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Comparing Patterns of Segregation in North-Western Europe: A Multiscalar Approach

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1 Introduction

Residential segregation is the state of spatial separation of groups of people, with the groups defined according to one or more dimensions, such as ethnicity, age, income or other social characteristics. A distinction is commonly made between ethnic segregation, the concentration of different ethnic groups, and socioeconomic segregation, separation of groups based on income, employment status or education level (Massey and Denton 1988). This definition implies a relationship between different geographical areas: there should be meaningful variation across neighbourhoods in the composition of their resident populations. Issues related to residential segregation frequently appear in political and public debate, as well as in academic debates within the social sciences. Academic interest and policy interest in segregation have been particularly strong in the USA, and since Wilson's (1987) influential work on black ghettos in US metropolitan areas. These urban areas, Wilson argued, were gradually abandoned by middle-income groups, which

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subsequently resulted in further deterioration of the community, through, for example, poorer public amenities and a loss of positive role models.

The American context is in many ways different from the European context, but connotations of the term 'segregation' in the public debate are mostly negative also in Europe. In media portrayals, residential segregation is typically associated with other contentious social issues such as crime, low school quality and poor housing conditions. The academic interest in segregation patterns goes hand in hand with an interest in "neighbourhood effects': the consequences of residing in particular areas for personal outcomes in the socioeconomic or sociocultural domains (see Musterd and Andersson 2005). Academics and policymakers connect residential segregation to concepts such as social cohesion and social capital, as well as the opposite: distress, social unrest and neighbourhoods as havens for extremists and terrorism. High migration rates and increasing attention to socioeconomic inequality in the last few years have underlined the importance of residential segregation for policymakers and researchers alike.

Earlier studies on residential segregation have used administrative or statistical areas (e.g. census tracts, wards, or neighbourhoods) to measure levels of segregation and illustrate segregation patterns. Until recent, these results were predominantly single scalar, i.e. they only looked at one such level of disaggregation or several administratively set levels (multilevel models) (Brattbakk 2014). However, the commonly used segregation indices are influenced by the size of the units for which they are measured, and the delineations and size of statistical units are typically quite different across and within countries. This is often referred to as the *modifiable areal unit problem* (MAUP). Because of these issues, cross-country comparisons are problematic (see Musterd 2005), and most studies so far have therefore focused on the situation in a single city or country. The relatively small number of internationally comparative studies have focused on either ethnic (Musterd and van Kempen 2009) or socioeconomic (Tammaru et al. 2016) segregation.

This special issue of the *European Journal of Population* reports a broad set of findings from a large comparative research project on residential segregation. The project '*Residential segregation in five European countries—A comparative study using individualised scalable neighbourhoods*' (abbreviated *ResSegr*[1]) considers both the causes and consequences of residential segregation across several dimensions in five European countries: Belgium, Denmark, the Netherlands, Norway, and Sweden.

The papers in this special issue, and the *ResSegr* project more generally, aim to make two main contributions to the segregation literature. First, we use a measure of segregation that defines neighbourhoods as groups of individuals who reside closely to the focal individual rather than those residing within some administrative border (Nielsen et al. 2017, p. 10). The main advantage of this approach is *comparable segregation* measures, to be used both over time and across urban areas and countries (Nielsen et al. 2017). Since data were processed in the same way in each country, by working with individualised rather than statistical units of analysis, it is

[1] 2014–1676 Residential segregation in five European countries. A comparative study using individualised scalable neighbourhoods. ResSegr, Urban Europe, Joint programming initiative.

possible to draw direct comparisons of segregation levels across countries. Mapping the variation in geographical contexts in the urban areas in northwest Europe using comparable ethnic and socioeconomic indicators will open up new possibilities for addressing questions of central importance for urban analysis and urban policies.

Second, the studies presented in this special issue study segregation in a *multiscalar* setting. Segregation can manifest itself at different spatial scales. Weak segregation at larger scales can go hand in hand with strong segregation at the smaller scales, or vice versa. At each of these scales, segregation can affect personal outcomes for individuals. Strong segregation implies large differences in the day-to-day neighbourhood experienced by people, whereas weak segregation means small differences between neighbourhoods and hence similar experiences of living in neighbourhoods (Andersson and Malmberg 2018).

After presenting a short background to the academic and policy debate around residential segregation, we will discuss the two contributions of the ResSegr project in more detail and will illustrate these with a comparison between the US context and the European countries studied within the project.

