Size Matters? Exploring Scale for Neighbourhood Effects

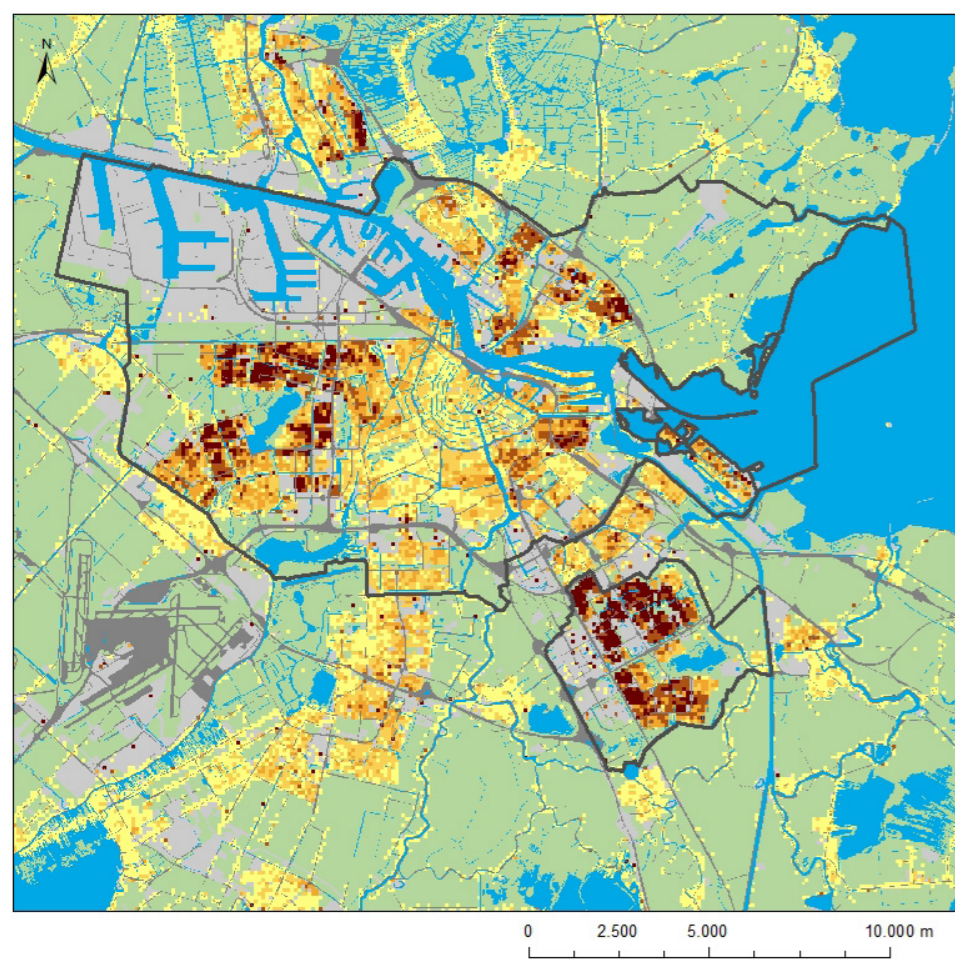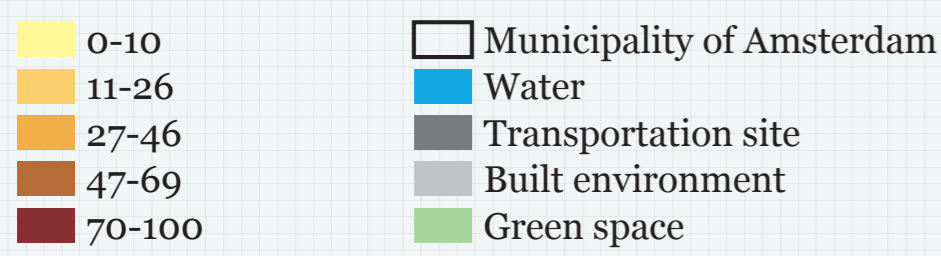**Ana Petrović [1], Maarten van Ham [1 2], David Manley [3]**

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The literature on *neighbourhood effects – the influence of the residential socio-environmental context on individual outcomes –* emphasizes that there is a variety of spatial contexts, ranging from very local to regional, through which influence may be exerted (see Van Ham, Manley, Bailey, Simpson, & Maclennan, 2012, 2013).

