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ETHNIC CONCENTRATION AREAS IN NEIGHBOURHOOD PERSPECTIVE IN ENSCHEDE, THE NETHERLANDS

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ABSTRACT

Previous studies suggest that measuring ethnic segregation at a disaggregated level allows capturing variability of ethnic concentration areas within a city. However, many ignore the relative locations of each neighbourhood to identify ethnic concentration areas. It causes misidentification of ethnic concentration areas. Using the 2009 population data of Enschede, this study investigated the concentration areas at postcode level. The "scale of the neighbourhood" represents the extent of concentration influenced by population in neighbouring postcodes. Using composite population at different scales of neighbourhood, it was revealed that concentration areas at sub-city level are characterized by isolation and clustering dimensions. Few postcodes are Turkish or Moroccan concentration areas which are located outside the city center. Small number of cluster and isolated area indicates that the ethnic concentration in Enschede is relatively low. The study has advanced the hypothesis about segregation measurement, that spatial proximity to neighbouring areas has a large impact on variability of ethnic segregation.

Key words: ethnic segregation, concentration area, isolated area, cluster area, neighbourhood perspective, Enschede

ABSTRAK

Banyak studi menyatakan bahwa pengukuran segregasi etnis pada tingkat rinci dapat menggambarkan variabilitas area konsentrasi dalam suatu kota. Namun, banyak studi mengesampingkan lokasi di lingkungan sekitar untuk mengidentifikasi area konsentrasi. Hal itu menyebabkan kesalahan dalam mengidentifikasi konsentrasi area. Studi ini bertujuan mengidentifikasi area konsentrasi pada tingkat area kodepos dengan menggunakan data populasi Kota Enschede tahun 2009. "Skala Lingkungan" digunakan untuk mewakili luasan konsentrasi yang terpengaruh akibat kumpulan populasi tertentu di sekitar areanya. Beberapa area kodepos yang terletak di luar pusat kota merupakan area konsentrasi keturunan Turki atau Moroko. Sedikitnya jumlah area terisolasi dan area klaster mengindikasikan bahwa konsentrasi etnis di Enschede adalah rendah. Studi ini telah memutakhirkan hipotesis mengenai pengukuran segregasi, dimana jarak menuju area sekitar mempunyai dampak besar pada variabilitas dari segregasi etnis.

Kata kunci: segregasi etnis, area konsentrasi, area terisolasi, area klaster, perspektif lingkungan, Enschede

INTRODUCTION

Many government European cities are characterized by the diversity of ethnic groups and their spatial concentration. Ethnic immigrants started to arrive to the European Union since the open door policy of the 1950s [*Edgar, Doherty, and Meert*, 2004] and they mostly came from developing countries. In the Netherlands, the influx of Turkish and Moroccan immigrants (among others) in older industrial cities happened due to the demand for unskilled work [*Blauw*, 1991]. While well-trained native Dutch refused to take the jobs, labour immigrants saw them as opportunities for well-paid jobs that were unavailable in their home countries.

These ethnic immigrants settled in different parts of the urban area but tended to concentrate in just a few neighbourhoods. This spatial concentration is usually referred as residential segregation particularly when an ethnic group live to some degree separated from the rest of population [*Yang*, 2000]. Even though ethnic segregation level is more modest in Europe compared to the US, the number of ethnic member is still increasing in European cities [*Edgar et al.*, 2004; *Musterd*, 2005]. For example in Enschede, the Netherlands, the growth of ethnic immigrants in 1997 to 2009 is higher than the growth of Native Dutch. Turkish has grown 22.7%, Moroccan has grown 21.49% while Dutch has grown 0.39% [*Enschede Municipality*, 2012].

One of the reasons for the attention given to issues of ethnic segregation relate to how a better understanding of this phenomenon can better inform (or discourage) policies aiming at mixing ethnic populations. The Netherlands made several attempts to apply mix neighbourhood policies to spread migrant households more evenly by mixing different tenures and price level within the same development or area. [*Bolt*, 2009; *Galster*, 2007; *Ireland*, 2008; *Musterd and Andersson*, 2005]. Urban renewal becomes one of the strategic actions to combat negative effect of ethnic segregation. However, there are counter arguments in applying the policy [*Ostendorf, Musterd, and Vos*, 2001; *Van Eijk*, 2010].

