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Remaking Urban Segregation: Processes of Income Sorting and Neighbourhood Change

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ABSTRACT

Segregation studies have mainly focused on urban structures as a whole or have discussed specific (gentrifying or renewing) neighbourhoods. The literature suggests that changes in segregation occur primarily through selective migration. In this paper, we follow up on recent work that has questioned these orthodoxies, suggesting that *in situ* social mobility, and entries to and exits from the city population should be taken into account as well, and that dynamics in all neighbourhoods should be considered. The paper traces the processes by which segregation changes for the cities of Amsterdam and The Hague for 1999–2006, using a longitudinal individual-level database covering the entire population. It extends previous work by looking at income rather than socio-economic status and by drilling down to the neighbourhood level. Applying an existing measure of segregation (Delta) in a novel way, the analysis focuses on changes in the spatial distribution of household income, measuring the relative contribution of a range of processes to changes in segregation. Results show that segregation rises in both cities but that different processes drive changes in each case. Furthermore, the aggregate change in segregation for each city masks a diversity of changes at the neighbourhood level, some of which tend to increase segregation while others tend to reduce it. Mapping these changes and the individual processes contributing to them shows that they have a distinct geography, which seems to be structured by historically specific trends in state and housing market context. © 2016 The Authors. *Population, Space and Place*. Published by John Wiley & Sons, Ltd.

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INTRODUCTION

Spatial segregation is one of the most basic characteristics of cities. Much evidence suggests that segregation matters for individual welfare, economic growth, and broader social cohesion. The neighbourhood effects literature, while not conclusive, provides a range of studies tracing impacts of living in high-poverty neighbourhoods on a range of welfare outcomes (Ellen & Turner, 1997; Galster *et al*., 2010; van Ham *et al*., 2012). Research on non-linear or threshold neighbourhood effects suggests that spatial patterning is more than a zero-sum game, with negative aggregate impacts for economic efficiency (Galster *et al*., 2015). It has also been suggested that segregation may affect social cohesion, for example, by reducing awareness of inequality and a commitment to the solidaristic institutions of the welfare state (Bailey *et al*., 2013).

The basic mechanisms underpinning economic segregation are rather clear. On the one hand, segregation emerges where individuals share preferences in location with others from their group, including a preference to live close to others from that group (Schelling, 1971). On the other, market-dominated housing systems sort people by

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income or wealth into distinct areas (Reardon & Bischoff, 2011) although it is important to acknowledge that the relationship between social inequality and socio-economic segregation is a complex one. First, choices related to household type, cultural background, and lifestyle preferences can cut across those based on income. Second, market processes are altered by diverse institutions of the welfare state (Musterd & Ostendorf, 1998; Maloutas & Fujita, 2012; Marcińczak *et al*., 2016). Both preferences and welfare regimes vary between places and over time.

Rather less attention has been given to understanding the processes by which spatial segregation changes. This is often assumed to occur entirely through selective residential mobility – an imbalance in the characteristics of those moving into or out of each neighbourhood (Dorling & Rees, 2003). Cities tend to be viewed as closed systems, while individuals are seen as having fixed characteristics, so the potential for inter-urban migration or *in situ* social mobility (changes in status for people who do not move) to reshape segregation is ignored. Over recent years, however, some new perspectives have emerged. In their studies of the process of gentrification, Van Criekingen and Decroly (2003), Teernstra (2014), Hochstenbach and Van Gent (2015), Hochstenbach *et al*., (2015), and McKinnish *et al*., (2010) showed the potential for *in situ* social mobility to drive change, challenging one of the three just-mentioned assumptions. Bailey (2012) challenged all three. His research highlighted the levels of social mobility and provided evidence that *in situ* mobility may be as important in driving change in segregation as selective migration. That work also highlights the scale of flows into and out of urban areas over the medium term.

The study by Bailey was limited to a single country (Scotland) and a single time period (1991–2001), had restricted measures of socio-economic status (notably no income data), and covered only a sample of the population (5%). The aim of this paper is to use the same analytical framework but to extend the analysis by using data from the Dutch System of Social Statistical Datasets (SSD), a longitudinal individual-level database covering the entire population in the period 1999–2006. First, the paper compares changes in segregation between two cities with rather different starting points: Amsterdam and The Hague. Second, it compares the processes by which household income is redistributed across each city. Third, and perhaps most importantly, the complete population coverage enables us to take the analysis down to the level of individual neighbourhoods, to examine the variations in change between neighbourhoods, and to explore the geography of the processes in each city.

