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Living in the metropolitan area. Correlation of interurban mobility with the structural cohesion of personal networks and the originaive sense of community



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ABSTRACT

This study analyzed the metropolitan lifestyle with a representative personal networks survey of the population of Alcalá de Guadaira ($n=403$), in the urban environment of Seville (SW Spain). A factorial analysis with density, centralization, number of cliques and the number of components allowed differentiating two dimensions of variability in personal networks related to cohesion and fragmentation of the network structure. The frequency of interurban travel plays a decisive role in the development of a metropolitan lifestyle, and is associated with a lower structural cohesion of personal networks and with some moderation in the original sense of community. Based on the results, we question the hypothesis of community decline in metropolitan contexts.

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Vivir en el área metropolitana. Correlación de la movilidad interurbana con la cohesión estructural de las redes personales y el sentido de comunidad originario

RESUMEN

En este estudio analizamos el estilo de vida metropolitano con una encuesta de redes personales representativa de la población de Alcalá de Guadaira ($n=403$), en el entorno urbano de Sevilla. Un análisis factorial con la densidad, la centralización, el número de cliques y el número de componentes permitió diferenciar dos dimensiones de variabilidad en las redes personales, relacionadas con la cohesión y la fragmentación de la estructura reticular. La frecuencia de desplazamientos interurbanos tiene un papel determinante en el desarrollo de un estilo de vida metropolitano, se asocia con una menor cohesión estructural de las redes personales y con cierta moderación del sentido de comunidad originario. Basándonos en los resultados, cuestionamos la hipótesis del declive comunitario en los contextos metropolitanos.

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Palabras clave:

Movilidad interurbana
Estilo de vida metropolitano
Redes personales
Sentido de comunidad
Cohesión
Centralidad

Urban life transforms personal relationships. In the early 20th century, the pioneering studies of the Chicago School assumed that urbanization, compared with traditional societies, brings problems of loneliness, isolation, anomie or stress. From this point of

view, living in the city involves the breakdown of the primary groups and has a negative psychological impact (Park, 1916, 1926). Among other changes, the individual is forced to move between separate socio-geographical contexts and alternative spaces of sociability that barely overlap. Consequently, residents of urban areas experience a relative weakening of both their integration into the community and the availability of social support resources.

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However, although the thesis of the community decline has remained over time (Putnam, 2000), empirical research has demonstrated since then that people usually manage to have meaningful social support relationships in different residential contexts and also with different lifestyles (Wellman, 1979). A milestone in this direction is the work of Fischer (1982), which analyzed the impact of residential communities in personal networks, relying on an extensive survey in 50 districts of the State of California with different degrees of urbanization. According to his observations, urban residence does not result in a deterioration of psychological well-being or a lower quality of personal relationships. Nevertheless, a comparatively greater spatial dispersion of relations is observed.

The people of the cities and metropolitan areas generally have more geographically widespread relationships, and at the same time a lower relative proportion of local ties in the personal network than residents of rural areas (Fischer, 1982). It is therefore a replacement of a part of the local relations with distant relationships, and is reflected in a lower density of personal networks in urban settings (Bidart, Degenne, & Grossetti, 2011; Fischer, 1982; Wellman, 1979). However, also in this case the spatial distribution of the relationships neither diminishes significantly the quality and types of social support available, nor adversely affects the subjective well-being of urban residents.

This does not mean that geographic distance does not entail a cost for maintaining relationships. In fact, residential mobility often involves changes in the structure and composition of the personal network (de Federico de la Rúa, 2003; Domínguez & Maya-Jariego, 2008; Lubbers et al., 2010; Maya-Jariego & Armitage, 2007). Both commuting from home to work as interurban mobility routines (and, of course, international migration) causes weakening of relationships, change to a dormant state or even their disappearance (Bidart et al., 2011). Weak ties are particularly sensitive to personal transitions, to changes in the institutional contexts of interaction and to frequent geographical mobility. Instead, the strongest relationships are those that best resist the geographical distance. Specifically, confidence and friendship relationships are more likely to remain even if the individual no longer frequents (or does it less often) the contexts in which they originated (Grossetti, 2005).