The analysis of ethnic segregation was originated by measuring segregation at city level summarizing the residential segregation phenomenon for the entire city into a single value. The most widely used measurement is the Dissimilarity Index [*Cortese, Falk, and Cohen*, 1976; *Duncan and Duncan*, 1955; *Massey and Denton*, 1987]. These measurements at city level are useful for comparing degree of segregation between cities (*inter urban compa-*

risons) or examining trends of residential segregation [*Grbic, Ishizawa, and Crothers*, 2010; *Massey and Denton*, 1987]

Other approach instead of calculating segregation at city level, proposed a segregation index at sub-city level to capture the variability within a city (*intra urban comparisons*) [*Brown* and *Chung*, 2006; *Deurloo and Musterd*, 1998, 2001]. The concept *ethnic concentration* is usually used at sub-city level when a single areal unit has an overrepresentation of a certain ethnic group [*Deurloo and Musterd*, 1998, 2001; *PBL*, 2010]. Other authors distinguish between global and local indices instead of city and sub-city measurements [*Feitosa, Camara, Monteiro, Koschitzki, and Silva*, 2007; *Wong*, 1996]. Analysing segregation at a disaggregated level can provide understanding of ethnic segregation processes by identifying local variations. It recognizes variation of segregation among areal units such as blocks, census tract, postcode, or district, particularly in areas with significant segregation.

In reality, ethnic concentration is a continuous phenomenon where each individual member is distributed across the city. Members of ethnic groups live in a neighbourhood and interact without being limited by its areal unit or administrative boundaries. Therefore, and despite that the available data on ethnicity is discrete, measuring ethnic concentration only within a single unit ignores the influence of neighbouring areas. If an areal unit consists of few members with the same ethnic background but in all neighbouring units there are many more members with similar ethnic background, the areal unit should be also highlighted as ethnic concentration because they are part of a larger ethnic population.

The aim of this paper is to propose an approach to identify ethnic concentration

areas by considering the influence of population in neighbouring units. The research question is whether ethnic members in a small areal unit (i.e. postcode) constitute ethnic concentration. If the neighbours are very similar, then it would appear that ethnic members in that areal unit live in an ethnic concentration. The following question is whether there are characteristics of concentration areas in different proximity to neighbouring units. This paper argues that concentration areas could be captured according to different proximity units from one areal unit to several neighbouring units as representation of influence of ethnic composition to residential segregation.

The first part of this paper, introduction explains the methodological backround. In intra-urban comparison of residential segregation part, dimension of residential segregation at city level is explained and then it focuses on how those dimensions at city level are interpreted at sub-city level. Next section narrows down to ethnic concentration at sub-city level and neighbourhood perspective. The methodology explains the modification method for identifying concentration areas. The next part presents the results of the approach applied in the case of Enschede and the interpretation of concentration areas for residents of Turkish and Moroccan background. These results were discussed within an expert group meeting in November 2011 and attended by three local policy makers and researchers from Enschede. Finally, in the last part conclusions are presented.

Several studies identified dimensions and measures of residential segregation mainly related to segregation at city level [*Brown and Chung*, 2006; *Massey and Denton*, 1988; *Reardon and O'Sullivan*, 2004] and others related to segregation at sub-city level [*Brown and Chung*, 2006; *Deurloo and Musterd*, 1998, 2001].

Five different dimensions of segregation from *Massey and Denton* [1988] are widely used to measure residential segregation at city level. They are *evenness, exposure, concentration, centralization,* and *clustering. Evenness* is defined as the degree to which members of different groups are over- and underrepresented in different subareas relative to their overall proportions in the population. Similarly, e*xposure* considers the likelihood of intra neighbourhood interaction among minority and majority groups within a given metropolitan area (measures potential contact). *Reardon and O'Sullivan* [2004] added isolation as the opposite of exposure, as the chance of having the same group living side by side. *Concentration* is the intensity of ethnic members over certain area which relate to the total area occupied by minority groups within the metropolitan area. *Centralization*, is the proximity of the minority racial group to the region's central business district. Brown & *Chung* [2006] argued that centralization is needed to be excluded because current cities are no longer monocentric. Finally, *clustering* is the extent to which areal units inhabited by minority members adjoin one another, or cluster, in space. Each dimension reflects the degree of segregation for the whole city, for example the degree of evenness for a city can range from 0 to 1 (where 1 indicates a high degree of evenness). For intercity comparison it is common that evenness is reported for several cities to compare their degree of ethnic segregation. One example is in The Netherlands, the degree of evenness is monitored for 50 municipalities and a ranking list is produced to compare them against their average. In the ranking, Enschede is 21 out of 50 municipalities with a value of 0.34. Ede is the most segregated with a value of 0.5 [*Marlet and Woerkens*, 2006]. However, to allow intra-urban comparisons other measures and dimensions of ethnic segregation are considered at each sub-city areal unit.

For intra urban comparison, each segregation dimension is reported at areal unit level, for example a postcode area can be highlighted as an ethnic cluster when there is a predominance of a particular ethnic group in the area. *Brown and Chung* [2006] identified ethnic clusters and concentration at sub-city level based on dimension of residential segregation at city level. They argued that at sub-city level, an areal unit that is highlighted as a "cluster area" portrays the clustering-exposure dimension while an areal unit that is highlighted as "concentration area" portrays the concentration-evenness dimension (see Figure 1. Dimensions of residential segregation. *Deurloo and Musterd* [1998] used the concept of ethnic concentration to show ethnic clusters in Amsterdam. They defined a postcode as an overrepresentation of Moroccan when the proportion of Moroccan in that area is higher than proportion of Moroccan in the city plus 2 standard deviation of all proportion.