Unlike the theoretical considerations on the role of scale in understanding neighbourhood effects, empirical studies on neighbourhood effects have paid less attention to the issue of *scale* as a *critical dimension of identifiable social and physical features of an environment* (Reardon et al., 2008; Smith, 2000).

1. We used registwer data for the full population of the Netherlands (Sociaal Statistisch Bestand), **geocoded at 100m by 100m grid cells**, and measured exposure to non-Western ethnic minorities at **101 spatial scales**.

The first scale is the cell itself. This is the **urban mosaic of Amsterdam** in 2013 - the **percentage of people with a non-Western background** in 100m by 100m cells:

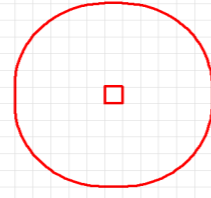|	
0-10	Municipality of Amsterdam
11-26	Water
27-46	Transportation site
47-69	Built environment
70-100	Green space

Multi-scale bespoke neighbourhoods

2. We created **bespoke neighbourhoods - areas centred around each individual** and used to measure exposure to the socio-spatial environment (introduced by Johnston et al. 2000, MacAllister et al. 2001, Buck 2001).
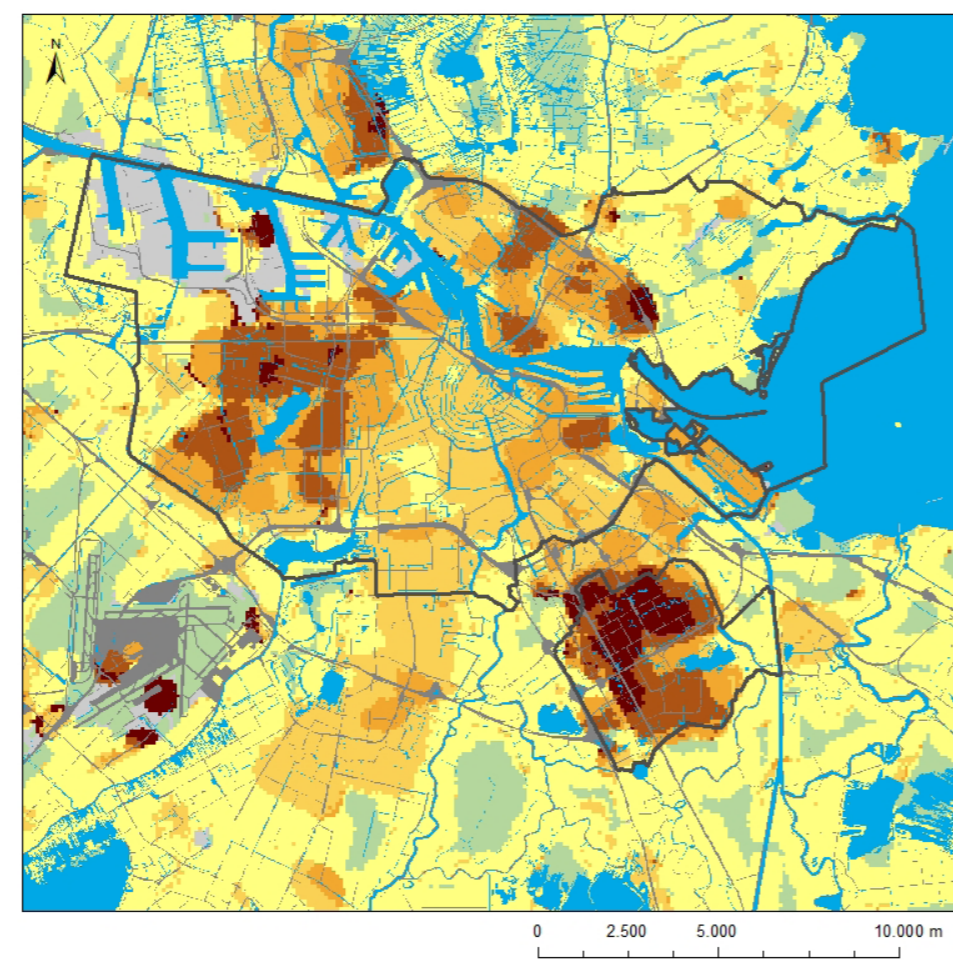
We delineated 100 concentric circles around each 100m by 100m cell, and measured the percentage of people with a non-Western background within the circles (bespoke areas).

The circles have radii of 100m, 200m, 300m, etc.