With regard to the structure of personal networks, deploying an active metropolitan way of life, with greater geographical mobility, usually results in a lower density (Bidart et al., 2011; Fischer, 1982; Wellman, 1979), higher nodal betweenness (Maya-Jariego & Armitage, 2007), and greater geographic dispersion of personal relationships (Magdol, 2000). It also often leads to a more heterogeneous demographic composition (Araya & Maya Jariego, 2005). Other forms of mobility such as changes of residence appear to be reflected in a lower degree centrality and a higher proportion of isolated nodes (Haynie & South, 2005), networks more centralized around ego (Viry, 2012), and a relative increase in the presence of ties outside the family (Degenne & Lebeaux, 2005). On the other hand, geographic mobility in all its forms, from commuting from home to work to international migration, modifies patterns of sociability and brings personal experiences that finally affect the sense of community (Maya-Jariego & Armitage, 2007), mainly through social interaction in urban neighborhoods (Valera, 1997; Sánchez-Vidal, 2001).

With this research we want (a) to describe the diversity of structures of personal networks in the general population, and (b) to identify the most relevant dimensions of this variability. For this, we take as a case study a metropolitan residential environment in the urban area of Seville, through which (c) we analyze the association of the patterns of geographical mobility with the properties of personal networks and the sense of local community.

Method

Sample

The data is based from a survey conducted between 2004 and 2005 in Alcalá de Guadaira (Province of Seville, SW Spain), consisting of a random sample of 403 individuals selected by gender quotas, district of residence, and age. From an estimated population of 62,000 citizens registered in the city of Alcalá de Guadaira at the time of the survey (with a total of 50,933 people that were 16 years old and over), interviews were conducted in the Northern districts ($n = 107$, 26%), South ($n = 47$, 11.7%), Midwest ($n = 97$, 24.1%) and Eastern ($n = 148$, 36.7%).

Respondents were 37.82 years old at the time of the interview ($SD = 15.96$), with an age range between 16 and 82 years. On average, respondents have lived in Alcalá 33.34 years ($SD = 16.43$), ranging from 1 to 81. The segments of the population are fairly compensated for men ($n = 188$, 46.7%) and women ($n = 214$, 53.1%), single ($n = 164$, 40.7%) and married ($n = 191$, 47.7%). Most respondents have completed primary studies ($n = 184$, 45.7%), followed in proportion by secondary studies ($n = 135$, 33.5%), university studies ($n = 46$, 11.4%) and the population without studies ($n = 23$, 5.7%).

Instruments

The survey consisted of the evaluation of personal networks, sense of community with Alcalá de Guadaira and Seville, and metropolitan mobility patterns. In addition some questions about socio-demographic aspects and the social situation of the city of residence were made.

Personal networks

The network interview is divided into three parts. First, the *Arizona Social Support Interview Schedule* (ASSIS) as name generator (Barrera, 1980) was used. Second, respondents were asked to complete the list until a total of 25 alteri. The use of a fixed number of contacts facilitates data processing and allows comparison between different personal networks (McCarty, 2002). On each name, respondents indicated the place of residence (Alcalá, Seville or other city) and the type of relationship (distinguishing between relatives, friends, acquaintances or classmates, neighbors and "other"). Finally, respondents completed the relationship matrix (25×25), generating a total of 80,343 edges on a total of 120,900 possible relations.

Sense of community

The 12 items *Sense of Community Index* (SCI) was applied (Chavis, Hogge, McMillan, & Wandersman, 1986), which we used in previous studies with international immigrants (Domínguez & Maya-Jariego, 2008), and population involved in a pattern of metropolitan mobility (Maya-Jariego & Armitage, 2007). As with the original, the Spanish version of the scale assesses the factors of membership, influence, satisfaction of needs and shared emotional connection (Maya-Jariego, 2004; McMillan & Chavis, 1986). SCI is composed of simple questions like "very few neighbors know me" or "it's very important for me to live in this neighborhood," which were filled with values from 1 ("Completely disagree") to 4 ("Totally agree"). In this case it was administered in duplicate, based on the place of residence (Alcalá de Guadaira) and the capital where they normally pursue their university studies (Seville). The values ranged from a low of 14 and a maximum of 47 in the case of Alcalá, compared to 12 and 44 in the case of Seville.

