in both developed and developing countries, and it is expected that 66% of the global population will live in cities by 2050 (UNESA 2014). This ongoing urbanization has major implications for global mental health, because people who live in urban environments are at higher risk of a range of mental-health issues, including depression, generalized anxiety disorders, psychosis, and addictive disorders (Peen et al. 2010, Galea 2011, Lederbogen et al. 2011). Crucially, the observation of a dose-dependent effect provides support for a causal relationship, rather than a mere association, between urban living and risk for mental illness (Pedersen and Mortensen 2001, Haddad et al. 2015). Further

living and even promote mental health. For example, living in urban areas with natural features such as trees, gardens, parks, birds, and water is associated with higher levels of mental well-being and reduced incidence of chronic mental illness (van den Berg et al. 2010, van Dillen et al. 2012, Astell-Burt et al. 2013, Nutsford et al. 2013, Richardson et al. 2013, White et al. 2013, Astell-Burt et al. 2014, Alcock et al. 2015, Mantler and Logan 2015, Taylor et al. 2015, Triguero-Mas et al. 2015, Cox et al. 2017). A number of biologically plausible theories have been proposed to explain this effect, including attention-restoration theory (Kaplan S 1995), stress-reduction theory (Ulrich et al. 1991), and biophilia theory (Wilson 1993).

The existing literature on the beneficial impact of nature



Urban Mind

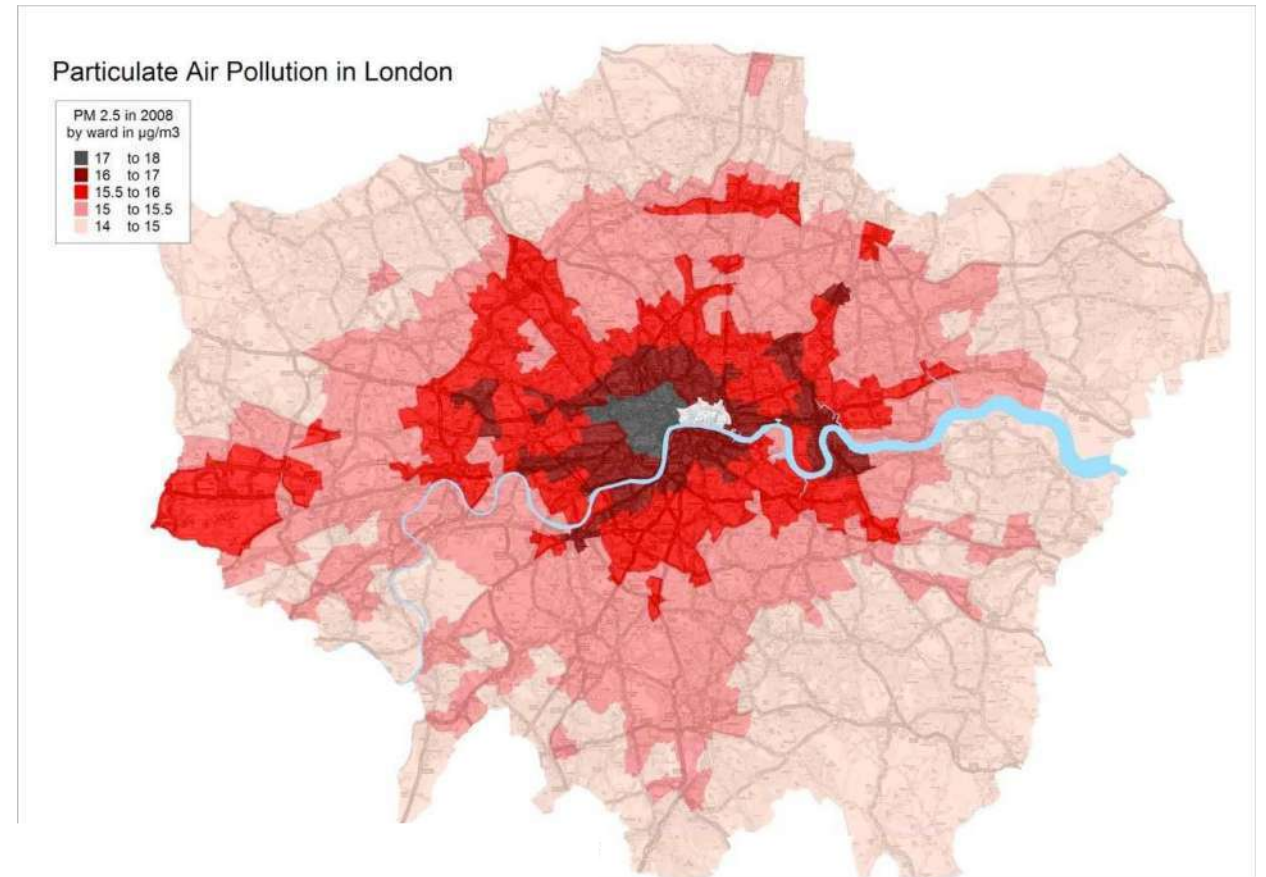


Using analytics to integrate the “micro” and the “macro”

Individual



Environment



How could the results be used?

- From the perspective of **mental health care**, the results could inform the development and roll-out of scalable interventions aimed at promoting mental health amongst urban and rural populations.
- From the perspective of **urban planning and design**, the results will provide a much-needed evidence-base to inform future policies aimed at improving mental wellbeing in urban and rural populations.



Bethnal Green Tenants & Residence Association, London



Thamesmead redevelopment, South-East London

The Urban Mind team

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- Lucie Burgess

Urban Geography

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Neuroscience

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- Ryan Hammoud
- Gunter Schumann

Urban Sociology

- Nikolas Rose
- Nicholas Manning

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- For more information, visit <https://urbanmind.info>
- Please send feedback / suggestions to: a.mechelli@kcl.ac.uk



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