Deurloo and Musterd [1998] and Brown and Chung [2006] used underrepresentation and overrepresentation of ethnic members as a benchmark to measure segregated areas. Under/overrepresentation of ethnic members relates to the concentration-evenness dimensions because they refer to the distribution of a specific ethnic group over an entire urban area. Therefore, the measurement is a relative to the ethnic composition of the entire urban area. Evenness could be reached if there is no area highlighted as overrepresentation of certain ethnic group. It means that ethnic members are distributed evenly or that each area has a proportion of a particular ethnic group lower than the total urban area.

Therefore, the dimension of segregation is not only used for inter urban comparison of residential segregation, but it can be used for intra urban comparisons. In this paper, the study of residential segregation was focused on the concentration dimension (Figure 1).

Residential segregation is a spatial phenomenon, which means that the population in neighbouring areas -and the proximity to those areas- influence the pattern of segregation. However, that has not been taken into account in many studies of ethnic segregation. According to *Reardon and O'Sullivan* [2004], the measurement of evenness from *Massey and Denton* [1988] is non-spatial because the relative locations of each neighbourhood are not considered. Other studies refer to checkerboard problem to show the shortcoming of non spatial measurement [*Feitosa et al.,* 2007; *Wong,* 1996]. Similarly, *Deurloo and Musterd* [1998] showed ethnic concentration at postcode level without considering proximity to neighbouring postcodes. Musterd approach does not consider the phenomenon of "transfers and exchanges" where the movement of individual in space is considered to affect segregation in the neighbourhood [*Reardon,* 2006]. Therefore, the resulting measure is a non-spatial measurement. *Dawkins* [2004] has proved that spatial proximity even among adjacent neighbourhoods already made a large impact on overall degree of ethnic segregation at city level.

Only few studies have focused on cooperating neighbouring units and they differed by the type of areal unit that they consider such as grid cell, census tracts or postcode level [*Dawkins,* 2004; *Feitosa et al.,* 2007; *Jakubs,* 1981; *Reardon et. al.,* 2009; *Wong,* 2002]. Basically, grid cell is generated from census tract which disaggregated into certain cell size using population density. However, using census tract has the advantage of simplicity. Moreover census tract such as postcode level is still adequate size to capture variability without being too aggregate.
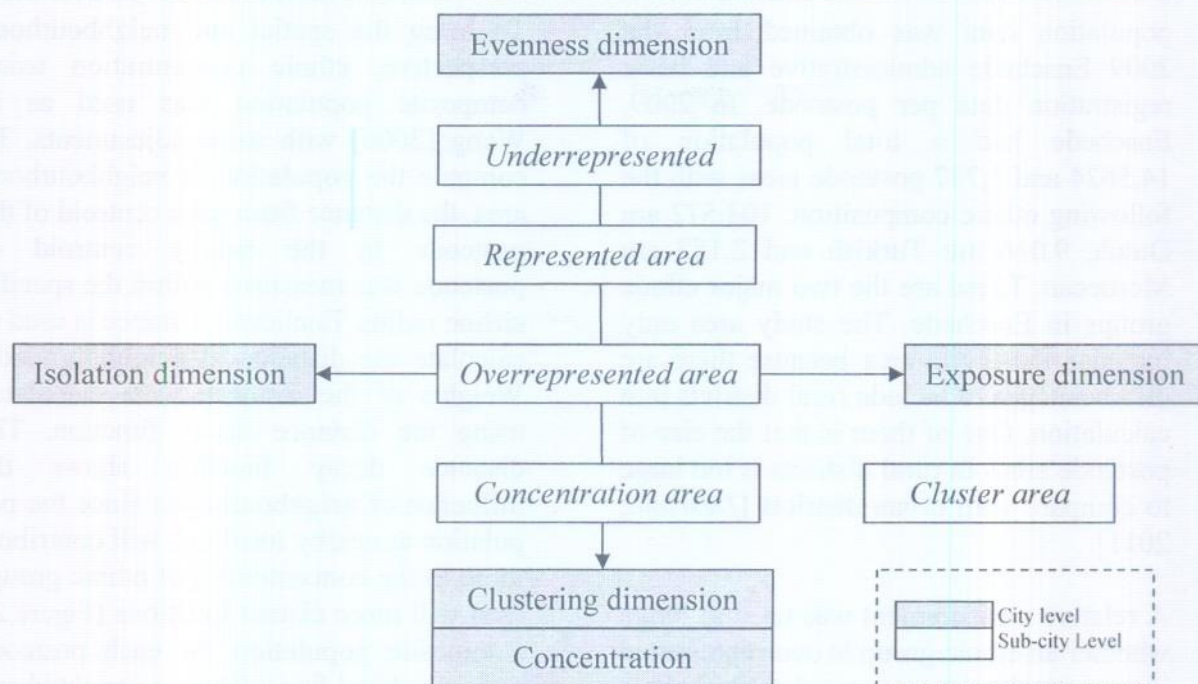
Figure 1. Dimensions of residential segregation at city and sub-city level
Source: *Massey and Denton* [1988]; *Brown and Chung* [2006]; *Reardon and O'Sullivan* [2004]; *Deurloo and Musterd* [1998].