Socio-demographic aspects and metropolitan mobility

Respondents indicated the frequency of travel between Alcalá and Seville choosing between "less than once a month", "once a

month”, “once a week”, “five times a week” and “once a day”. For further analysis was recoded into three levels: “once a month or less”, “once a week” and “five or more times a week.”

Data analysis

A total of 403 personal network matrices were treated and analyzed with Ucinet 6 (Borgatti, Everett, & Freeman, 2002). Survey data and summary indicators of personal networks (that is to say, graph-based measures) were both treated and analyzed with SPSS 22.

To compare personal networks, common indicators of nodal centrality were used. Degree centrality indicates that a particular node is directly connected to many other nodes or alteri. Closeness centrality is the sum of the distances to all other nodes. Betweenness is high when a node is located among many geodesic paths between alteri (i.e., between the shortest paths). The density is calculated from the total of existing ties based on the maximum number of links in the network. A clique is a set of nodes directly interconnected, whereas a component is a set of directly or indirectly interconnected nodes. A description of these indicators for personal networks is available at McCarty (2002).

To facilitate comparability between personal networks, in all analysis of this study, we used standardized average centrality indicators: that is, normalized average degree, normalized average betweenness, normalized average closeness, and normalized average eigenvector. Normalized average degree centrality matches the value of the density of the network (Everton, 2012). The normalized value of the nodal degree centrality is obtained dividing the number of links of the node by the maximum possible number of links of that node. Therefore the mean of the normalized values of the degree of all nodes in the network will result in a ratio equivalent to the density of all network links.

Results

The structural properties of personal networks in the general population

One of the empirical contributions of our work is the description of the personal networks of a representative sample of the general population, through centrality indicators and other structural properties. Grossetti repeated in the metropolitan area of Toulouse (Grossetti, 2005) the same method that Fischer used in 1977, in the area of San Francisco (Fischer, 1982). In Spain, Lozares also followed a comparison scheme in three locations with different levels of urban development in Catalonia (Lozares, López-Roldán, Bolívar, & Muntanyola, 2013; Lozares, Martí, Molina, & García-Macías, 2013). However, intentional samples have predominated in the investigation of personal networks, at the same time that data used were mainly aggregated attributes of the members of the network are mainly used (Campbell & Lee, 1991; McCarty, Bernard, Killworth,

Table 1

Measures of centrality, cohesion and subgroups.

| | Minimum | Maximum | Mean | SD |
|---------------------|---------|---------|-------|-------|
| Average degree | 20.67 | 100 | 66.46 | 19.51 |
| Average betweenness | 0 | 5.93 | 1.53 | 1.01 |
| Average closeness | 9.02 | 100 | 74.37 | 17.66 |
| Average eigenvector | 21.21 | 40.83 | 26.77 | 1.48 |
| Density | 20.67 | 100 | 66.46 | 19.51 |
| Cliques | 1 | 205 | 11.92 | 13.72 |
| Components | 1 | 4 | 1.09 | 0.36 |
| Centralization | 0 | 82.64 | 29.84 | 16.80 |

Johnsen, & Shelley, 1997). Only recently researchers have started using in personal network surveys the same structural indicators, graph-based measures, which were common in the analysis of entire networks (McCarty, 2002).

Table 1 shows the structural properties of personal networks in a medium-sized city in the metropolitan area of Seville. The indicators of centrality, cohesion and clustering show high variability, so we expect a wide variety of personal networks in the population. The indicators of density, degree, closeness, number of cliques and centralization move in a similar range of variability. For its part, betweenness centrality and the number of components are the indicators with a lower standard deviation.