2 Background

Measurement of segregation patterns has a long social scientific tradition spanning from the 1920s and the Chicago school, the 'index wars' of the 1930s (Gorard and Taylor 2002) via factor analysis and through today's analyses of large-scale data. Over the twentieth century, data availability and quality have increased markedly, and opportunities for adding to our knowledge about the causes and consequences of residential segregation have greatly expanded. Such knowledge is also in high demand among policymakers. Across Europe, policymakers worry that segregation will exacerbate local inequalities and ultimately have a negative effect on social cohesion. In the extreme case of very high segregation leading to low social cohesion, the majority population fear urban riots (Andersson et al. 2017) and the emergence of radical ideas opposed to the societal order.

One approach governments have taken to combat the negative consequences of segregation is to identify disadvantaged residential areas and offer those areas special support packages. In Denmark there is at present a 'ghetto list' consisting of 25 areas (Transport-Bygnings-og Boligministeriet 2016), and in Sweden there is a list of 15 deprived areas that needs attention, which changed into 386 smaller SAMS areas including 6.7% of the adult population (Command 2017, p. 13). In the Netherlands, the forty most-deprived neighbourhoods were selected for inclusion in the *'Empowered neighbourhoods [Krachtwijken]'* programme and received extra attention and investments from 2007 onward in order to combat the accumulation of social, economic and health-related problems. The effectiveness of this programme has been topic of a critical societal and academic debate (Permentier et al. 2013). Certain parts of Oslo, Norway, have had similar programmes (Oslo municipality 2017). Systematic comparisons of segregation between countries are useful when deciding which policies are efficient and when generalising from specific interventions to 'best practices'.

Segregation patterns have obvious consequences for contacts between social groups and possibly for attitudes towards other groups (Vertovec 2017). Cosmopolitan attitudes are tolerant and accepting towards local ethnic and socioeconomic diversity. It is unclear what forms of causal relationships exist between exposure to highly segregated (or highly diverse) areas on the one hand and more cosmopolitan values on the other. Ethnic mixing has been shown to increase contact between groups, and thereby to increase trust and reduce prejudice (Galster and Friedrichs 2015; Pettigrew et al. 2007), but there is also evidence of diversity not leading to tolerance towards migrants but rather to mistrust (Uslaner 2010). If native dominated-areas are highly segregated, xenophobic attitudes may also emerge in those areas (Strömblad and Malmberg 2016). Rapid increases in immigrant populations, however small they initially are, may lead to anti-cosmopolitan backlashes (cf. Andersson et al. 2017; Vertovec 2017).

2.1 Previous Transatlantic and Cross-European Comparative Studies

As much of the research on residential segregation comes from the US context, European–US comparisons are particularly useful to European researchers. Nevertheless, good comparisons are often difficult to make due to the idiosyncrasies of countries. The larger surface area of the USA, its large local variations in policies, as well as a lower state involvement in most societal sectors imply that the right comparison for a European country may be found at the state level rather than at the national level. Racial residential segregation in the USA is typically described as being more severe than in other industrialised nations, cutting deeply into the society, and generating particularly sharp geographical divides between black and white citizens (Massey and Denton 1993; Musterd and Ostendorf 1998).

Only a small number of studies comparing segregation patterns between Europe and the USA were published before the turn of the millennium (Huttman 1991; Peach 1999). Since this period, a number of studies have compared particular cities in the USA with cities/countries in Europe (Johnston et al. 2007; Quillian and Lagrange 2016; Wacquant 2007), and others have discussed segregation levels in more general terms (Galster 2002; Wacquant 2007; van der Wusten 1998). However, there is an abundance of within-European comparisons (Maloutas and Fujita 2016; Tammaru et al. 2016; Musterd 2005; Musterd and Ostendorf 1998; Musterd and van Kempen 2009; Skifter Andersen et al. 2016; van Kempen and Özüekren 1998; Wessel et al. 2016). The comparative study by Andersson et al. in this special issue presents a more detailed overview of these European comparative studies. Overall, these studies show that residential segregation and separation are much lower in European cities than in American ones (Friedrichs et al. 2003; Galster 2002), a fact that is probably linked to differences in welfare systems and housing policies, among other factors (Huttman 1991). The American experience of strong racial segregation is not shared with European countries, even though immigrants in Europe arguably are highly segregated (Huttman 1991, p. 403; Massey and Denton 1993). Below we present matters of transatlantic diversity in earlier research regarding the location of distressed neighbourhoods, stronger

segregation, country of birth vs. race and lastly criticism on these comparisons of differences across the Atlantic.