To include the population in neighbouring units, *Wong* [2008] developed the concept of composite population for measuring segregation at sub-city level. The composite population counts the population of the unit itself plus the population counts of neighbourring units. It is based upon the conceptuallization that enumeration unit boundaries are not legitimate features prohibiting or hindering population interaction. Unless there are physical barriers to prohibit interaction of population across unit boundaries, different groups in neighbouring units are not segregated and should be counted as if they are in the same unit. *Wong* [2000] used binary form (0 and 1) to differentiate neighbourhoods in adjacent and nonadjacent units. But using adjacent unit in region with very different size of census tract will reduce the uniformity of interaction. There will be area with very large and very small of neighbouring area. However, still using the same concept, it is better to use proximity to neighbouring unit since size and shape of neighbouring area varies. Distance decay is often used to weight the influence of neighbours [*Feitosa et al.*, 2007;

Reardon et al., 2009]. The concept is that the population at nearby locations will contribute more to the concentration of ethnic groups than those in more distant locations.

In summary, there are three main references in identifying concentration as a spatial phenomenon (Table 1). Those are used as a baseline in the methods of this study.

THE METHODS

Based on the recognition that ethnic concentration is a spatial phenomenon, this part describes a methodology to identify ethnic concentration areas in a city by considering the influence of population in neighbouring units at postcode level.

To empirically test the proposed approach, this paper used the case of Turkish and Moroccans ethnic groups in Enschede, a middle size city in the Netherlands. As a former industrial city, Enschede has been a destination for migrant labour in the beginning of 19th century. The ethnic and

population data was obtained from the 2009 Enschede administrative and basic registration data per postcode. In 2009, Enschede had a total population of 14,5624 and 3,737 postcode areas with the following ethnic composition: 103,572 are Dutch, 9,016 are Turkish and 2,157 are Moroccan. These are the two major ethnic groups in Enschede. The study area only includes the urban area because there are disadvantages to include rural districts into calculation. One of them is that the size of postcode areas in rural districts is too large to compare with urban districts [*Desriani*, 2011].

A relative measurement was used to judge whether an ethnic group is overrepresented in a postcode area compared to the whole city. Those areas were highlighted as concentration areas. Overrepresented areas are those where the percentages of a certain ethnic group (e.g. Turkish) in that postcode is over 2 standard deviations above the city average [*Deurloo and Musterd*, 2001]. This study uses two mutually-exclusive ethnic groups, Dutch-Turkish and Dutch-Moroccan. Therefore, city average is calculated from two population, Dutch-Turkish and Dutch-Moroccan. The binomial standard deviation ($\sqrt{(p*q)/n}$) is used for two pair of ethnic group, where p is Turkish or Moroccan percentage, q is Dutch percentage and n is the average number of residents per postcodes. The binomial standard deviation was used because it applied to events with two outcomes (i.e native Dutch & Turkish, and native Dutch & Moroccan). Therefore, the average number of residents per postcode is calculated only for two groups. For Turkish group, the standard deviation ($\sqrt{(8\%*92\%)/(112588/3737)}$) is 4.94%, where overrepresentation area (8%+2(4.94%)) is higher than 17.90%. For Moroccan group, the standard deviation ($\sqrt{(2.04\%*97.96\%)/(105729/3737)}$) is 2.66%, where overrepresentation area is (2.04%+2(2.65%)) is higher than 7.36%.

To bring the spatial and neighbourhood perspective, ethnic concentration using composite population was used as in Wong [2006] with some adjustments. To compute the population in neighbourhood area, the distance from each centroid of the postcode to the nearby centroid of postcode was measured within the specific airline radius. Euclidean distance is used to calculate the distance to neighbourhoods. Weights of the distance were calculated using the distance decay function. The distance decay function shows the influence of neighbourhoods since the population at nearby locations will contribute more to the concentration of ethnic groups than will more distant locations (Figure 2). Composite population for each postcode was calculated from distance weighted and total population of each neighbourhood.