LITERATURE REVIEW

Social-spatial patterns within a city can be attributed to a range of processes. These include individual-level features, such as the preference for certain dwellings and locations, and the extent to which individuals have been able to attain sufficient means to be able to realise these preferences. Individuals also tend to have social-spatial preferences aimed at social homogeneity; many people prefer to live close to other people who are like themselves (McPherson *et al*., 2001; Musterd *et al*., 2015). This clearly is in line with earlier work on the relationship between residential preferences and segregation outcomes, starting with Schelling (1971). In his seminal paper, he suggested that even small differences between group preferences could result in major segregation on aggregate. His ideas were empirically tested and elaborated, for example by Clark (1991). Fossett (2006) speculated that sustained segregation may have multiple causes, 'not only discrimination, but also social distance and preference dynamics' (p. 185), while Clark and Fossett (2008) argued 'that there is now a rigorous mathematical basis for the Schelling model and increasingly refined methods for simulating the impact of preferences and social distance dynamics' (p. 4114). These patterns are rendered more complex by the fact that they are not just socio-economically driven but also reflect independent demographic and cultural dimensions (Andersen, 2011).

Apart from individual-level conditions, structural conditions also play a role, and this has, for a long time, been the dominant way through which urban change has been approached. The character and position of the local urban economy will have major implications. It drives growth or decline with crucial effects for employment demand, and hence the social and professional characteristics of the local population. Some urban economies are more unequal than others, and this is reflected in space (Sassen, 1991). Walks (2001) has argued that such a relationship may be very complex when

DOI: 10.1002/psp

brought down to the neighbourhood level: 'the social ecology of the post-Fordist/global city may be characterised by increasing social complexity and differentiation among, between and within neighbourhoods' (p. 440).

Historically grown structures of the housing market will also have an influence. States with a long tradition as social democratic welfare regimes will likely have larger social housing stocks compared with more liberal welfare regimes. Deregulation generally results in higher levels of segregation (Musterd & Ostendorf, 1998; Reardon & Bischoff, 2011; Boterman & Van Gent, 2014; Marcińczak *et al*., 2015). Tenure structures and house price structures may also be very different between urban regions. Because the entire socio-economic character of the city will be related to such urban histories, cities will show different spatial structures in these respects as well, which will, again, eventually be reflected in the social-spatial patterns.

With regard to the impact of the type of welfare regime, we must also consider aspects that do not relate directly to housing or to the spatial organisation of housing. As clarified by Esping-Andersen (1990), states may be more or less active in terms of redistributing wealth, through the impact of policy on the income distribution, prices, or public services, such as schools or health services. They create the conditions for individual-level differences in terms of social positions, and the opportunities for changing such positions; and they create the conditions for structural differences in cities, which impact on residential mobility and migration processes (Hastings, 2009). Marcińczak *et al*. (2016, p. 378) concluded in their study on socio-economic segregation in European capital cities that processes of globalisation are triggering different levels of connectedness and international migration of affluent and poorer sections of the population in different cities; the restructuring of the economy and the labour market also impacts differently in cities with different development paths; increasingly, neo-liberal politics and – in some cities – declining investments in the social rental housing sector are important processes as well, which manifest themselves in different ways and with different rigour. Yet, all of these processes can be regarded to impact upon segregation.

Studies that have addressed neighbourhood change often assumed that these would be mainly driven by selective residential mobility; the characteristics of those moving in and out of neighbourhoods are seen as the main factors of change (Dorling & Rees, 2003). Inter-urban migration and *in situ* social mobility tend to be ignored – or are assumed to be important only as a driver of selective residential mobility (Cheshire *et al*., 2003). In the current literature on urban social inequality, the description of social-spatial processes has received a new impulse through a more analytical approach of the description of segregation. This literature makes efforts to 'deconstruct' urban social processes, bringing them back to essential components that together produce changes in social patterns (Bailey, 2012). Social structures in neighbourhoods can be seen as the product of people moving within the city; their attributes may differ with impacts on social composition. In addition, however, those who do not move, and those who move in to or out of the city, produce change. Moreover, people die and thus 'leave' the neighbourhood or they 'join' the adult population through ageing, and both again may affect the characteristics of the place.

This literature is, however, still rather limited. In the introduction, we already referred to the neighbourhood studies by Teernstra (2014) and Hochstenbach and Van Gent (2015), which were able to show that much income gain in urban neighbourhoods was in fact 'produced' by *in situ* processes: by social mobility of individuals who remained in these neighbourhoods. In the US, McKinnish and colleagues (2010) suggested similar processes were driving gentrification processes there. One of the interpretations was that stayers might 'experience disproportionate income gains' (McKinnish *et al*., 2010, p. 189). This seems to be particularly a driver for change in neighbourhoods that have the proper set of conditions to enable marginal gentrification (Van Criekingen & Decroly, 2003; Van Criekingen, 2010; Hochstenbach *et al*., 2015). Marginal gentrifiers have low incomes when they enter a 'gentrifyable' neighbourhood and then may stay there for a longer period of time, likely experiencing upward social mobility. In this study, we do not intend to relate such processes to the gentrification debate per se, because such processes may occur in all neighbourhoods and many of the changes will not just result in upwardly mobile processes either. What is important, however, is to pay more attention to the various components of social change at the neighbourhood level.