This is an example of the bespoke neighbourhood with a 500m radius:

3. We increased the radius further: 600m, 700m, 800m, etc.

This is an example of the bespoke area with a 2000m radius:

4. The largest circle has a radius of 10000m.

Changes in the structure of areal units (scale and zonation) can result in the same data giving different results of analyses, which is a serious methodological issue known as the **Modifiable Areal Unit Problem – MAUP** (Openshaw and Taylor 1979; Manley, 2014).
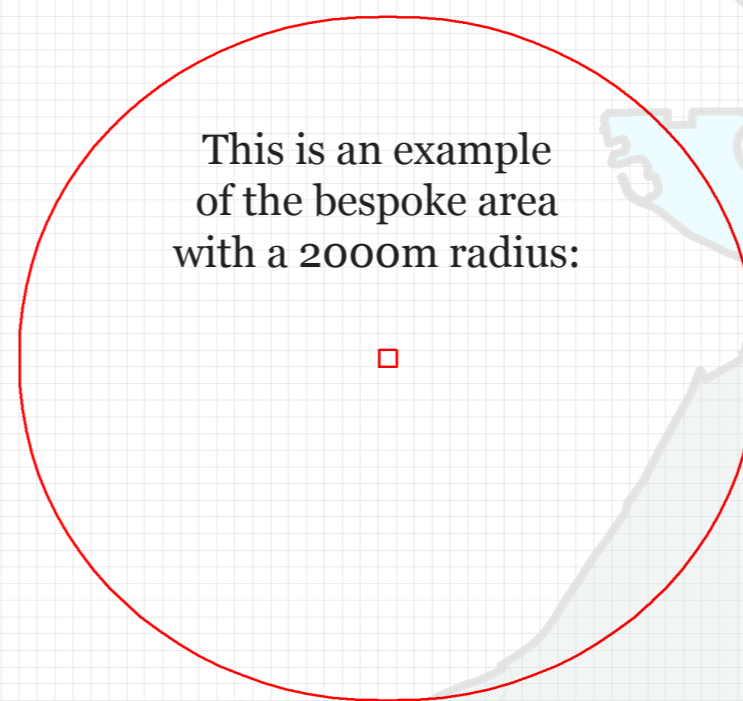
We mapped Amsterdam again, but the colours of the cells show the percentage of people with a non-Western background in bespoke neighbourhoods with a **500m radius**:
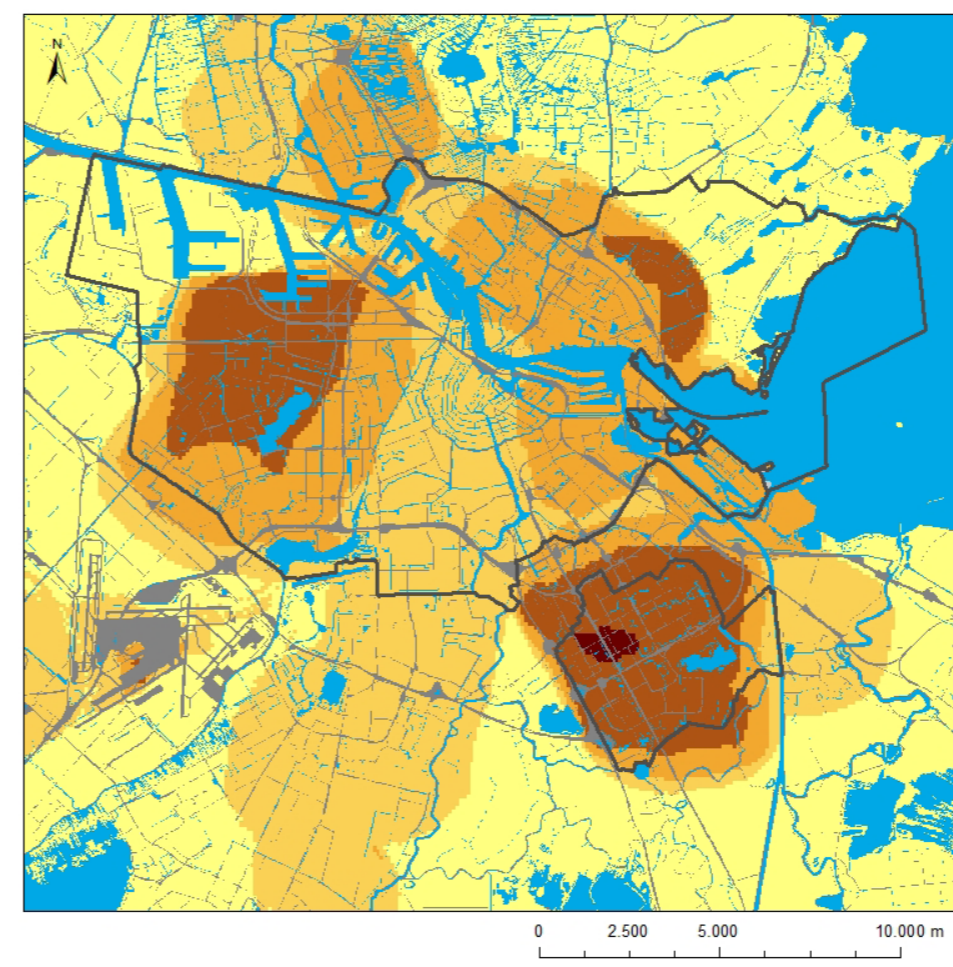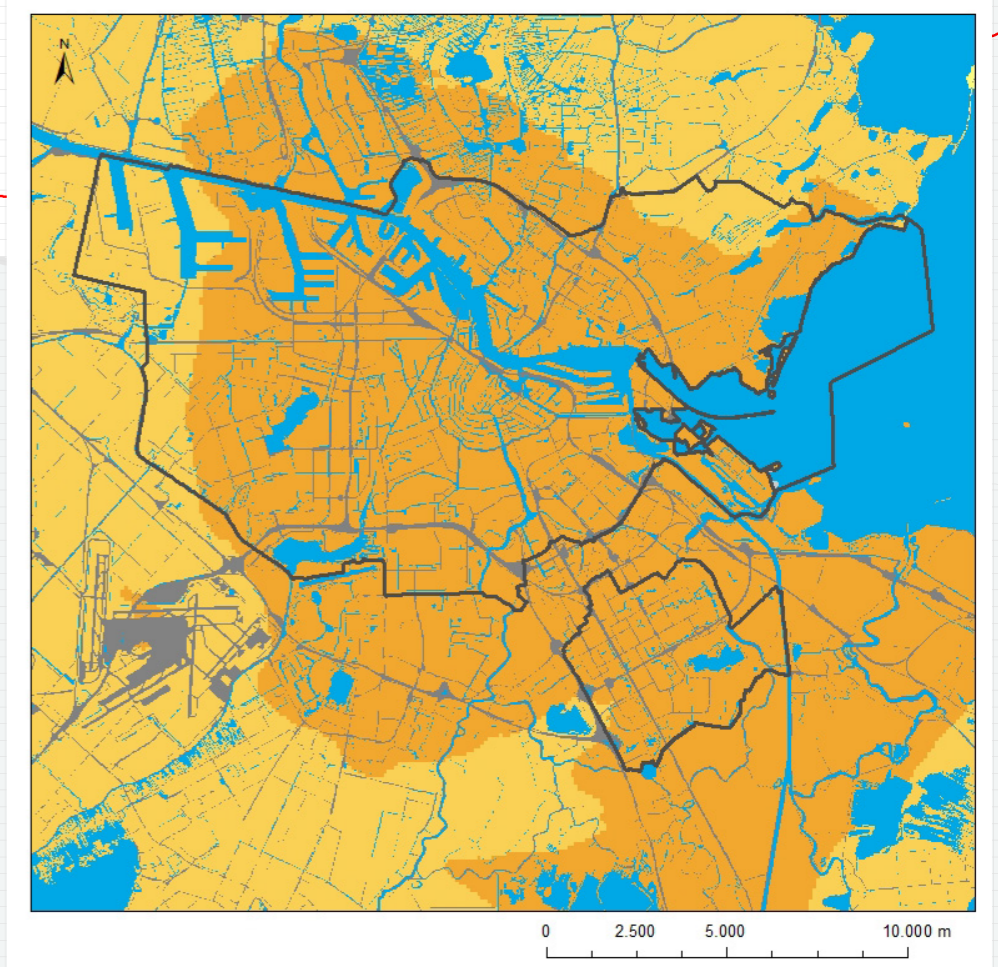
In this map, the colours show the percentage of people with a non-Western background in bespoke areas with a **2000m radius**:

The last map shows the percentage of people with a non-Western background in bespoke areas with a **10000m radius**:


Individual and cumulative distance profiles of ethnic exposure

We created distance profiles of ethnic exposure:
both individual distance profiles,
which encompass 101 bespoke neighbourhoods for each individual
and as such can be implemented in the models of neighbourhood effects,
and cumulative distance profiles,
which should highlight the role of urban form in dealing with the issue of spatial scale.

5. Individual distance profiles of **nine example cells** in **Amsterdam.** Each individual distance profile contains the percentage of non-Wester people measured at 101 spatial scales.
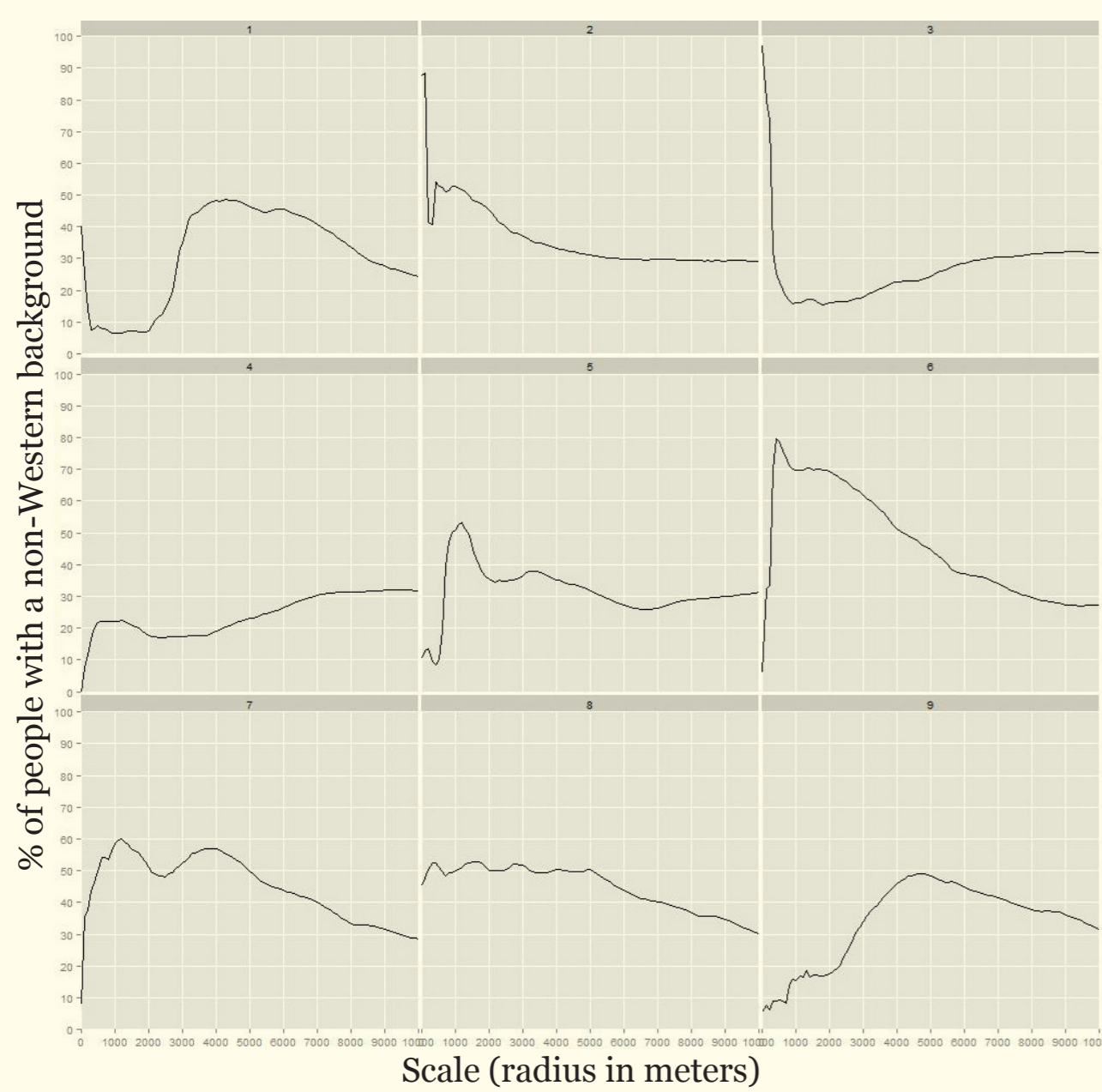
6. Cumulative distance profiles for three Dutch cities with different urban forms: **Amsterdam**, the most populated Dutch city, **Utrecht**, ranking the fourth (both part of the Randstad, the largest conurbation in the Netherlands), and **Groningen**, spatially isolated city, with the seventh largest population in the Netherlands. Each cumulative distance profile contains all individual profiles for the specific city, represented as 101 boxplots (one boxplot for each scale).