Therefore, the "scale of the neighbourhood" is determined by the distance from the centroid of a postcode to neighbouring postcodes, measured through specific radiuses of influence. This represents the influence of population in neighbouring postcodes into the ethnic concentration of certain group in any given postcode area. To see the effect of segregation at different scales of neighbourhood, this study used several radiuses; 0, 200, 400, 600, and 800 meters. Radius 0 meter refers to a non-spatial measurement that does not consider the influence of neighbouring units. The radius of 800 meters was used as the maximum radius because it was assumed that ethnic concentration in Enschede will not cluster over 800 meter.
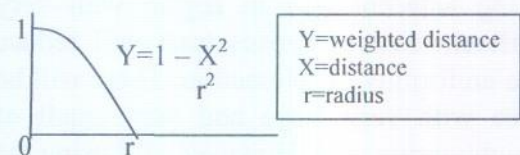

Figure 2. Distance decay function

Following is an example: supposing that postcode A has 10 Turkish and 40 Dutch

residents. Within 200 meters radius from the centroid of postcode A to the neighbouring postcodes' centroids, there are 20 Turkish and 10 Dutch inhabitants. Then the composite proportion of the postcode is 10+20 (total Turkish) divided by 50+30 (total population), equalling to 37.5%. Because the composite proportion is higher than 17.90% (2 SD above the city average), then postcode A is an area of Turkish overrepresentation within 200 meter from their residence.

The resulting ethnic composition for both the Turkish and the Moroccan population was calculated, mapped and classified into five categories:

1. No inhabitant area (value 0);
2. Underrepresented area (>0 and city average);
3. Represented area (>=city average and <city average +1 standard deviation) the composite proportion is relatively similar to the composition to the city average;
4. More represented area (>=city average +1 standard deviation and <city average +2 standard deviations).
5. Overrepresented area (>=city average +2 standard deviations)

there is considerable deviation from the overall proportion.

As we argue that ethnic composition at sub-city level is a spatial measurement in nature; ethnic concentration using neighbourhood perspective can capture other dimensions of residential segregation. With the combination of composite population and overrepresented area, it is more feasible to capture isolation and clustering dimensions at sub-city level (Figure 3). According to the definition of clustering and isolation (see previous section), those dimensions are related to distance. The areal unit inhabited by a certain group (clustering) is delineated by radius distances. Meanwhile, isolated areas only occur at short radius distance. Isolated area is an area having overrepresentation of an ethnic group and they are concentrated far from other many members of same group. In the scale of neighbourhood, isolated areas were represented by overrepresented areas at zero meters which become underrepresented areas at larger scale (i.e 200 m, 400 m, 600 m and 800 m).

Table 1. References in identifying concentration areas

Attributes	Wong*	Feitosa**	Reardon***
Areal unit	Census tract	Census tract	Grid Cell
Concept	Composite Population Enumeration unit boundaries, such as census tract boundaries, are not legitimate features prohibiting or hindering population interaction	Local Population Intensity Intensity of exchange experiences with their neighbours	Local Environment People in a grid cell will interact to other cell in their local environment
Neighbourhood boundaries	Adjacent neighbour	Bandwidth Kernel/radius in meters	Bandwidth Kernel/radius in meters
Population in neighbourhood	Sum of its areal unit plus neighbours	Weighted sum using distance decay	Weighted sum using distance decay

*) [*Wong*, 2002]; **) [*Feitosa et. al.,* 2007]; ***) [*Reardon et. al.,* 2009]

