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Neighbouring networks and environmental dependency. Differential effects of neighbourhood characteristics on the relative size and composition of neighbouring networks of older adults in The Netherlands

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ABSTRACT
The effects of four social-structural neighbourhood characteristics on the relative size and the composition of neighbouring networks are tested in a sample of 3,504 older adults born between 1908 and 1937 and living in three different regions in the Netherlands. Interactions with individual income and ADL capacity are included in multilevel regression analyses, to test effects of older adults' environmental dependency. Population density and residential mobility both have a negative effect on the relative size of the neighbouring network, and the effect of urbanisation is strongest among poorer respondents. These findings suggest first that the structural effects of urbanisation work at the level of concentration vs. dispersion of personal networks, and second that there is no general mechanism of environmental dependency.

KEY WORDS – networks, community, urbanisation, residential mobility, neighbourhood, environmental dependency.

Introduction and background

Geographical distance is important in personal relationships. People generally have more network members at a closer distance (Van der Poel 1993) and have more frequent contacts with network members who live closer (*e.g.* Wellman 1996). However, it remains uncertain whether and why a shared neighbourhood fosters relationships among its residents. As we will show in the following section, the so-called 'community question' (Wellman 1979) is not yet resolved with respect to the effects of urbanisation on individuals' neighbouring networks. Furthermore, older adults are easily seen as being particularly dependent on neighbouring networks. They are thought to be less

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mobile and to need the security of nearby support more than younger adults do (*e.g.* Dignum 1997; Naafs 1989; Rowles 1978). In other words, for lack of personal resources, they are allegedly more dependent on their direct physical environment and the opportunities it offers for maintaining personal relationships. To our knowledge there has been no systematic test of this assumption.

In this article we analyse in detail the positive and negative factors in urbanisation at neighbourhood level that contribute to the maintenance of neighbouring networks of older adults, relative to their personal resources. In the following sections we discuss the literature on urbanisation, neighbourhoods and neighbouring networks of older adults, and detail hypotheses on the positive and negative factors in urbanisation contributing to variations in neighbouring networks and on the environmental dependency of older adults. We tested these hypotheses in a random sample of Dutch adults aged 54–89 that cover a broad range of neighbourhoods in the Netherlands.

Neighbourhoods and neighbouring networks in the context of urbanisation

The negative consequences of urbanisation for the organisation of personal relationships have long been under discussion, notably since Wirth (1938) declared urbanism 'a way of life'. The scale, density and heterogeneity of urban societies would favour, it seemed, more impersonal and less intimate associations among people. Consequently, people living in cities would avoid close associations in their direct living environment, as opposed to people living more rurally (Davies and Herbert 1993). This viewpoint, according to which living in an urban environment is a single negative factor in the formation of neighbouring networks, has been modified by subsequent empirical findings.

Community studies in the 1950s and 1960s (*e.g.* Gans 1962; Whyte 1955; Young and Wilmott 1964) showed that specific groups in urban neighbourhoods, particularly people from the working class, did form close local communities. Later, Fischer (1975, 1982) and Wellman (1979) took up the community question, from an adult's personal network perspective – Wellman in a study in metropolitan Toronto, and Fischer in a comparison of urban and rural localities in northern California. This perspective draws attention to differences in the spatial organisation of personal networks. Whereas community studies focus on relationships within neighbourhoods, taking the neighbourhood as the main unit of analysis, personal network analysis focuses on the level of individuals and their relationships inside and outside neighbour-

hoods. This creates the opportunity to analyse the relative importance of neighbouring relationships within people's larger networks. In other words, local communities are viewed as part of 'personal' communities, consisting of a focal person and his or her network of personal relationships (Wellman *et al*. 1988).

We followed this approach. Wellman showed that most personal networks as a whole were geographically dispersed, with great variation in the number of network members living close by. Fischer (1982) found that the degree of urbanisation of the localities explained some of this variation in neighbouring relationships. In general, urban dwellers had geographically more dispersed networks consisting of more non-kin and/or single-stranded relationships than did the respondents in rural areas. However, this does not fully answer the questions of whether and why personal networks are organised less at neighbourhood level in more urban neighbourhoods. But let us first define neighbourhoods and neighbouring networks.

Neighbourhoods. We take neighbourhoods to be the people living in a certain area. In line with Fischer (1982), we view neighbourhoods as a set of social structural opportunities to maintain personal relationships. We return to these opportunities later. The scale of neighbourhoods may vary from a few houses (Keane 1991; Nauta 1973), smaller or larger blocks (Greenbaum and Greenbaum 1985) and groupings of blocks (Campbell and Lee 1991; Fischer 1982; Naafs 1989), to large precincts and whole villages (Davies and Murdie 1991; Wenger 1995), often without apparent argument (Dignum 1997; Ketelaar 1994). Studies nevertheless mostly yield similar results when comparing similar neighbourhood characteristics. Only the smallest scale (a few adjacent houses at the front or side of one's home) appears to make an important difference: irrespective of environmental characteristics, adults generally maintain relationships with their direct neighbours (*e.g*. Campbell and Lee 1991; Nauta 1973; Dignum 1997). For the purpose of this study we take a neighbourhood to be sufficiently small as to be recognised by inhabitants as part of their direct living environment, but to be sufficiently large as to include more than direct neighbours – *i.e*. containing a few blocks (*c.f*. Fischer 1982). Neighbourhoods are typically considered entities by the local population because of morphological or socio-economic characteristics (NCBS 1989).