DOI: 10.1002/psp

While we may benefit from efforts to understand urban social segregation at the level as just sketched, and search for individual or structural explanations for variations in segregation, the issue of segregation is frequently approached with an ambition to better define and describe the process at the level of the entire city. This, obviously, started with the work of Duncan and Duncan (1955) on the dissimilarity index, soon followed by others who designed additional measures that focused on different aspects of segregation. Initially, the measures focused on the comparison of two categories, but later on, the scope widened. Massey and Denton (1988) brought the range of measures together in a system of measurement methods, including measures for levels of unevenness (such as the index of dissimilarity, Gini index, and entropy index), exposure (including the index of isolation), and various measures of concentration, centralisation, and clustering. All can be used to measure different aspects of segregation, although they sometimes overlap.

There has been much discussion about these measures. Much debate relates to the size of the spatial unit, which has an impact on the level of segregation. In addition, the form and location of the area and its positioning relative to other areas has received ample attention, as well as a range of other technical aspects. This resulted in the development of more complex measures with a spatial character (Wong, 2008). The most recent efforts aim at using the rich information and more detailed geographies that have become available in various contexts (Johnston *et al*., 2008), yet none of these appear to focus on deconstructing the processes of segregation. All of these factors may help to change or reorder the positions of neighbourhoods, and this may happen when segregation is decreasing, increasing, or even staying stable for the system as a whole.

METHODS

Data

This study uses data from the SSD, made available by Statistics Netherlands. The SSD contains individual-level register data on the entire population of the Netherlands, including data on income from work, benefits, student subsidies, and pensions, as well as other characteristics such as neighbourhood of residence, ethnicity, age, gender, and household relationships for the period 1999 to 2006. There is no data for unregistered immigrants, and some very limited numbers of foreign diplomatic and military personnel are removed from the data. Income and benefits data are derived from Dutch tax and benefit registers. Individuals living in the Netherlands but receiving foreign benefits or paying income taxes abroad have missing or underestimated values on income but again with very minimal impact on this study. The dataset is compiled from a range of registers, merged by Statistics Netherlands on the basis of unique personal identification codes but 'anonymised' before release to researchers.

The paper focuses on two cities defined in terms of their administrative boundaries: Amsterdam and The Hague. Amsterdam is the largest and most diverse city in the Netherlands. It is the centre of finance and business, as well as of a rapidly growing set of creative industries. In terms of population, it grew slightly during the period of research, with the total population rising 2%, a result of an increase in the numbers below 20 years (by 6%) and 20–65 years (by 3%), but a decline of those 65+ (down 8%). The Hague is the centre of (international) law and government. While the city has long been known for its stability, over the research period, it showed remarkable population dynamics. The total population increased by 8%, mainly caused by a strong increase in the numbers under 20 (up 12%) and 20–65 years (up 11%), while the elderly lost 10% (Statistics Netherlands 2015). The Hague is known for its relatively high levels of segregation, and the city continues to show figures that are higher than those in the other large Dutch cities, including Amsterdam (Gijsbers & Dagevos, 2009).

The comparisons between Amsterdam and The Hague are made for the entire adult population (18+) present in either 1999 or 2006. This encompasses everyone who could contribute to the income situation in the urban neighbourhoods at each period. Incomes in 1999 are adjusted so that the total income for each city is the same in 1999 and 2006. This prevents inflation potentially distorting the picture of change.

We initially use four measures of household incomes: income from employment only (before taxes); income from employment and benefits combined, before and after taxes; and total

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income including income from self-employment or businesses (before taxes). In later analyses, we focus on the last of the four as providing the single most complete picture of income. In a very small number of cases, total incomes are negative because businesses that those people own have recorded a loss. Where such individuals have an income from employment and/or from benefits, we take that figure instead. Otherwise, we record negative incomes to zero on the basis that households must have had some income in order to survive; the negative recorded income represents a loss of wealth. Conversely, some individuals have extremely high incomes, which have the potential to unduly influence the analysis of change, particularly when looking at individual neighbourhoods. We have experimented with a range of thresholds for 'trimming' these extremes. This changes the details at the margin but does not affect the general structure of the results. In this paper, we report results based on removing people with an income in the top 0.1% at either time period.

Neighbourhood Units

This paper uses the neighbourhood units provided by Statistics Netherlands. Although it is widely recognised that the scale and nature of neighbourhood boundaries may impact on measures of segregation (Östh *et al*., 2015), there is no choice in this case. A predetermined set of units is the only option Statistics Netherlands offers, in order to minimise disclosure risks on what is relatively sensitive data. On the positive side, the units were determined in cooperation with local municipalities and are generally socially and physically homogeneous areas, which are clearly bounded by main roads, railways, or waterways. In a small number of cases, the neighbourhood boundaries altered between 1999 and 2006, or the neighbourhood only existed in 2006. These neighbourhoods are excluded, so the study is based only on those with consistent boundaries over time. We can be confident therefore that, for each neighbourhood, a change in characteristics is not driven by boundary changes and, for each individual, a change of neighbourhood represents a change in address. On this basis, Amsterdam has 93 neighbourhoods with an average 18+ population of 5700, while The Hague has 91 neighbourhoods with an average of 3500.