Changes at different scale of neighbourhood

This section shows the influence of the different neighbourhood scales and the resulting changes in the measures of ethnic segregation. The spatial ethnic concentration changes depending on the distance to neighbouring postcodes which is considered. There are many postcode areas that still become overrepresented areas and others become non overrepresented areas in larger scale of neighbourhood. This is because population within postcode area is influenced by population in neighbouring postcodes. Figure 4 shows that a spatial measurement could reveal areas which are part of a concentration of certain ethnic group in their neighbourhood.
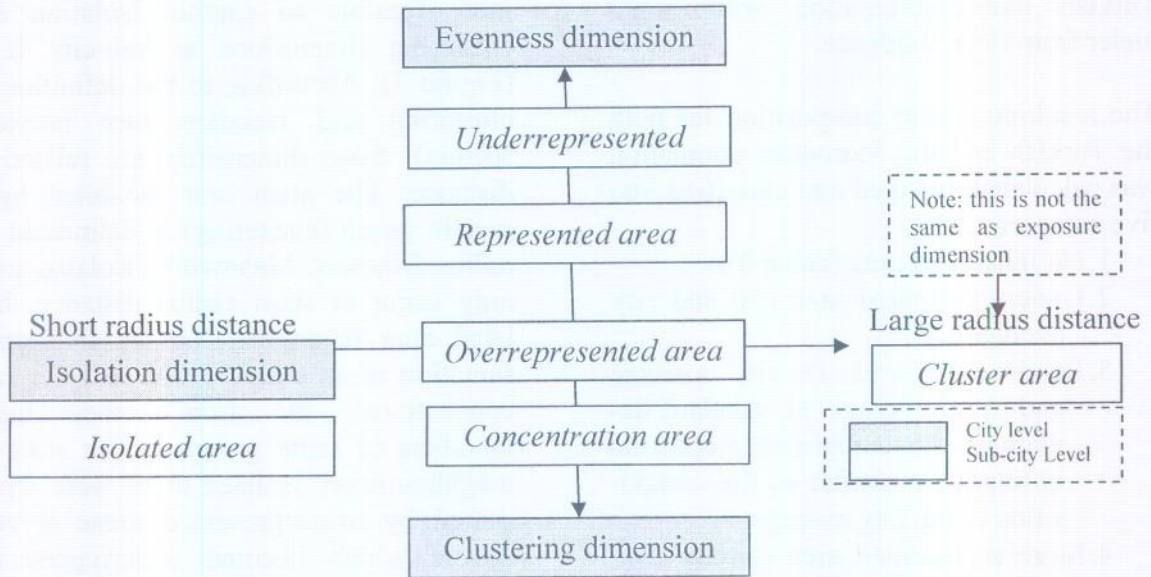
Figure 3. Characteristic of concentration areas using scale of neighbourhood
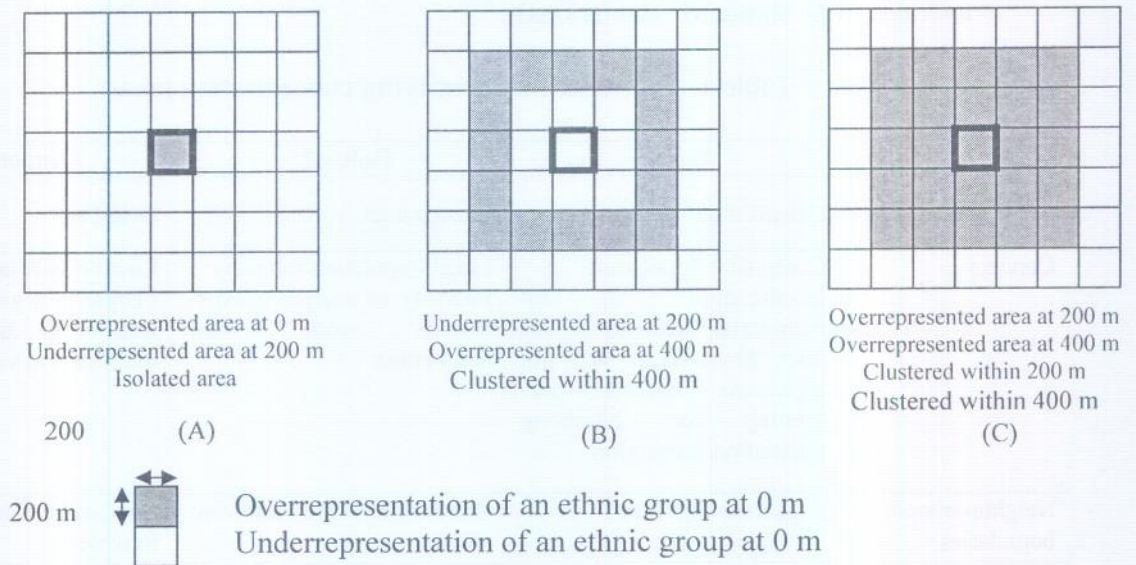
Figure 4. The hypothetical configuration of neighbourhood perspective

The hypothetical configuration (A) highlights an overrepresented area at zero scale which becomes underrepresented area at 200 meters scale. This area is isolated area since it is surrounded by areas with low number of their ethnic members in the neighbourhood. At city level, isolation refers to the distance to the same ethnic members. At sub-city level, isolated area means an area with overre-presentation of an ethnic group but not part of a larger concentration. In the same sense, isolated area is an ethnic concentration with a low chance of having the same group near concentration areas. Those areas which overrepresented at zero scale and underrepresented at 200 meter scale surely will stay underrepresented at a larger scale. This is influenced by the decay function, reducing the effect of a high proportion of ethnic members located further away.

The hypothetical configuration (B) highlights an area which is underrepresented at 200 meters scale but becomes overre-presented at 400 meters scale. It means that ethnic members at that area are part of ethnic concentration in their neigh-bourhood within 400 meters.

The hypothetical configuration (C) highlights an area which is overrepresented at 200 meters scale and stay overre-presented at 400 meters scale.

RESULTS AND DISCUSSION

When comparing Turkish and Moroccan concentration areas, it should be noticed that each group has its own ethnic percentage at city level. Percentages for each category can be seen in Table 2. Ethnic percentage to Dutch between Turkish and Moroccan are totally di-fferent, where Turkish is 8.00% and Mo-roccan is 2.04%. Therefore, Turkish and Moroccan groups have different minimum percentages as thresholds for overrepre-sentation areas, which are 7.90% for

Turkish group and 7.36% for Moroccan group.