Neighbouring networks. Neighbouring networks can now be defined as consisting of those members in an individual's network of personal

relationships who are located in his or her neighbourhood. We study neighbouring networks rather than neighbouring relationships. The network studies cited (Fischer 1982; Wellman *et al*. 1988) focused on individual neighbouring relationships within personal networks. We will focus on the *relative* number of neighbouring relationships instead: having a large number of relationships at a close distance may mean that a person's network is concentrated in the neighbourhood, but it can also be indicative of a large personal network, both inside and outside the neighbourhood. In the latter case it remains uncertain whether the larger number of neighbouring relationships is explained by the shared living environment of the neighbouring network members and not, for example, by network factors such as family size, or the personal characteristics of the focal person. Therefore we do not consider the number of neighbouring network members a valid indicator of the network as a local community. We propose to use the relative size of the neighbouring network instead, *i.e*. the proportion of neighbouring relationships in the personal network. A network with a larger share of the members located in the neighbourhood can be considered to be organised more at the level of neighbourhoods, and to be less geographically dispersed than a network with a smaller share of neighbouring relationships. Locally organised networks probably are more densely knit than geographically more dispersed networks, because more network members live at a close distance to each other (*c.f*. Wenger 1995). Network density, defined as the extent to which relationships among network members exist, is generally seen as an important characteristic of communities (*e.g*. Bott 1971; Wellman 1979; Wenger 1989). A densely-knit network implies more sharing of norms and resources than when there is less contact among network members.

By focusing on the relative size of neighbouring networks, or, inversely, on the geographic dispersion of personal networks, we build on the studies by Wenger and associates (*e.g*. Wenger 1989, 1993; Wenger and St Leger 1992). They are among the very few who did examine neighbouring relationships in relation to the surrounding network. Originally based on research among people aged 75 and over and living in rural Wales, Wenger (1989) found five types of networks among her respondents, three of which were based on local relationships, either with local kin, local extended kin or with local kin and non-kin. Local relationships could be up to five miles away. One of the other types was a very small network focused on spouse and children only, while the remaining network type was (also) oriented towards geographically more distant relationships. These types were

related to other typologies among younger adults and were also found among younger elderly people in two Dutch rural areas (Droogleever Fortuijn *et al.* 1993; Thissen 1995). The typology was applied as well in analyses of the networks of people aged 65 and over living in Liverpool (Wenger 1995) and Belfast (Wenger and St Leger 1992).

The dominance of local (extended) kin in the neighbouring network is an important second dimension underlying Wenger's network typology. Kin oriented and non-kin oriented neighbouring networks both represent a different type of local community. According to Wellman *et al.* (1988), networks containing a large share of non-kin are typical of a well-functioning community. To others, *e.g.* Litwak (1965), a neighbourhood community is almost equal to the presence of kin in the neighbouring network. In this view kin make up a neighbourhood community in large part. When distinguishing between kin and non-kin, we do not include first-degree kin, *i.e.* parents(-in-law), partner and/or children(in-law). It is unlikely that living nearby or not will be of great importance for the presence of these relationships in the network. Although distance also affects these relationships (*e.g.* Greenwell and Bengtson 1997), first-degree kin are governed more by the laws of kinship than by travel distance (*e.g.* Dykstra 1990). As to other relatives, such as siblings or grandchildren, whom we will further indicate as extended kin, it is unclear whether they are distinct from non-kin in the neighbouring network. Relationships with extended kin are more voluntary than relationships with first-degree kin (Johnson 1988; Bedford 1995). We therefore take extended kin to be subject to the same mechanisms in neighbourhoods as non-kin.

Summarising, we now have two characteristics of the neighbouring network: the relative size of the neighbouring network and the dominance of extended kin (versus non-kin) in the neighbouring network. We take the dominance of extended kin to be unchanged by factors related to urbanisation, because extended kin and non-kin are subject to the same mechanisms. We do expect that the relative size of the neighbouring network would be affected by factors related to urbanisation. We elaborate on this in the next section.

Urbanisation, neighbouring networks and environmental dependency

Although Wenger included both urban and rural localities in her research (Wenger 1995; Wenger and St Leger 1992), the focus was on validating the typology in different samples, and direct comparison between both types of community is brief. When focusing on the social structural opportunities offered in more or less urban neighbourhoods,

three (sets of) explanatory variables emerge: scale and density, composition, and mobility of the population.

Both the *scale* of cities and the *density* of the population increase the propensity to pursue relationships at a greater distance in urban neighbourhoods: people either tend to avoid their neighbourhood because of crowding and a dislike of strangers nearby (Naafs 1989), or they are pulled toward other urban places where they find people and pastimes that suit them best (Fischer 1982). Inversely, the scarcity of people in the wider surroundings leads older people living rurally to concentrate their networks in their immediate surroundings (Wenger and St. Leger 1992). Fischer in particular suggests that the scale of networks varies with the scale of the environment, with the less urban dwellers having a more locally oriented network than people living in more urban neighbourhoods. Our first hypothesis therefore is: *the larger the degree of urbanisation in the neighbourhood, the smaller the relative size of the neighbouring network*.