Segregation Measures

Many measures of segregation have been developed for use with categorical data (Massey & Denton 1988). It is these that were employed in previous work on processes of change in segregation; Bailey (2012), for example, used dissimilarity and isolation indices. We could have employed the same measures by collapsing our continuous measures of income into binary categories, but this throws away a great deal of information. We therefore use two alternative measures, Gini and Delta.

The Gini coefficient is widely used to measure national or regional household income inequality, but it can also be applied at the neighbourhood level. In this paper, we use it for both: household income inequality for each city and neighbourhood income inequality or segregation. In the latter case, the Gini coefficient measures the extent to which income is more or less equally shared between neighbourhoods, taking account of the population of each.

The Gini coefficient is built from the cumulative income distribution, not from the characteristics of each neighbourhood. We cannot therefore disaggregate the overall index to look at each neighbourhood's contribution nor use it to understand how processes of change vary between places. We can produce something that is closely related to Gini, however, by adapting one of the measures of concentration (Delta) discussed in Massey and Denton's (1988) review. They define concentration as the extent to which the physical area of the city is equally distributed across the population in each neighbourhood. We look instead at how the total income of the city is distributed across the population in each neighbourhood. For each neighbourhood i, we calculate Delta_i as the difference between the neighbourhood's share of city income and its share of city population:

$$\text{Delta}_i = [t_i/T - x_i/X]$$

t_i - total income for neighbourhood i

T - total income for city

x_i - population of neighbourhood i

X - total population of the city

For the city as a whole, Delta is given by

$$\text{Delta} = \tfrac{1}{2}\sum|[t_i/T - x_i/X]|$$

Delta is analogous to the dissimilarity index. Dissimilarity compares an area's share of group

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x with its share of group y, whereas Delta compares the distribution of people with the distribution of income. For an individual neighbourhood, a rise in Delta_i indicates that the residents are becoming more affluent (on average). Furthermore, there is a direct mathematical relationship between Delta and Gini as applied to income segregation, as both are derived from the same segregation curve; Duncan and Duncan (1955) established the relationship in their discussion of dissimilarity and Gini.

For the measurement of city-level income inequality (using Gini), household relationships matter because the measures are based on total income for each household. These measures do not capture inequality in access to resources within each household, but they are affected by processes of household formation or dissolution. For the measurement of neighbourhood income segregation (using Gini and Delta), measures are based on total income for each neighbourhood. Any inequality within the neighbourhood is correspondingly ignored, so they are unaffected by household formation or dissolution.

Analytical Approach

The paper aims to identify the processes by which spatial segregation changes. The starting point is the level of segregation of the population 18 or over in 1999, and the end point is the level in 2006. Following Bailey (2012), three groups of processes contribute to the change: exits from the adult population, change for adults present at both periods (referred to as the 'core group'), and entries to the adult population (Fig. 1). Exits occur where people present in 1999 are no longer recorded as part of the population of the city in 2006. Some exits occur through deaths between 1999 and 2006; others occur when people move out of the city. For the core group, change in segregation may occur where patterns of residential mobility are socially selective or where patterns of social mobility for non-movers are spatially selective; the latter termed *in situ* social mobility. Finally, change occurs through new entries to the population over 18. Some young people present in the city but under 18 in 1999 age into our population of interest. Other people already over 18 in 1999 but living elsewhere move into the city. A third group comprises those under 18 and not in the city in 1999. These could be counted either with the 'ageing in' group or with the 'moving in' group. Here, we identify them as a separate stream.

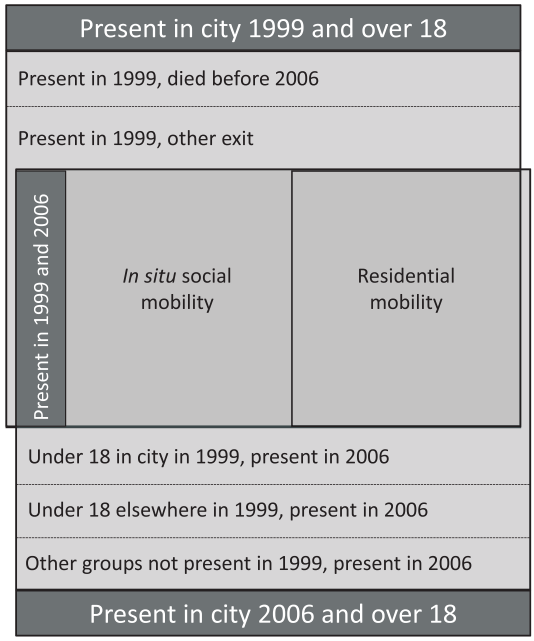

Figure 1. Processes of change in spatial segregation.