Table 2. Ethnic percentage for each category

Category	Turkish percentage	Moroccan percentage
No inhabitant area	0	0
Underrepresented area	>0 and <8.01	>0 and <2.04
Represented area	>=8.01 and <12.95	>=2.04 and <4.70
More represented area	>=12.95 and <17.90	>=4.70 and <7.36
Overrepresented area	>=17.90	>=7.36

Table 3. shows the number of postcodes which have overrepresentation of Turkish and Moroccan population. At zero meter scale, there are 598 postcodes with overre-presentation of Turkish population. From 200 to 600 meters scale, the number of overrepresented areas becomes lower and at 800 meters scale there are no overre-presented areas. It shows that the maximum scale of Turkish cluster areas is within 600 meters scale of neighbourhood. However, for Moroccan, maximum scale of concentration is 400 meters. There are no more Moroccan concentrated areas at 600 and 800 meter scale of neigh-bourhood.

Table 3. Number of postcodes and ethnic percentages for overrepresented areas

Scale	Turkish areas		Moroccan areas	
	Post*	Perc**	Post*	Perc**
0m	598	16.00	392	10.49
200m	427	11.43	166	4.44
400m	48	1.28	11	0.29
600m	5	0.13	0	0.00
800m	0	0.00	0	0.00

*) number of postcodes which has overrepresentation of certain ethnic group
**) percentages of postcode which has overrepresentation of certain ethnic group

In the next sections, the resulting spatial ethnic concentration is presented and

discussed for each ethnic group, the Turkish and the Moroccans. Ethnic concentration areas are characterized by cluster and isolated areas and interpreted by referring to expert group discussion.

Turkish concentration areas in Enschede - Figure 5. shows the Turkish concentration areas at different scales of neighbourhood. The concentration of Turkish groups is mostly located in two areas at southern and northern part of Enschede.

The spatial pattern of concentration areas can be explained by the immigration path of the two predominant Turkish groups in Enschede: the Turkish-Islamic and the Turkish-Christian (Suryoye). The Turkish-Islamic group came as labour immigrants in late 1960 while the Suryoye group came as refugees during the period 1975 – 1980 [*Schukkink*, 2003]. This time of arrival had made the location of both groups settled in different areas. Turkish-Islamic concentrations are found in Deppenbroek and Twekkelerveld (Northern part of Enschede). Those areas were built in industrial expansion era in 1950. *Kempen* [1998] argued that in medium cities (e.g. Enschede), concentration of labour immigrants are found in the early post-1945 areas. They are predominantly of publicly rented houses in apartment blocks. The time of arrival is not the only reason of location difference between Turkish Islamic and the Suryoye. Pre-existing conflicts in Turkey is another reason. This causes unwillingness to interact with each other which lead to polarization of their residential area.

Members of the Suryoye group were mostly asylum seekers who fled from the Islamic government in Turkey. They came at a later stage than the Turkish Islam group and they settled on the southern part of Enschede. They are clustered within 800 meter located in Wesselerbrink Noord-West neighbourhood.

> "Rental houses in the south areas were regularly offered for sale and, through intermediaries within their own circle, came into the hands of Suryoye families."[*Schukkink*, 2003, p. 9]

The concentration area in the northwest part of Enschede is predominantly the University of Twente area. There are Turkish descendants living in rental rooms, who cater to university students. They clustered within 600 meters which still is inside the university area. The cluster is probably due to the high proportion of Turkish to Dutch students because the placement for most foreign students have been choosen by scholarship provider while for most Dutch students are living outside the university area.

Other clusters appear in the northeast part of Enschede. Those areas are part of post war neighbourhoods. *Yücesoy* [2006] explained that in the Netherlands many Turkish moved to post war neighbourhoods that were left by social climbers who moved to the newly planned neighbourhoods.

There are 4 postcode areas where Turkish concentration is isolated from any other Turkish. Three postcode areas are located in District Binnensingelgebied at city centre. The percenttage of Turkish in this district is 5.8%, lower than the city percentage 8.00%. Therefore, the area represents the ethnic segregation dimension of isolation because the postcode area has a relatively high proportion of Turkish but the surrounding neighbourhoods do not present a concentration of Turkish population.
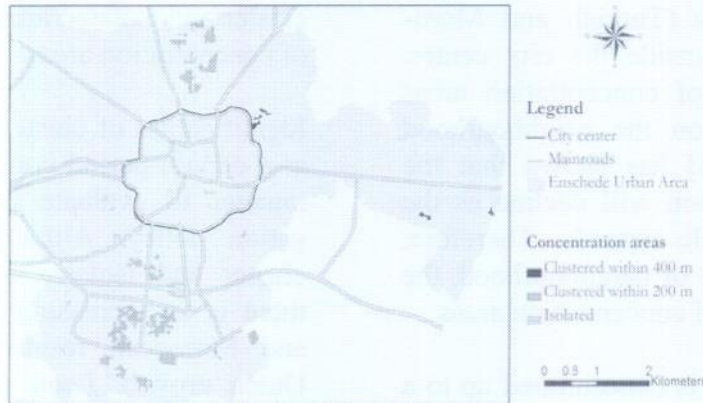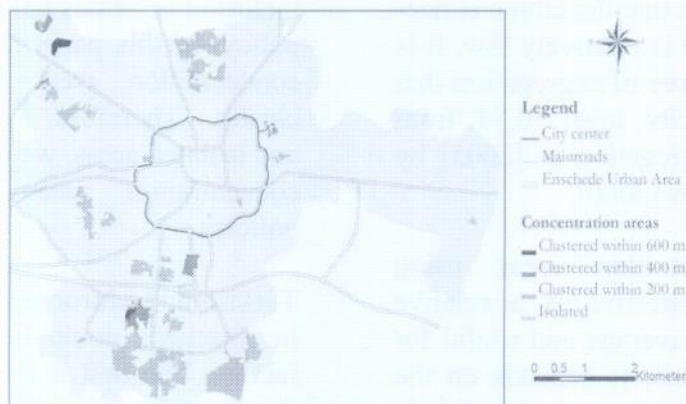
Figure 5. Turkish Concentration Areas