According to general ideas, distressed urban areas are located in suburbs in European cities and in central urban areas in US cities (Friedrichs et al. 2003, p. 798; Quillian and Lagrange 2016). This means that the discussion of distressed neighbourhoods, as a negative outcome of segregation, actually concerns rather different locations in the European and US contexts. In Europe, these areas were often built during the 1950s after the Second World War, and during the 1960s and early 1970s when there was a shortage of housing. Therefore, they are suburbs to already established European cities (exceptions are: Belgium, see this special issue on Belgium, and Dutch cities like Rotterdam and The Hague). In contrast, in the USA, distressed neighbourhoods are often neighbourhoods of decay close to central business districts and areas purposely built for low-income groups, so-called housing projects. Also, US suburbs are desired destinations for those who can afford home ownership (Huttman 1991, p. 404; Parisi et al. 2011).

In earlier research, the higher residential segregation in the USA is considered to be due to higher socioeconomic inequality in society, whereas in European countries there are stronger welfare states that counteract segregation (Quillian and Lagrange 2016; Sampson 2012). Sampson finds large differences between Chicago and Stockholm in terms of the level of violence (Sampson 2012, pp. 19–20). He claims to find that the ecological pattern of the occurrence of violence in Stockholm and Chicago neighbourhoods is similar, but is manifested at different levels. Sampson mentions larger principles of societal organisation, e.g. housing and ethnic stratification, as potential explanations. Such larger principles might be at play considering the similarity in graphs of non-EU migrant segregation in Denmark, Belgium, the Netherlands and Sweden (this issue, Andersson et al.). Sampson continues that there is something fundamental about place stratification and other phenomena that cut across international boundaries but are manifested locally. However, there are generally lower levels of spatial inequality in European countries, probably because European governments typically intervene earlier in deteriorating areas, for example through social mixing policies (Friedrichs 2002; Galster and Friedrichs 2015).

An important difference between the segregation literature in the European and the US contexts is the focus on ethnicity and country of birth in the former and the focus on race in the latter. In their edited book about Western cities, Van der Wusten and Musterd (1998) concluded that US cities such as Chicago have a ‘cultural divide’ (comparable to Belfast in Europe and Port Elizabeth in South Africa) with a resulting ‘pattern of advanced socioeconomic segregation’ which is not apparent in other Western European cities (Van der Wusten and Musterd 1998, p. 243). However, at the time of their study diversity, both in terms of ethnicity and the country of birth among European migrants, was lower than today. If the present-day segregation of white people in the USA is compared to the segregation of the native populations in European countries, there will probably be more similarities compared to the situation in the 1990s. Comparing different country contexts always has its drawbacks. Wacquant has suggested that French *banlieues* and African-American ghettos are de facto incomparable and argues that ‘[…] the chasm that

separates these two sociospatial constellations is not only of a quantitative order but also pertains more fundamentally to the socio-historical and institutional orders.' (Wacquant 2007, p. 6).

Quillian and Lagrange (2016) compared cities in France and the USA and found greater segregation in the USA. They concluded further that little of the French–US difference in income segregation could be attributed to differences in ethnic/racial segregation between the two countries. Wacquant (2008) suggested that there is no contagion across the Atlantic: '(…) I wish above all to urge the utmost caution in the transatlantic transfer of concepts and theories pertaining to the articulation of racial domination, class inequality, and the structuration of space.' (p. 7). The work of Wacquant does not solely focus on race and ethnicity, since he also emphasises the importance of class. The specific concept of 'ghetto' is important to Wacquant as is shown in his later work (Wacquant 2008).

In his comparison between 'banlieues' in France and 'ghettos' in the USA, Wacquant compared the main minority populations (blacks in the USA and non-European migrants in Europe), while including both first-generation migrants and their descendants. Wacquant writes: '(…) banlieues and ghettos have in common that they are enclaves with high concentrations of "minorities" or ethnically-marked populations—blacks on the American side, and immigrants (that is, immigrants phenotypically identifiable as being of extra-European origin) and their descendants on the French side—and enclaves that are clearly identified as such by those who live in them as well as those who flee or fear them' (Wacquant 2007, p. 15). Wacquant found a number of similarities between banlieues and ghettos, such as high unemployment and young populations, but even more marked dissimilarities. First, there are important differences in size, both related to the surface covered and the number of inhabitants. The largest banlieues around Paris have a population of around 35,000, but the largest Chicago black ghetto houses some 300,000 (Wacquant 2007, p. 21).

Second, whereas French banlieues are predominantly residential areas, black ghettos can be regarded as 'cities within cities'. Being societies in their own right, American ghettos are highly homogenous concerning race, and this homogeneity is further reinforced by the fact that people often marry within their own race group. In the French banlieues instead 'One of the most striking characteristics of the large estates of the French urban periphery in this regard, placing them at the antipode of the American ghetto, is precisely the fluidity and astonishing diversity of their ethnic composition.'(Wacquant 2007, p. 24). Third, according to Wacquant (2007) both poverty and crime rates are higher and the housing stock and public infrastructure are poorer in a US ghetto than in a French banlieue (Wacquant 2007).