To assess the effect that each individual process has on spatial segregation, we measure the level of segregation 'before' that process has occurred and again 'after'. For example, with the first process (deaths), we measure the segregation level for the whole population present in 1999 and then again with the records for those who died before 2006 removed, but all other characteristics unchanged.

FINDINGS

Scale of Flows

Table 1 demonstrates the very open and fluid nature of the two urban systems – a feature often underestimated in urban theorising and analysis. Almost one-third of the population in 1999 was no longer present in each city by 2006, and a similar proportion of the 2006 population had not been present in 1999. Because the exit flow is greater than the entry flow in each case, the net effect is a slight decline in population (down 2% and 6% for Amsterdam and The Hague, respectively). These declines contrast with the growth in both cities' populations noted in the preceding

DOI: 10.1002/psp

Table 1. Scale of flows for the two cities – 1999 to 2006.

	Amsterdam	The Hague
Exits (%)	30	33
Deaths	8	11
Outmigration	22	23
Entries (%)	29	29
Age in from city	6	7
Age in/move in	5	4
In-migrants	18	18
Net population change (%)	−2	−6
% of core group who move (%)	30	34

Source: System of Social Statistical Datasets. 'Entries' and 'exits' are expressed as percentages of the population 18+ present in 1999 and 2006, respectively.

text. The difference is due to the exclusion here of both under-18s (growing rapidly in both cities) and the 'new neighbourhoods', which did not exist in 1999, which, by definition, have seen population growth. For the 'core' group (those present in the city at both time periods), the table also shows that about one-third moved between neighbourhoods. Exits are made up of deaths and outmigration. Amsterdam's lower exit rate arises because of its lower death rate, indicating a younger population profile.

Changing Income Inequality at the City Level

Before looking at spatial segregation, Table 2 shows changes in income inequality at the household level. It reports the Gini coefficient for each city for the four income measures. Inequality appears greatest if we look at gross income from work, as we would expect. Once state benefits and other transfers such as state and private pensions are taken into account, inequality is markedly lower and becomes more so once the effects of tax are factored in as well. Gross total income is distributed slightly more equally than gross income from work and benefits, implying that much of the income from self-employment flows to people who have relatively few other income sources.

Income inequality is the same in the two cities if we look only at gross income from work, but, on the other three measures, it is slightly higher in Amsterdam in both periods. This implies that the tax and benefits system does less to reduce inequality there. This may reflect the presence in Amsterdam of more people who are ineligible for welfare benefits (such as students) or the presence in The Hague of more people for whom benefits and pension transfers are more important, perhaps reflecting the older population profile of that city.

In both cities, income inequality at the household level rose between 1999 and 2006. There was little growth in the inequality of gross income from work but rather more in incomes that include benefits. This indicates that the value of benefits and other state transfers was being eroded over this period compared with the value of income from work.

Changing Spatial Segregation

Gini coefficients at the neighbourhood level are much lower than those at the household level (Table 3), as we would expect: as we move to larger aggregations, inequality has to decline. The relative differences between the measures are very similar to those for the household level. The coefficients are higher in The Hague, but

Table 2. Household income inequality (Gini coefficient) in the two cities by type of income, 1999 and 2006.

	Work (gross)	Work + benefits (gross)	Work + benefits (net)	Total (gross)
Amsterdam				
1999	66	45	40	43
2006	68	49	44	48
Change %	+3	+9	+10	+10
The Hague				
1999	66	42	38	42
2006	69	46	41	45
Change %	+3	+8	+10	+9

Source: System of Social Statistical Datasets. People with an income in the top 0.1% at either period excluded.

DOI: 10.1002/psp

Table 3. Income segregation (Gini coefficient and Delta) in the two cities at the neighbourhood level, 1999 and 2006.

	Gini			Delta		
	Work + benefits (gross)	Work + benefits (net)	Total (gross)	Work + benefits (gross)	Work + benefits (net)	Total (gross)
Amsterdam						
1999	10.1	7.8	10.9	7.4	5.7	7.9
2006	12.8	10.2	13.4	9.5	7.6	10.0
Change in points	+2.7	+2.4	+2.5	+2.1	+1.9	+2.1
The Hague						
1999	13.7	11.1	13.8	9.7	8.0	9.9
2006	16.9	14.1	17.1	12.0	10.0	12.4
Change in points	+3.2	+2.9	+3.3	+2.3	+2.0	+2.5

Source: System of Social Statistical Datasets. People with an income in the top 0.1% at either period excluded.

we should be wary of seeing this as an indication of greater segregation; neighbourhood units in The Hague are significantly smaller. In both cities, we can say that spatial segregation increases over time and by similar amounts. Table 3 also compares Gini coefficients with the Delta measure used in the neighbourhood analysis in the succeeding text. All the features noted with the Gini coefficient are repeated with Delta, which is as expected given the mathematical connection between the two measures noted in the preceding text.