There are factors associated with urbanisation that affect the *composition* of the neighbourhood population. On the one hand, urbanisation is associated with a concentration of socially weaker groups in specific neighbourhoods. The present-day poor in many Western countries constitute a highly heterogeneous and often ethnically diverse population. This could lead to a loss of identity and identification for the neighbourhood dwellers (*c.f.* de Vos and Knol 1994); resulting in relatively smaller neighbouring networks. The concentration of poor only has a positive effect on the number or intensity of neighbouring relationships when lower-income neighbourhoods are also homogeneous and are stable, working-class neighbourhoods (*e.g.* Campbell and Lee 1991; Wenger 1995). Such 'urban villages' are atypical in the Dutch context (Dignum 1997). We therefore hypothesise *a concentration of lower-income households will have a negative effect on the relative size of the neighbouring network*.

On the other hand, urbanisation is associated more generally with the specialisation of neighbourhoods, leading to greater availability of similar people in more urban neighbourhoods. Often-mentioned in this respect is similarity in life cycle stage (*e.g.* Campbell and Lee 1991; Naafs 1989; Nauta 1973; Rosow 1970), which would imply similarity in needs. Other similarities often refer to a common identification, such as ethnic or lifestyle similarity. Although relevant to the general question, the approach we chose focuses more on structural opportunities in the neighbourhood. We therefore limit ourselves to this one, important, similarity and hypothesise that *a larger availability of age peers in the neighbourhood leads to a relatively larger neighbouring network*.

A greater *mobility* (or, inversely lower stability) of the neighbourhood population is traditionally associated with a higher degree of urbanisation (*e.g.* Bott 1971; Litwak and Szelenyi 1969). Some rural communities are characterised by high population turnover as well, specifically if they are popular migration destinies of (older) people moving out of cities (Thissen 1995; Wenger 1995; Wenger and St. Leger 1992). In both cases, we can follow earlier findings and put forward the hypothesis that *a greater mobility of the neighbourhood population is associated with relatively smaller neighbouring networks*.

Environmental dependency. So far, we presuppose that all older adults are equally susceptible to effects from neighbourhood characteristics on the relative size of their neighbouring networks. However, people differ in their dependency on their direct environment. Lawton (1989) phrased this as the 'environmental docility hypothesis': when people have fewer personal resources and abilities, they will experience more effects from the environment on their behaviour. Lawton focused on the physical dependence on the environment. The finding of Fischer (1982), that most effects of urbanisation on networks were strongest for people with lower incomes, supports the environmental docility hypothesis for income as a personal resource. Our final hypothesis is: *the effects of neighbourhood characteristics on the relative size of the neighbouring network of older adults are stronger the lower the income and the physical capacity of the older adults*. This includes the assumption that effects of neighbourhood characteristics are equal for kin and non-kin relationships in the neighbouring network.

Design of the study

Respondents

Personal interviews were conducted in 1992 with 4,494 respondents who participated in the Dutch 'Living arrangements and social networks of older adults' research programme (Knipscheer *et al.* 1995). This programme used a stratified random sample of men and women born between 1903 and 1937. To allow for comparisons between age groups, the oldest individuals, and in particular the oldest men, were overrepresented. The sample was taken from the population registers of 11 municipalities: the city of Amsterdam and two rural communities in the western part of the Netherlands, and two cities and six rural communities in the south and east. These three regions could be seen

to represent differences in culture, religion, urbanisation and ageing in the Netherlands.

The Dutch context. The Netherlands is a small, densely populated country, with a service- and trade-oriented economy. The density of the population varies considerably over the country. The three large cities, with 440,000, 596,000 and 720,000 inhabitants, are in the mid-west, the 'Randstad'. Around, and even in some parts of the Randstad, people typically live in smaller towns, or villages oriented toward these towns. The population of the other towns is mostly between 30,000 and 130,000. Villages predominantly have between 2,000 and 10,000 inhabitants, and differ widely in population density and urban orientation. Only the extremes of very large cities and very sparsely populated areas are lacking in the Netherlands.

The country also has a large variation in regional and local cultures, in spite of the short distances between settlements. An important source of cultural variation is religion: people living in the northern parts are mostly Protestant, most of the South has a Catholic population. In the Protestant areas exist two major and numerous smaller denominations. Particularly in an area from the Southwest to the Northeast of the country, some denominations can be quite sectarian. This part is sometimes called the Dutch 'Bible Belt'. In the urbanised West and in many other towns, secularisation is obvious, and religions in the population, if any, vary. Non-Christian groups are concentrated in the larger cities.

The Catholic southern region predominantly consists of cattle-farming villages and small industries (meat, pharmaceutics) in the regional towns. Until recently the head office of Philips used to be in Eindhoven, which is south-west of the region in our study. We selected the city of Oss (52,000 inhabitants) as a regional centre. One large, urbanised village (36,000 inhabitants) was selected, and one smaller village (9,000 inhabitants). Both have mixed populations in terms of age and wealth, which is associated with the orientation to nearby urban centres (Dignum *et al*. 1991). The Protestant north-eastern region is at the end of the Bible Belt, and was at the heart of the textile industry. The industry dwindled, and (town-)people now mostly live off small industries and services. Zwolle (90,000 inhabitants) was chosen as the regional centre. In the extensive, sparsely-populated villages around Zwolle, farming still is important, and some villages are popular for recreation and retirement housing. Four villages were selected. One (18,000 inhabitants) is larger, and more urbanised than the others, two of which have relatively wealthy and younger