Almost 90% of the indicators correlate significantly with each other (Table 2). On the one hand, density and average indicators of degree centrality, closeness and eigenvector are moderately or highly correlated. In this case they seem to behave, directly or indirectly, as measures of network cohesion. By contrast, average betweenness, the number of cliques, the number of components and the centralization of the personal network are negatively correlated with the measures of network cohesion. Finally, betweenness and centralization are positively correlated.

The above analysis differentiates roughly between indicators of cohesion (density, degree, closeness and eigenvector), intermediation (betweenness and centralization) and groups (cliques and components). To contrast, we return to this differentiation in subsequent analyzes.

Mobility and structure of personal networks

Alcalá de Guadaíra, is a village in the province of Seville, 16 kilometers from the capital and is fully integrated into the metropolitan area. Respondents have a high level of mobility between the two cities. Specifically, over 30% of the population moves to Seville from 5 to 7 times per week ($n = 124$, 30.7%), and 28.5% visit the capital at least once every seven days.

Two simple linear regressions show a clear association between the frequency of metropolitan displacements and structural properties of personal networks (Fig. 1). On one side, there is an inverse relationship between the density of the networks and the frequency of trips to Seville ($R^2 = 0.04$). Similarly, while most assiduous are

Table 2

Correlation between measures of centrality, cohesion and groups.

| | Degree | Betweenness | Closeness | Eigenvector | Density | Cliques | Components | Centralization |
|----------------|--------|-------------|-----------|-------------|----------|----------|------------|----------------|
| Degree | – | –0.929** | 0.833** | 0.762** | 1.00** | –0.273** | –0.246** | –0.876** |
| Betweenness | | – | –0.699** | –0.731** | –0.929** | 0.228** | 0.132** | 0.744** |
| Closeness | | | – | 0.733** | 0.833** | –0.172** | –0.622** | –0.615** |
| Eigenvector | | | | – | 0.762** | –0.075 | –0.313** | –0.595** |
| Density | | | | | – | –0.273** | –0.246** | –0.876** |
| Cliques | | | | | | – | –0.036 | 0.251** |
| Components | | | | | | | – | 0.071 |
| Centralization | | | | | | | | – |

Note. In all cases the indicator of normalized average centrality is used (normalized average degree, normalized average betweenness, etc.).

** $p < .01$.

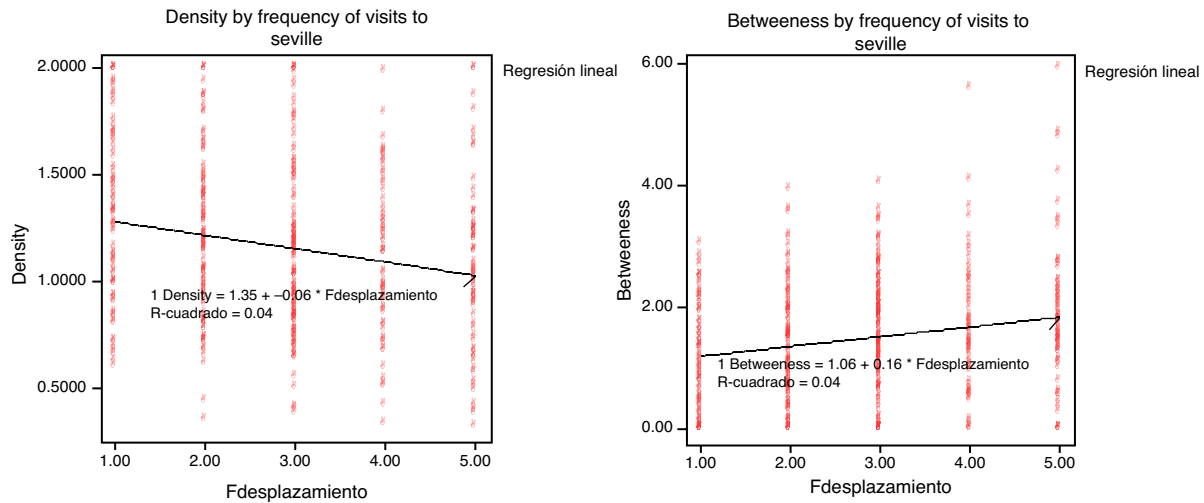


Fig. 1. Mobility and structure of personal networks in general population.

visits to the capital is highest the average betweenness of the personal network ($R^2 = 0.04$). That is, two different indicators seem to reflect an association between geographical mobility and level of structural cohesion.