3 Segregation Measurement and the Issue of Scale

Segregation studies often deal with the overrepresentation of ethnic or socioeconomic groups across space (Massey and Denton 1988; Musterd and van Kempen 2009; Nijkamp and Poot 2015). Thus far, studies of residential segregation have been conducted at a single spatial scale, mostly metropolitan regions, cities,

neighbourhoods, or census tracts. In each country, neighbourhoods were defined according to statistical or administrative delineations, often related to historical borders, natural barriers or infrastructural obstacles, such as railroads or highways. The type and size of spatial unit for which segregation is measured strongly influences segregation outcomes (Krupka 2007; Jones et al. 2015). For example, many of the existing studies use the 'dissimilarity index' (DI), which is not sensitive to the differences in areal subdivisions across countries. Also the 'isolation index', measuring the degree of exposure of a certain minority, increases with area size and depends heavily on the general size of minority population shares (Malmberg et al. 2011).

Consequently, over the past decade, a growing strand within the segregation literature has emphasised the issue of spatial scale and how this influences segregation measurement (Fowler 2016a, b; Johnston et al. 2016; Manley et al. 2015; Parisi et al. 2011; Reardon et al. 2008, 2009; Fowler 2016a, b). Krupka (2007) argued that the often-found stronger segregation in large cities is in fact a spurious correlation. There are large differences in neighbourhood size between larger cities and smaller towns: census tracts in metropolitan areas generally consist of one single neighbourhood, while neighbourhoods in smaller towns have fewer inhabitants and are combined in order to create a census tract of comparable size. This results in census tracts in smaller towns having a more heterogeneous population than census tracts in large cities. However, at the same time, the neighbourhoods on which the non-metropolitan census tracts are built may be as segregated as those in metropolitan areas. Comparable differences in statistical units also exist between countries, and the size of the units commonly used for segregation studies in different national contexts varies widely. In some countries, such units have on average between 3000 and 6000 residents, such as the census tracts in the USA (Galster et al. 2000; Lichter et al. 2012) or neighbourhoods or postal code districts in the Netherlands (Hartog and Zorlu 2009; Musterd et al. 2012). Other countries make use of much smaller units, examples of which are wards and output areas in the UK (Manley and Van Ham 2012; Manley et al. 2015) and SAMS (Small Area Market Statistics) in Sweden (Musterd and Andersson 2005; Östh et al. 2014). Such differences in ways of measurement and size hinder reliable cross-contextual comparisons of segregation patterns and are referred to as the *modifiable areal unit problem* (MAUP) (Openshaw 1984; Malmberg et al. 2011; 2014). As a way to control for MAUP, Krupka (2007) compared segregation scores at different spatial scales and concluded that using smaller areas of analysis resulted in smaller differences between metropolitan areas and smaller towns.

The demand for multiscalar measurements of segregation has intensified over the past few years. Fowler (2016a, b) argued that segregation is a multiscalar phenomenon: it is not restricted to one single scale but is continuous across scales. Single scalar measurements may also ignore the fact that smaller units are embedded in larger spatial contexts. Within larger entities with low or moderate segregation levels, very strong concentrations may exist at smaller spatial scales, or vice versa. Focusing on only one spatial scale may overlook specific ethnic concentrations, which is why a multiscalar research design is more appropriate (Fowler 2016a, b). In a similar vein, focusing on areas with fixed borders may cause

over- or under-estimations of very specific concentrations occurring at the border of two administrative or statistical districts (Clark et al. 2015; Hedman and Andersson 2015). Jones et al. (2015) stressed that scale is important for understanding the causes and impact of segregation. In their study on ethnic segregation in London, the strongest concentrations of most ethnic groups were found at both the largest and the smallest scales: they were clustered into specific boroughs and within these boroughs they were concentrated in several smaller areas.

Besides methodological arguments for comparing different spatial scales, there are also theoretical arguments. Over the individual's life course, the size of the neighbourhood relevant to the individual may increase, and depending on the type of segregation, different scales may apply. The scale level at which the environment is most likely to influence personal outcomes depends strongly on the specific topic under study, and on population density, and also differs between age categories. For example, with respect to socialisation, the local level may be the most relevant scale level for children (Andersson and Malmberg 2015, p. 2119), whereas larger spatial scales become more important in later stages of the life cycle, when activities and social networks generally extend beyond neighbourhood borders (Andersson and Musterd 2010). An argument for focusing on more fine-grained units of segregation measurement was made by Clark et al. (2015): they stressed that the immediate environment of individual residential locations presumably has a larger impact on personal social or economic outcomes and household decisions than the population composition of the generally larger administrative or statistical districts (Clark et al. 2015).