populations (8,000 and 9,000 inhabitants). The fourth village (4,000) has an older and less well-to-do population. In the West, Amsterdam was selected as a large city, with a population of 720,000. North of Amsterdam, we also selected an area with two municipalities (18,000 and 14,000 inhabitants) consisting of villages and small hamlets that is characterised by a mixed economy and mixed religions. In spite of their proximity to Amsterdam, many villages are somewhat secluded. Some of them have become tourist sights because many of the colourful local traditions are kept alive by the inhabitants. Some (also) are popular retreats for the better-off from Amsterdam. Population density in the 11 selected municipalities varied between less than 500 inhabitants per square kilometre and 2,500 and over.

Sample. Of the 7,279 eligible individuals in the sample, 2,785 (38.3 per cent) were unwilling to participate due to a lack of interest or time; another 1,079 were ineligible because they had died or were too ill or cognitively impaired to be interviewed. Respondents were interviewed in their homes and personal computer assistance was used in the data collection. The interviews mainly covered demographics, the personal network, loneliness and event history. The interviews were carried out by interviewers who had received training for four days and who were intensively supervised, and the interviews were tape-recorded to monitor and enhance the quality of data.

Our hypotheses refer to people living independently. We therefore limited the analysis to the 4,089 respondents who were living independently at the time of the interview. For 3,773 of these respondents, the personal networks have been delineated. There were various reasons why the networks could not be delineated for all the interviewees, *e.g.* the premature termination of the interview, the respondent's refusal for privacy reasons or lack of time. The most frequent reason was because an abridged version of the questionnaire was used with the respondents who were too physically or cognitively frail to be interviewed using the full questionnaire. Of the remaining 3,773 respondents, 3,504 had personal relationships with people outside their household other than parents, parents-in-law, partner, children, children-in-law, and step children, who they were in contact with at least monthly. Because of our selections from the original sample, the younger and female respondents became overrepresented. There were no biases as to partner status or urbanisation.

We distinguished neighbourhoods as identified by the Netherlands' Central Bureau of Statistics (NCBS 1989). Demarcation of neighbourhoods, mostly on morphologic or socio-economic grounds, is

often based on local conventions. They mostly consist of a few blocks in urban settings, and of larger areas in less urbanised settings. There is considerable variation in neighbourhood size. There are 1,500 inhabitants on average (SD = 2,174). The average neighbourhood surface is 7.69 square kilometres (SD = 17.77). Neighbourhoods typically are delimited by roads, water or parks. There were 225 neighbourhoods in our sample. On average, there were 16 respondents per neighbourhood (SD = 30).

Instruments

Respondent characteristics. For the personal network, the main objective was to identify the socially active relationships of the older adult in the core as well as the outer layers of the larger network (Van Tilburg 1995). The procedure was adapted from Cochran *et al.* (1990). Network members were identified in seven domains of the network: household members (including the spouse, if there was one), children and their partners, other relatives, neighbours, colleagues from work (including voluntary work) or school, members of organisations (*e.g.* athletic clubs, church, political parties), and others (*e.g.* friends and acquaintances). With respect to the domains, the question was posed: 'Name the people (*e.g.* in your neighbourhood) you have frequent contact with and who are also important to you'. Contact could be face-to-face, by telephone or by any other means of communication. Wellman (1996) showed that the frequency of both face-to-face and telephone contact increases with decreasing distance between network members. Only people above the age of 18 could be nominated. A limit of 80 was set on the number of names, but no one reached this limit. Information was gathered on all the identified network members as regards the type of relationship, sex and frequency of contact. For a subset of network members, *i.e.* the 12 with the highest frequency of contact, additional questions were posed. Travel time to reach the network member was asked for in hours and minutes and scored in minutes. Data obtained within a side study showed that the travelling time reported by the older adults correlated strongly ($r > .80$) with the time reported by the network members, and with the distance in a straight line and travelling distance and time by car, as obtained from public databases.

We made two selections of network members. First, we excluded relationships with a partner, children(-in-law) and parents(in-law), for reasons indicated earlier. In the analyses we controlled for the presence of these relationships. We also excluded (other) household members,

because we consider neighbouring relationships to exist outside the household. Second, we only used data on the maximum of 12 network members with whom there was at least a monthly contact. This allowed us on the one hand to include most of the personal relationships that were potentially supportive (*e.g.* Dykstra 1990; Van Tilburg 1988), and on the other hand to have a uniform demarcation of the network. We call this network of monthly contacts (excluding the household and family) the core network. The average size of the core network was 5.3 relationships (SD = 2.9).

Environmental dependency had two indicators, income and physical capacity. Respondents were asked the net monthly income of the household. Answers were divided into 12 categories, each indicated by the mean income for that category. The lowest value was 1,125 guilders, the highest was 5,750 guilders (approximately £330 and £1740 respectively). The household income of married respondents was multiplied by 0.7 to approach an individual income. The average income was 1,744 guilders per month (£538, SD = Dfl 1,069). This is between the state pension for which all people over 65 are eligible (approximately 1400 guilders or £425 before tax for single people) and the Dutch minimum wage (approximately 2,000 guilders or £605 before tax). Physical capacity was measured by asking four questions about having difficulties with activities of daily living (ADLs), *e.g.* 'Can you walk up and down stairs?' The five answers ranged from 'not at all' to 'without difficulty'. The four ADL items constituted a hierarchically homogeneous scale ($H = .68$) which was reliably measured ($\rho = .87$). The scale ranged from four (numerous problems) to 20 (no problems).