Processes of Change in Segregation

Table 4 shows how much each process contributes to changes in segregation in each city, using the Delta measure of inequality applied to the total income measure; the results are very similar using other combinations of measures. Looking at the three broad groups of processes (exits, entries, and change for the core group), we see significant differences between the two cities. In Amsterdam, change in segregation is driven primarily by the core population. Entry flows are also important, but exit flows play little role. In The Hague, however, change is dominated by entry flows with exit and core flows both important but clearly secondary.

Looking at the more detailed processes in Amsterdam, residential mobility is the reason the core group contributes to increased segregation, with in-movers having the next largest effect although the entry moves of those who are also turning 18 in our research period ('age in, from outside') offset this to some extent. In The Hague, it is in-movers that dominate with no similar offsetting effect. It is worth reinforcing here that the effects of any process occur in complex ways. For example, residential mobility increases segregation when richer people tend to leave poorer neighbourhoods but also when poorer people move away from more affluent neighbourhoods. Similarly, in-movers can widen segregation either by richer people moving into neighbourhoods with above-average incomes (provided their incomes exceed the existing average) or by poorer people moving into poorer neighbourhoods (with the same caveat).

A Typology of Neighbourhood Change

One advantage of Delta over Gini is that the contribution that each neighbourhood makes to the total index can be identified separately, so we can disaggregate changes down to neighbourhood level. This also allows us to see changes that are hidden when we only consider aggregate segregation for the city as a whole. Segregation assesses whether neighbourhoods are pulling apart or moving together, but, within these changes, we can also observe the reordering of neighbourhoods – the tendency for some poorer neighbourhood to become richer and vice versa. Figure 2 compares each neighbourhood's income shares in 1999 with its change in income share between 1999 and 2006. For both cities, there are neighbourhoods in all four quadrants, giving four types. The two types top-

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Table 4. Changes in segregation by process – Amsterdam and The Hague.

	Amsterdam	The Hague
Delta in 1999	7.9	9.9
Changes due to:		
Exit	0.1	0.6
Death	0.1	0.2
Outmigration	−0.1	0.3
Core	1.2	0.5
In situ social mobility	0.1	0.2
Residential mobility	1.2	0.2
Entry	0.6	1.5
Age in, in city	0.4	0.2
Age in, from outside	−0.3	0.0
In-migration	0.6	1.2
Delta in 2006	10.0	12.4
Change 1999–2006	+2.1	+2.5

Source: System of Social Statistical Datasets. People with an income in the top 0.1% at either period excluded.

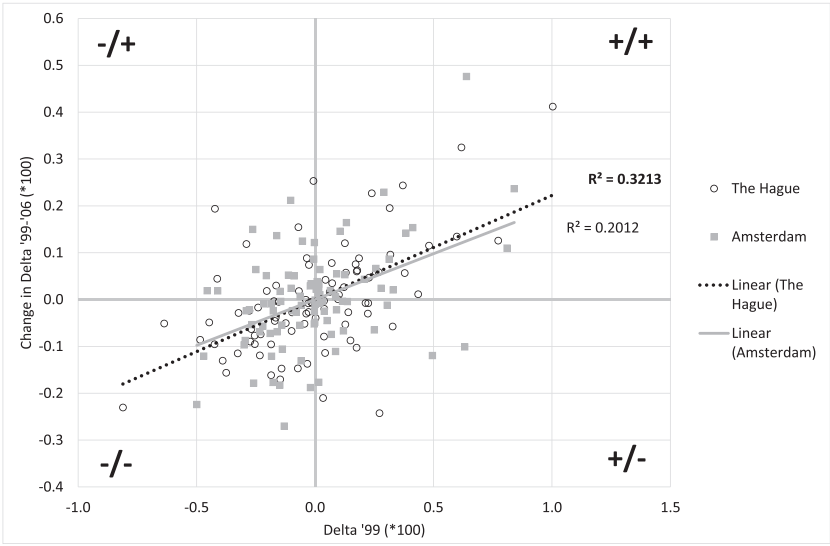

Figure 2. Neighbourhood income share in 1999 versus change – Amsterdam and The Hague.

right and bottom-left have changes that contribute to increasing segregation – they start either with above-average income shares and see these increase (labelled '+/+'), or they start with below-average incomes and see them decrease ('−/−'). We term these 'polarising neighbourhoods'. The other two types contribute to reducing segregation because they either had below-average shares of income initially but saw these rise ('−/+') or were above average initially but with incomes falling ('+/−'). We might term these 'reordering neighbourhoods'.

There is slightly more correlation between initial incomes levels and change in The Hague than in Amsterdam, but in both cities, the proportion of the variance explained by the starting position (as shown by the R^2) is relatively low. There is not just a pattern of rich neighbourhoods getting richer and poor getting poorer but also considerable movement within

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the overall structure. This is particularly so in Amsterdam where 36 out of 93 neighbourhoods are 'reordering', compared with 25 out of 91 in The Hague.