A number of recent studies have presented possible solutions for these boundary and scale issues. Since increasingly, geocoded address information is available in European countries, scalable 'egocentric' or 'individualised' neighbourhoods can be constructed. These neighbourhoods are constructed as a buffer drawn around the exact residential location of an individual. The buffer consists of either a predefined distance radius (Reardon et al. 2008) or a predetermined number of one's k number of nearest neighbours (Andersson and Malmberg 2015; Östh et al. 2014). The resulting sample of individuals is subsequently used to compute aggregate statistics, measuring, for example, the proportion of a certain minority group in the neighbourhood population (Clark et al. 2015). The number of nearest neighbours within the buffer can vary, and these different sizes, referred to as 'k-levels', let the researcher generate 'individualised neighbourhoods' of different sizes as seen from the exact same location. The characteristics of the neighbourhoods can be studied, enabling analysing residential segregation from a multiscalar perspective.

According to Clark et al. (2015), individualised units at different scales help us to understand neighbourhood dynamics better, since they enable a link to be made between actual changing patterns of segregation and experiences of changing population compositions in individuals' residential locations. Using scalable individualised neighbourhoods based on k nearest neighbours, Andersson and Malmberg (2015) find that the effects of role models, norms and peer effects on educational outcomes are three times greater in the smallest individualised neighbourhoods than within administrative boundaries (SAMS) in Sweden. MacAllister et al. (2001) found similar effects in their study on voting behaviour

in the UK: significant differences in voting behaviour within social classes were detected at the smallest scale levels, according to the socioeconomic status of their individualised neighbourhood. Also, Chaix et al. (2005) found much stronger relationships between contextual deprivation and the prevalence of disorders in individualised areas of a smaller size than in administrative neighbourhoods.

4 Contributions of the ResSegr Project

The ResSegr project and the contributions in this special issue adopted a multiscalar approach to measuring segregation, using scalable individualised neighbourhoods. Instead of using measures based on administrative borders, neighbourhoods around each individual were formed, based on the number of neighbours with certain characteristics. Geocoded population register data were used, which implies that each address is coupled to a pair of geographical coordinates: the location on a north–south axis and the location on an east–west axis. All individual addresses were subsequently grouped into grids of 100 by 100 ms. From each 100 by 100 metre grid, a geographical information system named *EquiPop* found the nearest neighbours in adjacent grid cells, based on the coordinates for each individual (see Östh 2014 for a more detailed description of how this tool works). Technically, a geographical buffer was expanded around the location of each individual until this buffer contained a predetermined number of nearest neighbours. We used different scales, ranging from the 50 to the 400,000 nearest neighbours, in order to differentiate between small-scale and large-scale neighbourhoods. The proportion of group members (such as migrants) in those neighbourhoods was then calculated.

A major advantage considering individualised neighbourhoods is that it becomes possible to draw comparisons across countries while using the same methodology and similar spatial units. In the ResSegr project, we compared segregation levels and patterns in five European countries (Sweden, Denmark, the Netherlands, Belgium and Norway), four of which are included in the contributions in this special issue.

Quillian and Lagrange (2016) emphasise the importance of harmonising data structures and data processing. For confidentiality reasons, it was impossible to harmonise the data at the individual level. Instead, partners have used the same nearest neighbour approach, using the same EquiPop software (Östh et al. 2014), and agreed on a set of scale levels (number of closest neighbours) as well as definitions of variables (Nielsen et al. 2017). An advantage with this approach of measuring characteristics among the closest neighbours of individuals is the aggregated output, which is in accordance with confidentiality requirements. In a next step, data were further aggregated before being used in the comparative article (Andersson et al. this issue); we aggregated all individual neighbourhoods into percentiles ranging from the lowest to the highest proportions of neighbours with non-Europeans (Nielsen et al. 2017).

Studying segregation in an internationally comparative set-up helps with understanding the influence of structural factors (e.g. the housing market, welfare state system and spatial planning) on segregation levels and patterns. The five

countries included in the project all reflect different national and cultural backgrounds when it comes to overcoming inequality and how to deal with diversity in society. The involvement of the state in a wide variety of areas will influence segregation and social inclusion. Also, depending on the type of state, different area-based policies and programmes are implemented or favoured. The five countries in the project reflect this diversity and range from more liberal types of (welfare) states to conservative corporative types and more social democratic types of states (Esping-Andersen 1990). These different welfare types are of importance when studying segregation patterns, its causes and consequences. Furthermore, the countries have different national immigration policies, different histories of immigration, different housing for newcomers, and different employment possibilities for immigrants. Longstanding policy traditions among the countries will potentially lead to different patterns of socioeconomic segregation such as differences in segregation patterns of education and income.