Neighbourhood characteristics. The level of urbanisation was measured in five ordinal classes, ranging from (1) less than 500 addresses per square kilometre to (5) over 2,500 addresses per square kilometre. These data were derived from a database provided by the Netherlands Central Bureau of Statistics on the basis of the mean number of addresses per square kilometre within a circle with a radius of one kilometre (Den Dulk *et al*. 1992). The aim was to measure the concentration of human activities. These data were aggregated to neighbourhood level. On average, the degree of urbanisation was 2.8 (SD = 1.7); outside Amsterdam it was 2.1 (SD = 1.4).

The share of age peers in the neighbourhood was determined with NCBS-data on the percentages of neighbourhood inhabitants in different age categories. For respondents younger than 65, we used the percentage of inhabitants between 45 and 64. For respondents of 65

and older we used the percentage of inhabitants over 64. On average, there were 21 per cent age peers in the neighbourhoods (SD = 8).

The share of lower-income households in the neighbourhood was determined with NCBS-data on the percentage of households with a net yearly income below 19,000 guilders (average income in Dutch neighbourhoods is 24,000 guilders, SD = 3,160). This was on average 39 per cent of the neighbourhood (SD = 7); in Amsterdam it was 44 per cent of the neighbourhood (SD = 7).

The residential mobility in the neighbourhood is not a standard statistic. Where possible, we obtained data from the municipality offices on the number of people moving out of neighbourhoods in 1992 or a nearby year and the total population of these neighbourhoods. With this, we calculated the number of residents leaving the neighbourhood per annum per thousand inhabitants. The smaller municipalities did not dispose of the necessary data. We used the municipal data in these cases. This forced us to count only the people moving out of a municipality in the other cases, resulting in an underrepresentation of movers. On average, the residential mobility was 39 per thousand (SD = 19), with scores varying between 0 and 223 per thousand.

Pearson correlation coefficients between the neighbourhood characteristics were below .20, except those between urbanisation and the share of lower-income households (.49) and residential mobility (.29) respectively.

Procedure

The neighbouring network arbitrarily consists of members of the core network who are within 10 minutes travel distance. Note that the neighbouring network can be located in more than one neighbourhood, since the neighbouring network is relative to the location of the respondent in the neighbourhood. We did not expect any systematic bias from this. The relative size of the neighbouring network is the percentage of core network members in the neighbouring network. The percentage of extended kin in the neighbouring networks is by definition complementary to the percentage of non-kin.

In our operationalisation of neighbourhood communities as relatively large neighbouring networks, we supposed that relatively large neighbouring networks would also be relatively dense-knit. In a side study with a random subsample of 648 respondents we obtained information on the mutual relationships between a maximum of eight core network members. This enabled us to construct a density measure

for that part of the network. The density of a network is the ratio between the existing relationships between network members and the logically possible relationships between network members. The value is between 0 (no relationships between network members) and 1 (all network members are connected). The available measure was not valid for the density of the neighbouring network, because of the selections of network members we applied. We would have had to select only the neighbouring relationships among the eight selected core network relationships included in the network study. This would harm the validity of both the density measure and the relation of the measure to the larger neighbouring network under study. However, the original density measure did give a good impression of the extent to which core networks with relatively more neighbouring relationships were more densely knit than geographically dispersed core networks.

By using a multivariate analysis, we could eliminate spurious effects because of interrelations between neighbourhood characteristics. However, using ordinary regression analysis, effects of neighbourhoods with many respondents could for example dominate the effects since they have a relatively large number of representations on the lower level. Respondents living in the same neighbourhood also will usually be more alike than respondents living in different neighbourhoods. Applying ordinary least squares regression analysis would then violate the assumption of independence of error terms (Hox and Kreft 1994). One consequence would be that we would overestimate the number of degrees of freedom, and consequently, the significance of effects, leading to a number of spurious effects. We therefore applied multilevel regression analysis with respondents nested within neighbourhoods.

There are two dependent variables: the relative size of the neighbouring network and the percentage of non-kin in the neighbouring network. We tested two models explaining each. The models were analysed with MLn, a programme for multilevel analysis (Rasbash and Woodhouse 1995). Both models had the same set of explanatory variables. We followed a stepwise procedure in both analyses. In the first step, only the intercept was estimated. In the second step, age, sex and the presence of partner, children, children-in-law, parents and parents-in-law in the network were entered into the equation as control variables. Furthermore, to exclude confounding effects from the 12 per cent of respondents who still participated in the labour force, we also included a variable indicating whether the respondent had paid work, either part-time or full-time. The presence of a car plus a valid driver's licence in the household was also included as a control variable. We included the size of the core network as a

control, to eliminate any effects related to a large network, rather than a relatively large neighbouring network. Two dummy variables were entered to indicate in which region the respondents lived, with the south as the reference group. Finally, we included the individual income and the ADL capacity as control variables since the hypothesis on environmental dependency specified an interaction effect and not a direct effect of individual resources. In the third step, the neighbourhood characteristics were entered: degree of urbanisation, percentage of age peers, percentage of lower-income households, and residential mobility. In the final step, variables for the interaction effects were entered into the equation. There were eight interaction terms: individual income and ADL capacity times four neighbourhood characteristics. To avoid multicollinearity, all the variables for these effects were centred before interaction terms were computed.