Sense of community with Alcalá and Seville

Identification with Alcalá reaches an average score of 33.25 ($SD = 6.03$), whereas the sense of community with Seville is at 24.70 on average ($SD = 7.14$). Both have a moderate positive correlation ($r = .239$, $p < .0001$). No differences by district of residence were observed.

Identification with Alcalá correlates positively with the residence time in the city ($r = 0.243$, $p < .0001$) and the respondent's age ($r = 0.250$, $p < .0001$). The sense of community in Alcalá is higher among women than among men ($F_{1,398} = 5.281$, $p < .022$), and between married and widowed than among single ($F_{4,393} = 11.584$, $p < .0001$). They also express greater identification with Alcalá those who are satisfied or very satisfied with living in the city ($F_{3,396} = 55.509$, $p < .0001$) and those who believe that Alcalá has improved over the last three years ($F_{2,395} = 34.734$, $p < .0001$). Finally, a slight positive correlation of the number of organizations mentioned by the respondent with sense of community is observed, both with Alcalá ($r = 0.125$, $p < .013$) as with Seville ($r = 0.111$, $p < .029$). These results coincide roughly with the available evidence on the importance of local roots, relational integration and overall time spent in the community of reference.

Clear differences can also be seen based in the frequency of displacements. The identification with the place of residence is lower among those who move five or more times per week to Seville ($F_{2,398} = 7.913$, $p < .001$). On the contrary, those who go one or less times a month to Seville have a significantly lower score on the sense of community with the capital of the metropolitan area ($F_{2,393} = 7.975$, $p < .0001$).

Table 3
Correlation of SOC-Alcalá and SOC-Sevilla with indicators of personal networks.

| | Degree | Betweenness | Closeness | Eigenvector | Density | Cliques | Components | Centralization |
|-------------|--------|-------------|-----------|-------------|---------|---------|------------|----------------|
| SOC-Alcalá | .240** | -.206** | -.052 | .239** | 0.240** | -.128* | -.116* | -.227** |
| SOC-Seville | -.061 | .025 | .045 | .032 | -.061 | .008 | .000 | .089 |

Note. In all cases the indicator of normalized average centrality is used (normalized average degree, normalized average betweenness, etc.).

* $p < .05$.

** $p < .01$.

The sense of community has a consistent association with the structural properties of personal networks (Table 3). Specifically, cohesion measures with the exception of closeness have a statistically significant positive correlation with the degree of identification with Alcalá de Guadaira. By contrast, indicators of intermediation and groups show a negative association. Density and centralization are the indicators with a stronger correlation with the sense of community with Alcalá.

Interestingly, the sense of community with the city where they study, Seville, has no significant relationship with the structural properties of the personal network. As noted elsewhere, possibly different patterns of sociability mediate the impact of geographical mobility in the local identity (Maya-Jariego & Armitage, 2007). According to this hypothesis, the metropolitan lifestyle is characterized, among other things, by an active pattern of interurban mobility that is expressed in a lower structural cohesion of personal networks and possibly then in an attenuation of the degree of identification with the town of residence.

