

data capacity that might be available to these systems compared with the restricted information, even of very high quality, available to the clinician.

The idea of capturing spontaneous digital detritus to aid the identification of risk and response to mental illness is appealing to us because the future of early detection and intervention would be very different from what we do today.

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## Neurourbanism: towards a new discipline

City life and mental wellbeing are interdependent in many ways. However, this web of interdependencies is far from being sufficiently understood. Urban planners and health providers have so far largely failed to develop strategies coordinating the bidirectional interaction between urban life and mental wellbeing. Before the backdrop of an accelerating global urbanisation, we have founded an interdisciplinary research forum on neurourbanism, spanning neuroscience and the urban disciplines including urban planning, architecture, and sociology, and we call for more cross-sectional approaches in different global regions (figure).

Nowadays, every second human being lives in a city. In 1950, only a third of the population lived in cities, and by 2050, 70% of the world's population will be living in urban environments. This trend will have far-reaching consequences for our quality of life, health, and in particular for our mental wellbeing. Neurourbanism as a new interdisciplinary field of research must focus on the interdependencies between urbanisation and mental wellbeing with the aim to offer planning and health disciplines the necessary knowledge and tools to meet these challenges.

Cities are the cultural and political centres of most societies everywhere around the world. Education, health, wealth, culture, social stimulation, and participation, as well as personal development, are all values that people seek predominantly in cities. But cities are also places of competition, conflict, and political confrontation.

City dwellers live in a setting where, compared with rural areas, on average, medical care is better, a psychotherapist is easier to find, and the distance to the nearest hospital or pharmacy is shorter, facilitating access to adequate care. Still, some major mental illnesses that are assumed to have a stress-related cause occur more frequently in cities. In 2010, a Dutch meta-analysis found that in city dwellers, the risk of developing mental disorders is 38% higher (39% higher risk for affective disorders, 21% higher risk for anxiety disorders);<sup>1</sup> the risk of developing schizophrenia is at least two times higher than in people living in rural areas.<sup>2,3</sup> City living and cannabis consumption are assumed to be similar risk factors for schizophrenia in genetically predisposed individuals.<sup>3</sup> In fact, there is a dose–response relationship pointing towards a causal relationship: the more of one's formative years are spent in a city, the greater the risk of schizophrenia in adulthood.

For the UN World Urbanization Prospects (2015) see <https://esa.un.org/unpd/wup/publications/files/wup2014-report.pdf>

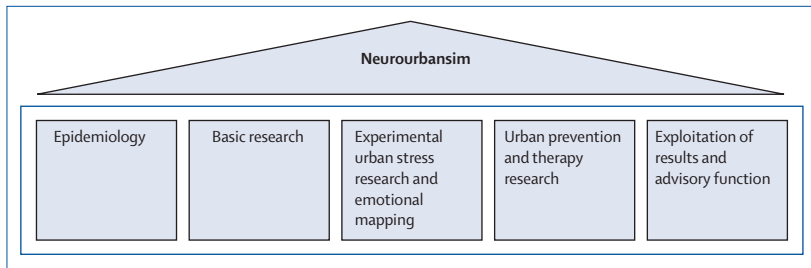


Figure: The structure of neurourbanism as an academic discipline

Some researchers estimate that up to 30% of the risk of schizophrenia is attributable to urban upbringing.<sup>4</sup> The causal factors underlying these differences in prevalence remain unclear. Lederbogen and colleagues<sup>5</sup> found that living and growing up in a city influences the stress-dependent activation and connectivity of emotion-regulating areas of the brain, such as the amygdala and the cingulate cortex. Haddad and colleagues<sup>6</sup> reported that the number of years that healthy adults have spent in a city during their first 15 years of life affects the size of the dorsolateral prefrontal cortex. On the other hand, being exposed to the social and cultural complexity of cities is considered to contribute positively to social competence in children and adolescents.<sup>7</sup>

A specific feature of pathogenic urban stress seems to be the simultaneity of social density and social isolation, paired with the feeling of being exposed to an uncontrollable environment. Stressors, social density, and social isolation are independent health determinants and seemingly occur more frequently in cities than in rural areas (social stress hypothesis).<sup>8</sup> In the presence of pertinent individual risk factors that diminish an individual's resilience (genetic, personality-related, sociodemographic including age, poverty, and migration status), this social stress can easily become health-relevant. The risk of diminished mental wellbeing is probably escalated by extreme socio-economic gradients within a confined space, inadequate housing conditions, and violence.

Against this background, neurourbanism aims to investigate the effect of built and social environments of cities on mental health, and ultimately on the brain. Architectural psychology has examined the influence of physical stimuli, mainly on specific emotions. Neuroscientific research has made progress with respect to the neural mechanisms that help to orient oneself within a building or a broader spatial environment.<sup>9</sup> But an interdisciplinary public health-oriented approach is

missing, and the results of existing neuro-architectural research<sup>10</sup> have been largely ignored in the training of architects.

Neurourbanistic research should further aim to characterise urban stressors and their modulators and identify high-risk populations (eg, migrants) who do not have equal access to what is called the urban advantage, but are more exposed to stressors such as social isolation. Rapp and colleagues<sup>11</sup> showed that independent of individual income, inhabitants of central boroughs of Berlin showed an increasing mental health burden with increasing neighbourhood poverty, an effect which was pronounced in inhabitants with Turkish migration backgrounds. City authorities and health-care providers in the major cities of the Middle East and Europe that are the primary destinations for intraregional and inter-regional migration (including by flight) must deal with populations that are frequently severely emotionally distressed and have post-migration stress, which might even outweigh the health-relevance of pre-migration stress.<sup>12</sup>

It is therefore time for an interdisciplinary neuro-urbanistic approach that connects public mental health to urban planning to create better environments that will improve the mental wellbeing of individuals and communities in cities, and strengthen the resilience of high-risk individuals and children.

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## Corrections

Yatham LN, Mackala S, Basivireddy J, et al. Lurasidone versus treatment as usual for cognitive impairment in eurythmic patients with bipolar I disorder: a randomised, open-label, pilot study. *Lancet Psychiatry* 2017; **4**: 208–17—In table 2 of this Article, the third sentence of the legend has been changed to “Cohen’s d effect size listed for each variable. For within-group effect sizes, used SD of baseline assessment. For between-group effect size, used pooled SD.” In table 3, the sentence “Cohen’s d effect size listed for each variable computed as difference in adjusted means (post-pre) divided by square root of mean square error” has been removed from the legend. In table 4, the second sentence of the legend has been changed to “Effect size listed for each variable computed as difference in adjusted means divided by square root of mean square error”. These corrections have been made to the online version as of Feb 23, 2017, and the printed Article is correct.