In order to make progress from a cross-national perspective, we need to aim for comparative measures that allow us to study the above in more detail. In the following section, we illustrate with an example how scalable individualised neighbourhoods can be used to illustrate different segregation levels and patterns across countries, comparing the US context to the European countries included in the ResSegr project.

5 A Comparison of the ResSegr Countries and the us

In the following, we offer an explorative comparison of the ResSegr countries with the USA. We use the same method and approach used in the ResSegr project. Previously, most comparisons used data on cities. Here, we use data for entire countries and make comparisons across these countries.

We analyse non-European migrants (according to an agreed definition from ResSegr technical report, Nielsen et al. 2017) and compare their level of segregation with the segregation of blacks in the USA. Blacks are not migrants and may be more homogeneous as a group than the multifaceted non-European migrants in European countries. Blacks constituted 13%[2] of the population in the USA as a whole in 2010, and non-European migrants in our studied countries constitute 7.3%. Blacks and non-European migrants may share some experience of being discriminated against. Both groups are those found to exhibit the strongest spatial segregation in earlier studies (Massey and Denton 1993; van Kempen and Özüekren 1998). US tracts have on average about 3600 inhabitants, which compare to individualised neighbourhoods of one's 3200 closest neighbours in the four European countries.

The results from this individualised neighbourhood technique showed that the US black–white segregation is stronger than the level of segregation of non-European migrants in Belgium, Denmark, the Netherlands and Sweden. Table 1 shows that,

[2] Our estimated number in downloaded material, as well as calculated from Table 1. Population by Sex and Age, for Black Alone and White Alone, Not Hispanic: 2010, https://www2.census.gov/programs-surveys/demo/tables/race/2010/ppl-ba10/ba10tab1.xls.

Table 1 Concentration of non-European migrants in 3200 k for four countries and of the black population in US census tracts. Share minority in percentiles in intervals of 10–99% of the population in 2011

Percentile interval	BE k = 3200 (%)	DK k = 3200 (%)	NL k = 3200 (%)	SE k = 3200 (%)	US census tracts (%)
10	1.20	1.19	1.31	1.90	0.44
25	1.90	1.72	2.32	3.12	1.17
50	3.70	3.30	4.79	6.10	4.03
75	9.50	6.33	10.17	11.65	13.78
90	19.90	11.36	18.83	24.53	37.35
95	27.50	16.24	26.72	34.74	62.51
99	41.50	28.75	42.32	52.02	93.89

Table 2 Dissimilarity index for different numbers of closest neighbours, four countries and for US census tracts (average 3600 inhabitants)

K value	Belgium (%)	Denmark (%)	Netherlands (%)	Sweden (%)	US blacks
200	51.2	47.5	48.7	48.9	
400	49.8	45.2	46,9	47.7	
800	48.5	42.9	45,2	46.2	
1600	47.3	40.4	43.6	44.1	
3200	46.2	37.5	41.8	41.9	61.7%

despite the population-wise larger mean in US tracts, up to 25% of areas (percentile interval, Table 1) have very few black residents, 1.17%, whereas there is a larger proportion of non-European born in the ResSegr countries in 25% of the areas. In the USA, there is also a higher concentration of blacks in tracts, percentiles > 90 (Table 1) with between 37 and 94% black people. Compared to the results from European countries, segregation across areas is much higher in the USA.

Measured as unevenness in the dissimilarity index, the segregation of blacks is more pronounced in the USA than it is for non-European migrants in the four European countries (cf. Table 2). The dissimilarity index for Belgium comes closest to the US blacks' index of dissimilarity, being 46.2%, compared to 61.7% for the US.

Figure 1 shows under-representation in the neighbourhoods with low representation of non-European migrants and blacks. An equal representation everywhere, when a population is divided into *percentiles*, is 1% in every percentile bin to add up to 100% of that particular population. If all non-Europeans in a country were evenly distributed geographically, they would be represented by 1% in every percentile of the population. If they are less than 1%, they are under-represented, and if they represent more than 1% in one percentile, they are overrepresented, Fig. 2. For details, see Andersson et al. this issue.

Figure 1 shows an *under-representation* of blacks in the USA for more than 70% of the population's individualised neighbourhoods (share of population in *x*-axis, top of diagram equal to 1%). The second strongest under-representation is found among non-European migrants in Belgium: they are under-represented in neighbourhoods including almost 70% of the Belgian population. In the European countries, only 15% of the population experience a strong under-representation of non-Europeans (representation of only $< 0.2\%$) among their closest 3200 neighbours. A representation of 0.2 is one-fifth relative to what would be observed given an equal distribution across tracts. In contrast, 40% of the population the USA live in areas with only one-fifth of black representation ($< 0.2\%$).