Figure 6. Moroccan concentration areas

Moroccan concentration areas in Enschede - Figure 6 shows the Moroccan concentration areas at different scales of neighbourhood. Only a few Moroccan overrepresented areas occur at 400 meter scale of neighbourhood and there is no overrepresented area at higher than 400 meter scale. At 600 and 800 meters scale of neighbourhood, there is no postcode area with composite population over 7.35%.

Those small cluster areas are located at Wesselerbrink Noord-Oost. After the recruitment of Mediterranean groups ended in 1976, family reunification had led to high fertility rate for Moroccans [*Blauw*, 1991]. This coincides with the last period of urban growth in Enschede where housing development mostly was directed towards suburban area in the southern part of Enschede.

There are still Moroccan concentration areas that are single unit concentration in a postcode area. In total, there are 20 isolated areas which located spread in three districts. Moroccan isolated areas are located at centre and southwestern part of Enschede. However, unlike Turkish, there is no indication that the Moroccans is isolated because of group differences within the Moroccans.

CONCLUSIONS

This paper argues that neighbouring units are important for measuring ethnic segregation because it shows the spatial pattern and characteristics of concentration areas. The scale of neighbourhood was defined as a distance to neighbouring postcodes from each individual postcode. Using different scales of neighbourhood, and illustrated by the case of Enschede, it was revealed that the pattern of each ethnic

concentration areas (Turkish and Moroccan) is located outside the city centre. Also the number of concentration areas varied depending on the neighbourhood scale. *Wong* [2005] has shown that the degree of segregation will decline as the neighbourhood scale extends. Therefore, the higher the scale of neighbourhood, the lower the number of concentration areas.

The Turkish group is concentrated up to a radius of 600 meter while the Moroccan group is concentrated up to a radius of 400 meter. This indicates that the ethnic concentration in Enschede is relatively low. It is in line with the degree of segregation that was measured at city level (0.34 from maximum 1 for segregation in [2005] by *Marlet and Woerkens* [2006].

Identifying concentration areas using neighbourhood perspective is a relative measure to the city average and useful for intra-city comparisons. It depends on the total ethnic population and the ethnic composition. Therefore, a postcode area cannot be directly compared among different ethnic group segregation measures, i.e. Turkish segregation to Dutch and Moroccan segregation to Dutch. However it is suitable for identifying the changes of spatial concentration for each ethnic group.

We have specifically looked at characteristic of concentration areas which are clustering and isolation. Rather than trying to measure each segregation dimension per se, using neighbourhood perspective could capture two dimensions of residential segregation, isolation and clustering at sub-city level. The proposed neighbourhood perspective can reveal the pattern of cluster and isolated areas as characteristics of concentration areas.

Identification of cluster and isolated areas at a certain period could be used as a parameter to evaluate housing and segregation policy. Although there are few cluster and isolated areas in Enschede, there is an increasing growth of Turkish and Moroccan residents compared to Dutch growth. *Laan Bouma-Doff* [2007] explained that areas where level of ethnic concentration is high have to apply social inclusion activities rather than housing mix policy. In this paper, high level of ethnic concentration areas is represented by cluster. Therefore, by identifying cluster and isolated areas, we could classify ethnic concentration areas with appropriate policies.

Turkish and Moroccan concentration areas in Enschede could be related to several factors. The first is the history of housing development causing the distribution of available houses, especially rental houses for ethnic immigrants. The second is the history of immigrants' arrival such as time arrival or reason arrival. The third is intermediaries' circle where houses were regularly offered to their ethnic group.

Finally, the interpretation of the result from neighbourhood perspective needs local knowledge concerning neighbourhood characteristics, on-going urban processes, and historical paths. A mixed-method approach that incorporates qualitative data such as focus group discussions with ethnic groups can provide a better understanding of the ground-level reality of ethnic concentration.

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