The Geography of Neighbourhood Types

Figures 3 and 4 map the four types of neighbourhood for each city. Differences are mostly related to housing market characteristics and state interventions (Teernstra & Van Gent, 2012). Looking at Amsterdam, the overall picture could be summarised as increasing income shares in the older, inner neighbourhoods. These include middle-class neighbourhoods like Middenmeer, newly built Eastern Docklands or Rivierenbuurt, and highly affluent neighbourhoods such as the Canal Belt and Oud-Zuid ('Old South'). They also include poorer areas, which are gentrification neighbourhoods close to the historic city centre (see also Hochstenbach & Van Gent, 2015). By contrast, outer areas with falling income shares include poorer areas found in the highly urbanised post-war areas in the western and southern parts of town and north of the IJ estuary as well as richer post-war suburban neighbourhoods, which were once relatively affluent but are now experiencing housing market decline due to newer suburban alternatives. There are of course some exceptions to the general pattern. For example, there are some centrally located neighbourhoods characterised by high shares of social housing, which show decreasing deltas.

In The Hague, the initial picture in 1999 is characterised by a marked income divide across a line running from north-east to south-west. To the north and west, the neighbourhoods almost all have above-average income, while to the south and east, they almost all have below average. The latter include some of the poorest neighbourhoods in the Netherlands (notably Transvaal and Schildersbuurt). The pattern of change is rather different, however, with rising income shares largely confined to neighbourhoods in the area north of the city centre but on both sides of this line. This includes more affluent areas with villas and townhouses along with some poorer but 'reordering' neighbourhoods, including areas that were undergoing urban renewal at the time, as well as several centrally located areas undergoing gentrification. Like Amsterdam, richer suburban neighbourhoods from the 1970s and 1908s to the south-west are experiencing relative housing market decline and falling income shares along with poorer pre-war and post-war areas in the south.

Figure 3. Four neighbourhood types – Amsterdam.

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Figure 4. Four neighbourhood types – The Hague.

Processes of Change at Neighbourhood Level

Figure 5 shows how the processes driving change vary between the four types of neighbourhood; entry and exit processes have been collapsed for simplicity. In Amsterdam, residential mobility is the dominant influence in all four types. In the polarising neighbourhoods, its effects are reinforced by entries (in-movers). These two processes were dominant in driving change in segregation for the city as a whole (Table 4). In the reordering neighbourhoods, however, the effects of in-movers are either reduced or cancelled out by the effects of exits (out-movers), while *in situ* social mobility plays a much greater role. In particular, the poorer neighbourhoods that are becoming more affluent are benefitting from the upward mobility of existing residents who choose to remain.

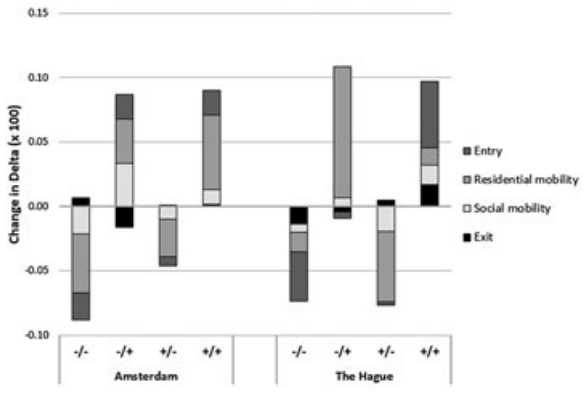

Figure 5. Processes of change by neighbourhood type – Amsterdam and The Hague.

Figures 6 and 7 map the effects of residential mobility and social mobility in Amsterdam. They show that most of the inner areas have this 'double effect' of income gains through both processes. Discrepancies may be explained by renewal (positive effect for residential mobility). Also, a few peripheral areas with suburban housing built in the late 1980s and early 1990 still see an increase in income shares from *in situ* social mobility but a loss through residential mobility. Lastly, very affluent areas in Oud-Zuid see a negative effect of *in situ* social mobility and a positive effect from residential mobility. This may be explained by the older age structure in these areas as incomes tend to rise more rapidly in the early stages of a career while retirement generally comes with a drop in income.

By contrast, in The Hague, entries (predominantly in-movers to the city) are a strong influence only in the polarising neighbourhoods where they act to increase segregation. In Table 4, we saw that residential mobility has very little

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Figure 6. The effect of residential mobility on change in income share – Amsterdam.