Figure 2 depicts overrepresentation in about 70% and more of the neighbourhoods in all countries (overrepresentation is above 1% of population in the percentile-wise ranked neighbourhoods). Also, for more than 85% of the population arranged in percentiles the US overrepresentation 'takes off' compared to the European countries' curves. For example, about 10% (90th percentile) of the US population live in areas with one-third more blacks in them compared to an even distribution.

This is an explorative comparison of segregation between the European ResSegr countries and the USA, where caution is warranted in the way tracts vary around the mean of 3600 but in which we adjusted the number of closest neighbours to a similar amount of 3200 in the ResSegr countries. Larger areas in the USA are a precaution in the analysis against the conclusion of higher segregation in the USA. Typically, larger areas give space for more population diversity in them so that segregation compared to the population-wise smaller areas in the ResSegr countries would be expected to be less.

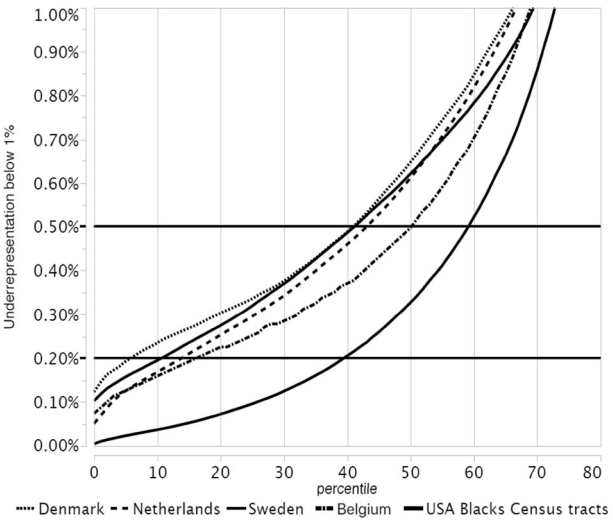

Fig. 1 Under-representation of non-European migrants in 1% bins in Belgium, Denmark, the Netherlands, and Sweden with 3200 closest neighbours and under-representation of black Americans in tracts in the USA. 0.50% represents half of the even distribution of 1% of non-Europeans or black Americans, 0.20% represents one-fifth of an even distribution (compare technique in Andersson et al., this issue)

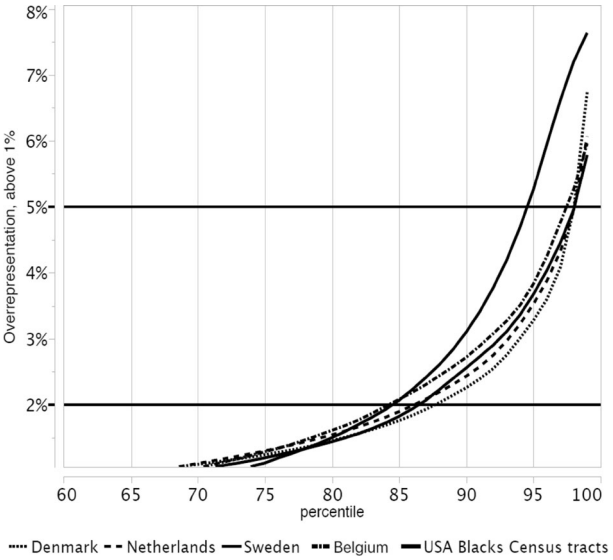

Fig. 2 Overrepresentation of non-European migrants in 1% bins in Belgium, Denmark, the Netherlands, and Sweden with 3200 closest neighbours and overrepresentation of black Americans in tracts in the USA. Only > 1% bins, that is bins of neighbourhoods with overrepresentation. (Compare technique in Andersson et al., this issue)

6 The Contributions of this Special Issue

This special issue of the *European Journal of Population* contains an individual-oriented perspective on residential segregation. It reports research from the ResSegr project financed by the *Joint Programme Initiative Urban Europe*. One of its motivations has been to show the possibilities in comparisons of segregation levels using different spatial scales. A second motivation is the use of individualised neighbourhoods. Taking people's actual neighbours as representing their neighbourhoods, we come closer to the lived environments of the people under study. High segregation among one's neighbours implies large differences in the day-to-day neighbourhood experienced by people, whereas low segregation among one's neighbours means small differences between neighbourhoods and hence similar experiences of living in neighbourhoods (Andersson and Malmberg 2018). Individualised neighbourhoods can be composite measures of several social characteristics of neighbours and at the same time take into consideration the scale of segregation in the neighbourhood's *k-level*, or population size.