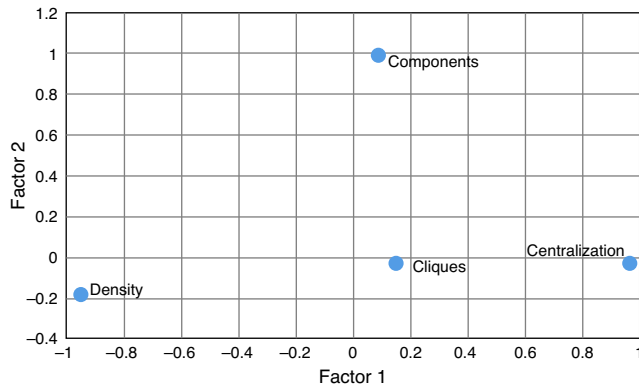
Factor analysis of the structural properties of personal networks

With the above analysis, we found that a high density of relationships and a low level of intermediation characterize the sample of personal networks as a whole. Accordingly, there are few components and a high number of cliques, centralization is moderately low and average closeness is high. In this section we explore the relationship between the different structural measures, applying factor analysis. We selected four indicators based in the table of correlations and in a proposal for theoretical operationalization (based in part on Lozares et al., 2013), namely: cliques (integration), components (fragmentation), density and centralization (cohesion). Thus we choose the indicators in which further empirical differentiation is expected and at the same time that represent the main theoretical dimensions of the structure of the networks.

Table 4

Factor scores of structural indicators of the personal networks.

| | Factor 1 | Factor 2 | Factor 3 |
|----------------|----------|----------|----------|
| Density | −0.946 | −0.179 | −0.141 |
| Centralization | 0.969 | −0.021 | 0.105 |
| Cliques | 0.149 | −0.025 | 0.988 |
| Components | 0.087 | 0.995 | −0.025 |

**Fig. 2.** Scores of personal networks variables in factors 1 and 2.**Table 5**

Factor scores based on the frequency of intercity travel.

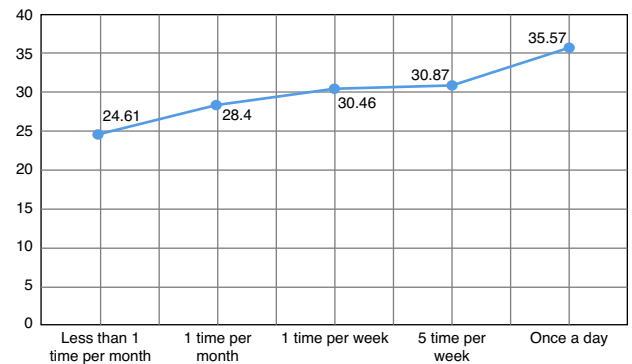
| | Factor 1 | Factor 2 | Factor 3 |
|----------------------------|----------|----------|----------|
| One time per month or less | −0.211 | −0.161 | −0.030 |
| One time per week | 0.0561 | −0.0675 | 0.125 |
| Five or more times a week | 0.227 | 0.276 | −0.0767 |

The factor extraction using principal component analysis yields a satisfactory solution of three factors that accumulates 97.37% of the explained variance.¹ In Table 4 we have summarized the factor scores of the four analyzed structural indicators, and Fig. 2 represents the first two factors. The resulting structure is very sharp and consistently reflects the previous theoretical differentiation.

Specifically, the 51.26% of the total variance corresponds to the first factor. That first axis of variability corresponds to a continuum of structural cohesion of the network (represented by the indicator of centralization and density). Both indicators, even with a different orientation, saturated with a very similar weight in this first factor. The second axis accumulates 26.07% of explained variance and reflects the fragmentation of the network into separate components.

The integration of the network in cliques formed a third factor accounting for 20.04% of the explained variance. However, the number of cliques maintains a slight negative correlation with the density (and positive with centralization), so that it is not as independent from structural cohesion of the network. In fact, it is the fragmentation of the network (the second factor) the one that seems more differentiated and less related to the rest.

To conclude the analysis, we compared the factor scores above depending on the frequency of intercity travel between Alcalá de Guadaíra and Seville (Table 5). Both the structural cohesion as well as the fragmentation of the networks seem clearly associated with geographic mobility. Specifically, people who move to the capital daily or almost daily (between five and seven times a week) tend to have networks with higher levels of centralization ($F_{2,400} = 5.640$, $p < .004$), and occasionally they are broken up into components ($F_{2,400} = 8.545$, $p < .0001$).