Results

Neighbouring networks

Neighbouring networks constituted on average 60 per cent of the core network (SD = 35), which amounted to a mean of 3.2 neighbouring relationships (SD = 2.5). Within an hour's travel, 78 per cent of the core network could be reached (SD = 56). The relative size of the neighbouring network was correlated to the absolute number of neighbouring relationships (Pearson's $r = .61$, $p < .001$). The relative size of the neighbouring network was not correlated to the absolute number of core network members (Pearson's $r = .00$).

On average, core networks had a density of .49 (SD = .25, N = 648). The larger the number of core network members, the lower the density (Pearson's $r = -.35$, $p < .001$). However, when controlling for the number of neighbouring relationships (Beta = −.35), the *relative* size of the neighbouring network was positively associated with network density (Beta = .22, $F_{(2,620)} = 20.7$, $p < .001$). That is, the presence of a larger number of (neighbouring) network members lowered the network density. If network members were more locally concentrated, however, density increased. The local concentration of network members increased the chance of relationships among network members.

Most neighbouring networks only included non-kin. In 39 per cent of the neighbouring networks extended kin were identified. On average, these networks consisted of 44 per cent extended kin (SD = 30). Half the respondents who had extended kin in their neighbouring

TABLE 1. *Multilevel regression of the relative size of the neighbouring network on characteristics of neighbourhoods* ($N = 214$) *and of respondents* ($N = 3{,}310$)

				Variance at level		
	B	S.E. B	Deviance	1	2	3
Constant	57.00	4.00	32,886	1,410.00	201.00	2.71
Step 2: Control variables			32,664**	1,318.00	187.00	1.53
Region: East[a]	1.83	1.77				
Region: West[a]	−7.84**	1.56				
Sex (m, f)	−5.83**	1.33				
Age (54–89)	.02	.08				
Paid work (no, yes)	.74	.70				
Car (no, yes)	−2.52	1.37				
Partner (no, yes)	−2.77	1.41				
Children (no, yes)	8.13**	1.71				
Parents (no, yes)	−3.32	2.46				
Size of core network (1–12)	.79**	.21				
ADL capacity (4–20)	−.99**	.30				
Income (1,125–5,750)	−.0017*	.0006				
Step 3: neighbourhood characteristics			32,630**	1,208.00	122.00	1.71
Urbanisation degree (1–5)	−2.52**	.49				
% Age peers	−.15	.09				
% Lower incomes	−.14	.10				
Residential mobility	−.25**	.04				
Step 4: Interaction effects			32,616	1,138.00	120.00	1.63
ADL capacity × urbanisation	−.11	.18				
ADL capacity × age peers	−.03	.03				
ADL capacity × lower incomes	.004	.04				
ADL capacity × mobility	−.02	.02				
Income/100 × urbanisation	.11*	.04				
Income/100 × age peers	−.001	.007				
Income/100 × lower incomes	−.008	.008				
Income/100 × mobility	.001	.003				

* $p < .01$; ** $p < .001$
[a] The category of reference is the southern region.

networks only identified one relative in the neighbourhood, often a sibling. Non-kin relationships most typically were nearby neighbours, but also people from organisations, friends or volunteers. The relatively larger neighbouring networks most typically contained more neighbours and siblings (Pearson's $r = .22$ and .20 respectively). A negative correlation (−.21) between the number of non-kin and the number of extended kin named in the neighbouring network indicates that kin and non-kin oriented networks are, to some extent, mutually exclusive.

Neighbourhood characteristics and relative size of the neighbouring network

Table 1 shows the parameters of the regression of the relative size of the neighbouring network (the percentage of neighbouring network members in the core network). In the appendix we discuss how to read outcomes from multilevel analysis. The intercept-only model had a deviance of 32,886, with a variance at the respondent level of 1,410.00 and at the neighbourhood level of 201.00. This indicates that there is much more variance between respondents and their networks than between neighbourhoods. The variance at the regional level was 2.71. At step 2, control variables were added. Women had smaller neighbouring networks than men, on average 5.83 per cent smaller. The presence of a partner did not have an effect, but the presence of children did: respondents without children in the network had on average 8.13 per cent fewer neighbouring relationships in the core network than respondents with children in the network. A poor ADL capacity contributed to a relatively larger neighbouring network, as did a higher individual income. We also found that the respondents living in the west had on average 7.84 per cent fewer neighbouring network members in the core network than respondents in the southern and eastern regions. Note that the availability of a car plus driver's licence did not affect the relative size of the neighbouring network. This model was an improvement over the intercept-only model ($\chi^2_{(10)} = 222$, $p < .001$); the variance at the respondent level decreased to 1,318.00, at the neighbourhood level to 187.00, and at the regional level to 1.53. As to the effects of neighbourhood characteristics (Step 3), the degree of urbanisation ($B = -2.52$) and the residential mobility in the neighbourhood ($B = -.25$) had significant effects on the relative size of the neighbouring network. The estimated difference in relative size of the neighbouring network between the most and the least urbanised neighbourhoods (scores 5 and 1) was 10 per cent (4×2.52). The quarter of respondents living in the neighbourhoods with residential mobility below 30 per thousand had an estimated 12 per cent more neighbouring relationships in the core network than the quarter of respondents living in neighbourhoods with residential mobility above 50 per thousand. There was a positive correlation between the degree of urbanisation of the neighbourhood and the percentage of core network members between 10 and 60 minutes travel (Pearson's $r = .18$, $p < .001$). This indicates that a larger share of the core network living at middle distance compensates the smaller neighbouring networks in more urbanised neighbourhoods. Degree of urbanisation and residential mobility were not correlated with the