A third motivation for this research is to encourage future comparative research. The work presented in this special issue is a contribution to the study of how differences in segregation emerge between countries. Similarities emerge across countries, despite these countries' different economic institutions, welfare systems, and housing markets. Belgium, Denmark, the Netherlands and Sweden showed more similar patterns of segregation than expected. What are the causes of these

similarities? Earlier studies of segregation in European cities and differences in national housing markets would suggest quite dissimilar segregation levels.

Three of the papers study a single national context, namely the Swedish, Dutch and Belgian contexts, and one study takes a comparative perspective across the Netherlands, Belgium, Sweden and Denmark. All contributions in the issue make use of individualised neighbourhoods. Characteristics of the neighbourhoods are calculated using individuals' k nearest neighbours with different k's used for different scales. For Sweden, the Netherlands, Belgium and Denmark, detailed geocoded information is available, which has made it possible to use uniform ways of segregation measurement in each of these countries. This enables comparisons across the four countries that are not (or at least to a lesser degree) affected by the methodological and theoretical issues related to scale and boundaries described above. Geocoded register data were used for Sweden, Denmark and the Netherlands and census data for Belgium for the year 2011. Each paper makes use of the geographical detail of the available data.

In their analysis of Swedish data, Bo Malmberg, Eva Andersson, Michael Nielsen, and Karen Haandrikman present findings on ethnic segregation from the Swedish context, focusing on both European and non-European migrants and including both urban and rural areas. Their paper studies how a growing and changing migrant population has affected the composition of Swedish neighbourhoods at different spatial scales. The study design combines several descriptive tools: percentile plots, aggregate segregation indices and maps based on a multiscalar classification of neighbourhood types. The analysis is based on Swedish geocoded individual-level register data for the years 1990, 1997, 2005, and 2012, which allow for computing and analysing the demographic composition of individualised neighbourhoods, ranging from the nearest 100 to the nearest 409,600 neighbours.

Bart Sleutjes, Helga de Valk and Jeroen Ooijevaar focus on ethnic segregation in the Dutch context and the role of spatial scale for segregation measurement. Their contribution compares two ways of measuring segregation: one based on static administrative spatial units and one based on individualised neighbourhoods at eleven spatial scales. Their main question is to what extent these scalable individualised neighbourhoods provide a more nuanced picture of segregation compared to static administrative units. The study uses population register data from 2011 in order to measure the segregation of the largest four non-Western foreign origin groups in the Netherlands: persons of Turkish, Moroccan, Surinamese or Antillean origin. Factor analyses present a picture of how the segregation patterns of these groups overlap at different spatial scales. In addition, isolation index scores have been compared for individualised and administrative neighbourhoods, taking the Amsterdam Metropolitan Area as an example.

Rafael Costa and Helga de Valk conducted a study on the overlap between socioeconomic and ethnic segregation in Belgium. The authors suggest that the effects of segregation are greatest when the concentration of ethnic groups is paired with socioeconomic inequalities. Their contribution aims to give a comprehensive picture of residential segregation with a high level of geographical detail, focusing on Belgium's three largest urban agglomerations: Brussels, Antwerp and Liege.

Their study pays attention to the links between socioeconomic and ethnic segregation, and investigates the role of spatial scale therein.

The final article is a comparative study, in which the authors, Eva Andersson, Bo Malmberg, Rafael Costa, Bart Sleutjes, Marcin Stonawski, and Helga de Valk compare levels of segregation for non-EU migrants in Sweden, Denmark, the Netherlands and Belgium. They compute comparative measures of segregation that are independent of existing geographical subdivisions and use aggregates for individualised neighbourhoods with different population counts in order to assess segregation patterns at small, medium and large geographical scales. The study distinguishes between *concentration*—the proportion of the local neighbourhood's population that consists of non-European migrants—and *representation*: the proportion of the *total* non-European migrant population that is living in a neighbourhood.

In sum, the papers take on a set of related problems in the field of residential segregation research. They make comparisons of segregation levels and patterns across countries, show the importance of considering scale levels and units of analysis, consider the degree of overlap between ethnic and socioeconomic segregation, and show the dynamics of segregation of migrant groups over time. The improvements in data techniques and precision of comparisons are important as research developments, but it is also hoped that research will be used to pinpoint the variation in lived experiences in different neighbourhoods, the variation in opportunities open to people in different neighbourhoods, and the harm brought to a society by residential segregation in terms of separation and reduced cohesion and trust.

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