**Fig. 3.** Mean of network centralization, based on the frequency of displacements to Seville.

The cohesion of the network may decrease linearly according to the assiduity of metropolitan travel (Fig. 3). It is interesting to note that in the range of greater mobility both men as people with high school and college studies are significantly represented.

Discussion

In this study, we described the variability of personal networks and the sense of community among the inhabitants of a city of medium size of the Seville metropolitan area, depending on interurban mobility patterns. The results were very consistent in terms of co-variation of (a) the structural cohesion of personal networks and (b) the identification with the location of residence, with (c) the frequency of trips to the capital of the metropolitan area.

On the one hand, cohesion and fragmentation are the two fundamental dimensions of variability of personal networks, and both are associated with the patterns of intercity geographical mobility. Specifically, the bi-local way of life, with regular journeys between metropolitan area and urban core, is reflected in less dense personal networks, often divided into distinct components. By contrast, the individuals most deeply rooted at the local space usually develop their daily lives in more limited circles of relationships and have comparatively more cohesive networks. Anyway, the distribution of time between different geographical areas seems to be one of the distinctive features of personal networks in metropolitan areas and, consequently, in the individual differences in the structural indicators observed in this study. Geographic mobility has a structuring role in personal networks.

Furthermore, the cohesiveness of personal networks is also connected to the sense of belonging to the place of residence. Specifically, we observed an inverse relationship between the centralization of personal network, the nodal betweenness, and the number of components, on the one hand, and with the sense of community with Alcalá de Guadaíra, that is the city in which respondents live, on the other hand. The linking of the individual to relational and territorial spaces that are different to the place of origin carries more attenuated forms of identification with the local space. The complexity of the metropolitan area appears to be reflected in more heterogeneous interaction opportunities that potentially affect the cohesion of the personal network. Linking with different social circles weakens the originative sense of community.

This study shows that the loss of cohesion in the structure of personal networks and the relative decline of local identification are not necessarily negative phenomena. In fact, the results showed a psychological sense of community with the place of residence between moderate and high, regardless of the degree of geographical mobility. Throughout the research we also confirmed the existence of a strong neighborhood life in Alcalá de Guadaíra,

¹ The Bartlett sphericity test was significant ($X^2 = 685.178$, $p < .0001$).

although it is integrated into a larger metropolitan area. In this case the forms of intercity life seem to temper localism (or develop complex expressions of the multiple senses of community) rather than result in an immediate decline in community involvement. For example, in the group of university students from Alcalá, which is a particularly mobile segment of the population, we observed precisely that when they start their studies in Seville they usually begin to exert a role of bridge between localities that helps articulate the metropolitan area (Araya & Maya Jariego, 2005; Maya-Jariego & Holgado, 2005). The forms of bi-local life not necessarily result in a decoupling of (or participation problems in) the town of residence.

Likewise, changes that affect a population segment take a meso-social impact, in the wider community. When a group with a metropolitan lifestyle develops direct intercity links with Seville, it also automatically increases the proportion of indirect metropolitan relationships for the whole population of Alcalá. So, in relational terms, to live in a city in the metropolitan area is different from living in a village in a rural area, even for the less mobile people, with a neighborhood life or an eminently local life.

Instead of a decline of community, the integration in large urban spaces could be interpreted in terms of intercity articulation, as well as the development of more flexible identities. As in the seminal study by Fischer (1982), urban and metropolitan residence appears to be associated with less dense personal networks. These changes may be more likely in the personal networks of individuals with a higher level of education, which usually have a wider geographic range and also comparatively less dense networks. However, as we have indicated, they might indirectly affect the entire population living in metropolitan areas. Along with that, in our study we have delved into other dimensions of cohesion, fragmentation and integration of networks associated with the community of residence. Overall, participation in multiple relational fields appears to be a key, both as regards the network structure and with respect to the sense of local community. Indeed, as Fischer indicated (1982, p. 264) “urbanism does not seem to weaken community, but it does seem to help sustain a plurality of communities”.

Conflict of interest

The authors of this article declare no conflict of interest.

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