Figure 7. The effect of *in situ* social mobility on change in income share – Amsterdam.

impact on segregation in The Hague and that is apparent here as well. In this city, its effect is confined to the reordering neighbourhoods. Figure 8 shows the effect of in-movers at neighbourhood level. The pattern reflects the overall picture of income change from Figure 4, with the largest gains in income shares concentrated in neighbourhoods north of the inner city. By contrast, residential mobility is the key process in the reordering neighbourhoods. In some cases, it seems to be triggered by neighbourhood renewal going on at the time (notably in south of Transvaal, on

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Figure 8. The effect of in-migration on change in income share – The Hague.

the coast, and in a few of the poorer southern neighbourhoods). In contrast to Amsterdam, *in situ* social mobility plays only a marginal role in The Hague (e.g. Valkenboskwartier and city centre).

CONCLUSIONS

In this paper, we demonstrate a new approach to understanding how urban segregation gets remade. Extending Bailey's (2012) approach, we show how household income is reallocated across the neighbourhoods of two Dutch cities in the period 1999 to 2006, using longitudinal individual-level data for the whole population. We show how much segregation changed in each city as well as the processes that underpinned this. Going beyond earlier analyses, we examine variations at the neighbourhood level, constructing a typology of neighbourhoods based on these changes, exploring the geography of this typology and identifying the role of different processes in explaining neighbourhood trajectories.

This paper therefore makes a number of important contributions to our understanding of how socio-spatial segregation changes over time. First of all, it is clear that there is a very high degree of churn in urban populations, at least in these two cities. In each, a third of the population left within the 7-year period and were replaced by an equal number. These high levels of population dynamics underpin segregation, in some cases contributing to change but mostly to sustaining existing patterns (Musterd *et al*., 2015). Indeed, given this level of change, one might argue that the degree of continuity in segregation is the most notable feature.

Nevertheless, we also show that segregation changes and that the patterns and processes of change vary between cities, even within the same country. Both our cities experienced increasing income segregation at the household and neighbourhood levels, but The Hague saw sharper increases than Amsterdam. The sorting processes underpinning this were rather different. In Amsterdam, residential mobility within the city and in-migration were the dominant processes, while in The Hague, it was mainly in-migration. These findings support insights gained from recent social-spatial research in which – among other things – *in situ* social mobility processes were brought forward as important dynamics for understanding urban social change, particularly in gentrifying neighbourhoods (Van Criekingen & Decroly, 2003; Teernstra, 2014; Hochstenbach *et al*., 2015).

The examination of change at the neighbourhood scale reveals much greater fluidity than the

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aggregate, city-level picture suggests. Our typology distinguishes '*polarising* neighbourhoods' from '*reordering* neighbourhoods'. The former contribute to increased segregation, while the latter contribute to reducing levels of segregation and to moves within the existing neighbourhood hierarchy. Not only did the balance in types vary between the two cities, but also the processes that created the types did too. In Amsterdam, for example, reordering neighbourhoods arose primarily from *in situ* social mobility, but in The Hague, it was mainly residential mobility that drove reordering, in large part due to renewal efforts. These processes seem to be the outcome of contextually and historically specific processes like gentrification and renewal.

Mapping neighbourhood changes revealed distinctive geographies, which, in both cities, related to readily recognisable housing market structures. Amsterdam's concentric structure emerges with more wealthy areas in the centre and at the outmost periphery, as does The Hague's North–South divide. Indeed, trends in segregation in Amsterdam are more pronounced when a coarser scale is used (Boterman & Van Gent, 2015). At the same time, variations at the neighbourhood level can often be explained by government interventions (e.g. privatisation, renewal, or new development) or by the presence of particular types of housing for specific populations (e.g. concentrations of student housing or elderly homes, and, with residualisation continuing, social housing). We know that using a finer scale of neighbourhood units increases measures of segregation, and we may speculate that smaller units here would reveal more variance, and more 'polarising' and 'reordering'.

Overall, this broader geography suggests that a specific kind of long-term urban change is underway. Central cities and already affluent suburbs are becoming richer, while outer areas dominated by post-war housing are becoming poorer. In addition to general welfare arrangements, housing market regulations, and economic cycles, this trend of rising urban inequality is also slowed or stalled by the early gentrification of several poorer inner areas as well as relative housing market decline for some more affluent outer areas. As we have seen, this is particularly the case in Amsterdam. This reordering may eventually imply circular processes of movement up and down, or a longer-term restructuring in the system of neighbourhoods. At the moment, the 'gentrifying' older inner neighbourhoods are becoming less poor, but there may well come a point when their incomes rise above average and their continued change then acts to increase segregation.

In this paper, we were able to provide only tentative explanations as to why different processes are operating in different neighbourhoods and cities. The role of specific housing market contexts of the two cities indicate that historically shaped demand-side and supply-side factors appear to be relevant for such understanding (cf. Brown & Chung, 2006). Nevertheless, even though more research is required, understanding the differentiated impact of various sorting processes arguably provides substantial new input for ongoing discussions on urban socio-spatial change and to the body of knowledge on segregation overall.

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NOTES

(1) We should note that some of these neighbourhoods may contribute to increased segregation if the change in Delta is very high, but such cases are rare and are ignored here.

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