number of core network members (Pearson's $r = .02$ and .05, respectively, both $p > .01$). This model was an improvement over the previous model ($\chi^2_{(4)} = 134$, $p < .001$).

There was one significant interaction effect: the interaction between individual income and degree of urbanisation in the neighbourhood (B = .11). The coefficient was positive, indicating that the negative effect of the degree of urbanisation on the relative size of the neighbouring network increased when respondents had lower incomes. The interaction effect could also mean that income effects on the relative size of the neighbouring network were stronger in less urbanised neighbourhoods.

To gain more insight into the interaction, we conducted an analysis of variance with the respondents living in the 67 neighbourhoods with urbanisation degree below three. Respondents with incomes above 2,500 guilders per month in these neighbourhoods had particularly small neighbouring networks, on average 10 per cent less than other respondents in rural neighbourhoods. About a third of these respondents lived in rural neighbourhoods in the towns in the northeastern and southeastern regions. Their mean age was 75 years. They could belong to the older elite in these towns, living in the 'better' neighbourhoods. They probably had always had more dispersed networks (*c.f.* Wenger 1989). Another 40 per cent of these respondents lived in two attractive villages, one in the West and one in the Northeast of the country. They had an average age of 67 years. Both villages are known migration destinations for pensioners. This subgroup probably consisted of pension migrants, who had retired to comfortable country houses and did not make many contacts with the local population at their new residence.

In spite of this effect, the model with interaction terms included in the equation (Step 4) was no improvement over the previous model ($\chi^2_{(8)} = 14$, $p > .01$). The relatively large number of non-significant interaction effects accounts for this.

Neighbourhood characteristics and percentage of non-kin

Within the second model, we analysed the percentage of extended kin in the neighbouring network, to examine whether effects of neighbourhood characteristics on neighbouring relationships would be stronger for non-kin than for extended kin. Our assumption was that extended kin and non-kin in the neighbouring network would be subject to the same influences of neighbourhood characteristics.

The multilevel analysis showed no significant effects of neigh-

bourhood characteristics, nor any significant interaction effects. We therefore have not reported the results in detail, but observe that the effects of neighbourhood characteristics and environmental dependency do not differ between extended kin and non-kin in the neighbouring network. The ratio of extended kin and non-kin in the neighbouring network was not affected the degree of urbanisation and the residential mobility in the neighbourhood, nor by the share of age peers and lower-income households in the neighbourhood. This means that the dominance of relations with either extended kin or non-kin in the neighbouring network was equally susceptible to effects from the neighbourhood characteristics in the analysis.

Discussion

This study has examined the extent to which neighbourhood characteristics related to urbanisation affect the neighbouring networks of older adults in various parts of the Netherlands, paying special attention to older adults' alleged dependency on these neighbouring networks. We found the composition of the core networks of older adults to differ according to the degree of urbanisation (i.e. population density) of neighbourhoods they lived in. Older adults living in neighbourhoods with a higher degree of urbanisation were oriented less to their direct neighbourhoods: they had relatively smaller neighbouring networks, but had larger core networks within an hour's travel. A greater population turnover in neighbourhoods had a similar effect, leading to geographically more dispersed core networks of older adults.

In an earlier study among Dutch adults aged 18–70, van der Poel (1993) concluded that the level of urbanisation did not affect the travel distance of network members. However, in contrast to that study, we studied a large variety over the country, both culturally and in the types of environments studied. Our results rather support the earlier observations of Fischer (1982) that urban networks differ from rural networks, but are not necessarily smaller. Moreover, stability in the neighbourhood population is important for having larger neighbouring networks, independent of the degree of urbanisation (*c.f.* Wenger and St Leger 1992). Older adults possibly avoid investing in neighbouring relationships with people who might move (again) shortly, former neighbouring network members might already have moved, or they themselves have prospects of moving more often than older adults living in more stable neighbourhoods.

Two other social characteristics of neighbourhoods related to urbanisation had no effects on the local concentration of personal networks. Neither the share of age peers nor that of lower-income households in the neighbourhood had a significant effect on the relative size of the neighbouring network.

The assumption behind age peers in the neighbourhood having an effect is that people in the same age category share important needs and interests, which makes age peers attractive as network members (Rosow 1970). Given the data available, we defined people over 65 years as age peers for older adults of 65 and over. In retrospect, this might have been too crude a measure. Not only is there a large range of ages among people in this category, there is also large variation in the way people shape this phase of life. The idea of similar needs in similar life phases may be valid for youth and families with children, but it needs further qualification when it comes to old age.