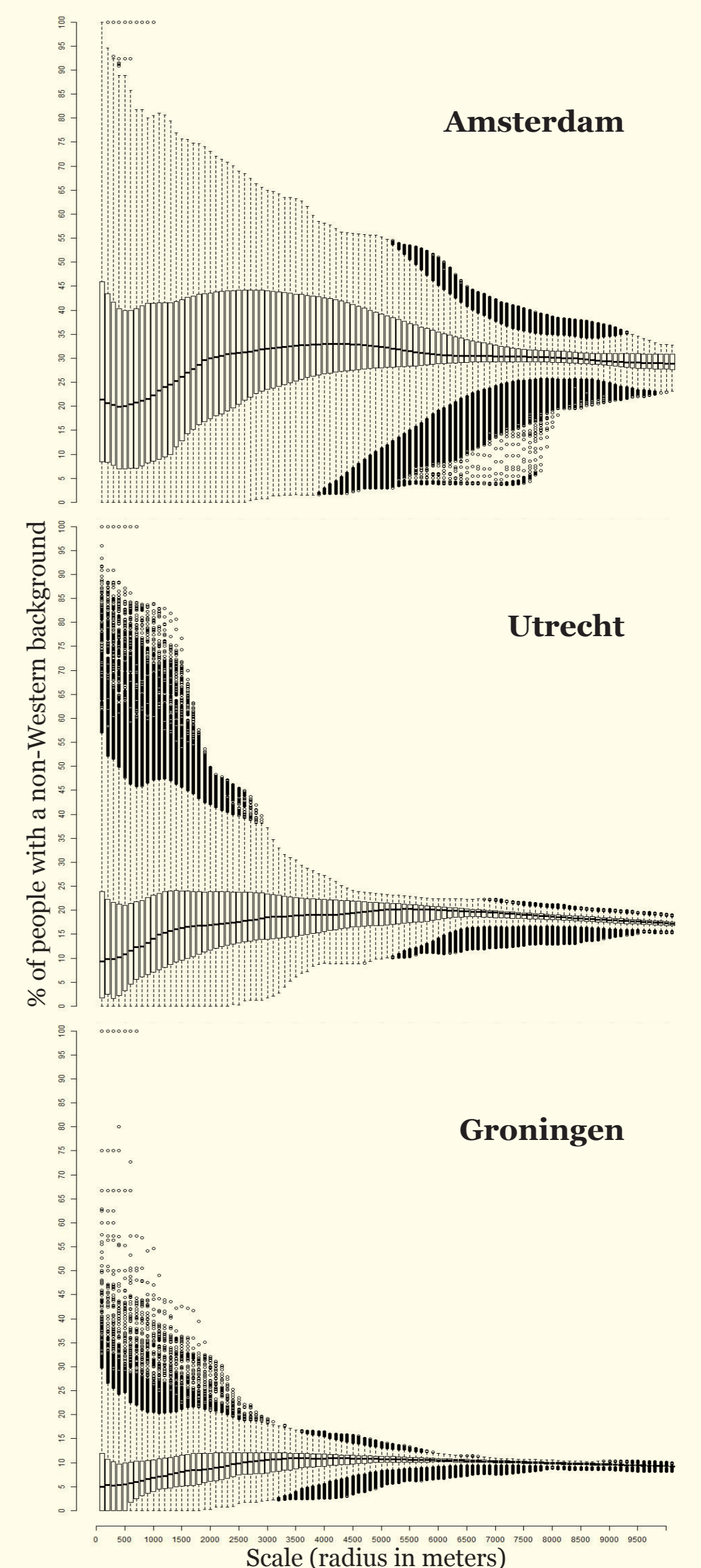
Scale matters in different ways within one city and across cities

- Different scales yield different measures of exposure to ethnicity, which may lead to different conclusions regarding an individual's environment as a potential source of neighbourhood effects.

- Areas of high concentration can be blurred if too coarse a scale is used. Conversely, too fine a scale risks splitting larger areas of concentration into non-significant units and not representing the wider context in which an individual resides.

- For the larger polycentric cities, a single scale has different meanings in different parts of the city.

- The relationship between scale and urban form is a fundamental issue for national level investigations into neighbourhood effects, or investigations taking in multiple urban centres, as measures of context at one scale possibly do not measure the same thing in different spaces.

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Amsterdam

Utrecht

Groningen

% of people with a non-Western background

Scale (radius in meters)