As to the share of lower-income households, we assumed that this would indicate a lack of homogeneity or integration in the neighbourhood, since the present-day poor consist of a larger variety of social and cultural categories. It could well be true at neighbourhood level, but these various groups in themselves can form local subcultures with intensive neighbouring relationships (Campbell and Lee 1991). This could in turn imply that the effects of the composition of the neighbourhood population are to be found in common identification, either with each other or with the neighbourhood.

In both cases, that of age-homogeneity and of social homogeneity, we need more refined concepts and measures, that also take into account the identification of older people with (others in) their neighbourhood. This directs us to the cultural characteristics of neighbourhoods, and the subjective experiences people have of them. In contrast, the approach chosen here focused on the social opportunities offered by, in this case, a specific composition of the neighbourhood population.

The degrees of urbanisation and population turnover not only have an effect on the number of neighbouring relationships, as earlier research has shown, but also affect the geographic dispersion of core networks: networks are organised differently when people live in more urban and less stable neighbourhoods. In themselves, these factors do not pose a risk of older people not having enough personal relationships. It is only when people have specific needs for neighbouring relationships, or when neighbouring relationships are totally lacking, that a high degree of urbanisation and high population turnover can

become such risk factors. Very old people, who were selected less frequently in the sample because many lacked relationships outside the family, and people with a low physical capacity, are at risk in this respect.

However, we did not find a general mechanism of environmental dependency, by which lack of resources such as good ADL capacity increases the *influence* of neighbourhood characteristics on neighbouring relationships. There was no indication that dependence on neighbouring relationships increases with age, or that older people have smaller neighbouring networks. The age and ADL differences in relative size of the neighbouring networks we found existed in all neighbourhoods.

Only individual income proved to be a source of variation among older adults with respect to their susceptibility to environmental influences on their neighbouring networks. We observed that the effect of the degree of urbanisation in the neighbourhood was particularly strong for the neighbouring networks of older adults with lower incomes. This is in accordance with the observations of Fischer (1982) we reported earlier. The effect also worked the other way: better-off older adults living in the more sparsely populated neighbourhoods had relatively smaller neighbouring networks than the other rural respondents. These apparently were pension migrants who moved to rural areas without compensating for the loss of their former neighbours and nearby friends. Getting accepted in some rural communities after moving can be difficult (Wenger 1989), even if the newcomers should be willing to try. When the migrants need help, they might have very few neighbours to rely on (Keating 1991). Living rurally could thus be a risk factor for this group of older adults.

It appears that the effects of the neighbourhood characteristics we observed work mainly at the general level of local concentration versus dispersion of personal networks. When it comes to explaining the role of specific relationships in the neighbouring network, such as relationships with age peers or kin relationships, personal and relational circumstances might be more important than the opportunities offered in a specific neighbourhood. We did not observe any significant differences between neighbourhoods in the percentage of kin relationships in the neighbouring network. Apparently, neighbourhood characteristics have similar effects on kin and non-kin relationships in the neighbouring network. This supports our assumption that extended kin as a single category, are less subject to kin obligations than are partners, children and parents. We can interpret this in two complementary ways. First, kin relationships in general may have

become more voluntary, making affectionate or other interpersonal criteria more important in explaining the existence of a relationship. Second, older adults may differ in their focus on kin relationships. Older adults from lower social-economic classes may have more relationships with (local) kin than do elderly people from the middle classes (Greenwell and Bengtson 1997; Wenger 1989).

Given the similarity of our results to findings in other settings in western countries, the specific nature of the Dutch context does not appear to affect the role of urbanisation and residential mobility identified. Effects on neighbouring networks of the more subjective and interpersonal characteristics of neighbourhoods we indicated earlier could depend more strongly on the idiosyncrasies of specific neighbourhoods and cultural traditions (*e.g.* Terpstra 1996). However, our findings suggest that the effects on neighbouring of social opportunities offered by different levels of population density and mobility in neighbourhoods are not culturally specific, at least within western societies. Cross-cultural comparison of neighbouring networks should reveal to what extent this is the case.

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Appendix. How to interpret multilevel analysis

The multilevel analysis leads to a regression equation which can be read as the product of an ordinary regression analysis. We evaluated the significance of the effects by computing the *t*-value as the unstandardised regression coefficient divided by its standard error, with an infinite number of degrees of freedom, which is satisfactory, given our sample sizes at both levels. The unstandardised regression coefficients are given.

There are two methods to evaluate the fit of the model in the multilevel analysis. The first one focuses on the significance of the model change. Each model is characterised by the −2 log likelihood

(deviance). We applied the forward modelling approach using an empty model (only containing the intercept) at the start and adding effects in several steps. The difference between the deviance of the successive steps is χ^2 distributed with the number of added variables as degrees of freedom. Thus the significance of the model improvement can be evaluated after each step.

The second method uses the decrease of the unexplained variance (Snijders and Bosker 1994). In each step, the variability of the dependent variable is estimated at each level of analysis. The sum of these variance components in the empty model equals the variance of the variable. By adding explanatory variables to the model, the variance should decrease for one or more of the levels. The amount of decrease gives insight into the explanatory power of the model (modeled variance). We give the variance remaining at each level after each step. Unlike ordinary regression analysis, the added modeled variances might be negative. If they are strongly negative, the specification of the model should be doubted. We applied both of the methods. The coefficients of the final equation are presented, together with the significance of the model improvement (deviance reduction) and the variances at each level.

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