



Relationships in context and contexts of relationship: a normative transition at the end of Secondary Education

Isidro Maya-Jariego¹ · Daniel Holgado-Ramos¹

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Abstract

High school is an institution where teens spend a large part of their time. Consequently, in this context, a dense network of relationships tends to be formed during the period of study at the institute. However, at the end of secondary school, this set of contextualized relationships begins to disintegrate. In this study, we analyze the transition from high school to university of a cohort of high school students. First, we interviewed all the students who were in their last year of high school at an institute in the province of Seville ($n=69$). A year and a half later, we interviewed them again when many of them were already studying at university ($n=57$). Using a hybrid research design, we collected personal network data from each interviewee in the context of a longitudinal whole network design of the entire cohort analyzed. The results show a decrease in the structural cohesion of the networks, both for personal networks and for the complete network. Furthermore, less cohesive personal networks seem more likely to experience short-term changes in ecological transition processes. In the discussion we reflect on the impact of educational transitions on friendship relationships.

Keywords Social networks · Personal networks · Structural cohesion · Educational transitions · Friendship

In this study, we use a longitudinal hybrid design, in which we combine data from personal networks with data from whole networks. With this methodological innovation, we explore the overlap of the different social contexts in which a group of high school students participate with the relationships they maintain within the group itself. To provide a theoretical framework, we first describe the way in which relationships are generated or maintained in different interaction contexts, as well as how they become independent of them.

1 Nodes, ties and contexts

One of the basic notions in social network analysis is the distinction between personal networks and whole social networks. In both cases, they are social structures, capable of being analyzed as a set of actors and a set of relationships. However, the first ones are formed around an individual

actor, while the second ones correspond to a set of actors whose relationships between them are thoroughly examined (Crossley et al. 2015; McCarty, Lubbers, Vacca and Molina 2019; Perry et al. 2018). Although the same structural analysis techniques can be applied in both cases (McCarty 2002), both differ in the way in which they approach the study of interaction contexts. Whole networks are often focused on a specific relationship context, so that one of the methodological challenges is, precisely, to set the limits of the network. By contrast, personal networks usually embrace the different contexts in which an individual participates. Although ego-net analysis can also be restricted to a single context (Maya-Jariego 2020), in practice one of its characteristic contributions consists in examining the diversity of social circles in which an individual participates.

In whole network analysis, an exhaustive census of all members of a population and their relationships to each other is conducted. Therefore, the logic of randomly drawing a sample from a population is not applied, but the aim is to examine a social system in its entirety (Crossley et al. 2015). With this approach, the patterns of connection that exist in a specific interaction context are usually described and, accordingly, it has been applied preferably to small groups and meso-social structures, such as organizations,

✉ Isidro Maya-Jariego
isidromj@us.es

¹ Faculty of Psychology, Universidad de Sevilla, Calle Camilo José Cela s/n, 41018 Sevilla, Spain

schools, neighborhoods and communities. As a whole, it is an effective strategy to characterize a context through its relationships.

In personal network analysis, the use of name generators has been extended to capture the diversity of social contexts in which the individual interacts (McCarty 2002; McCarty et al. 2019). As a result, it is useful to describe how the different social environments that surround a person are articulated or, in classical terminology, the intersection of social circles (Simmel 1955). Although ego-net can also be drawn from whole networks with regard to a single relationship context (Crossley et al. 2015; Perry et al. 2018), the contribution of personal networks is indeed revealing the different foci of activity in which the respondent participates (Feld 1981). In a study about the visualization of personal networks, we proved that university students reported an average of four clusters, generally referring to family, friends, colleagues, and similar interaction contexts (Maya-Jariego and Holgado 2005). Cohesive subgroups are usually associated with a context of interaction, such as home, workplace, associations, bars, or churches, although they may also, in part, overlap each other (McCarty et al. 2019).

Despite this clear distinction, the two levels of analysis can be combined in the same research. For example, with data from a sample of personal networks, a whole network can be built (Roman et al. 2012; Weeks et al. 2002). Similarly, from the density of the individual ego-nets, the clustering levels in the whole network can be inferred (Crossley et al. 2015). This is more feasible when the data are based on intensive, long-term fieldwork, although there are also specific computer programs which make identification of each person based on their attributes (Perry et al. 2018).

However, beyond such methodological integration, the potential of combining the two levels of analysis in the description of individual relational contexts has hardly been explored. As we have just shown, whole networks describe relationship processes in a specific context, while personal networks allow us to examine the distribution of the interpersonal relationships of an individual in different interaction contexts. On paper, they allow to characterize, respectively, (a) the situational context and (b) the multiple meso-social structures of belonging, as well as their mutual influences. For example, we can assume that the types of personal networks of each person predispose them to be located differently in a given interaction context. In reverse, the position that an individual occupies in a specific interaction setting could influence the structural properties of their personal network. Let us take a look at these two ways of interpreting the relationship contexts.

2 Contextualized relationships and multiplicity of relational contexts

A large part of social interaction is organized around specific contexts in which a shared activity takes place, such as schools, workplaces, associations or home (Feld 1981). Whole social networks usually refer to one of these contexts of activity, so their structural properties are inseparable from the focus of interaction in which they originated. Therefore, to the extent that the relationships that occur in these environments constitute emerging social structures and form social networks, they are *contextualized relationships*.

From this point of view, contexts contribute to the formation of clusters of relationships that contain individuals within them. Thus, the dynamics of transitivity progressively lead to the closure of the network, especially as individuals spend more time in that focus of activity. This process is particularly relevant if we consider that the value of dyadic relationships may depend on the broader relational context in the reference group. For example, love relationships acquire different meaning in different community groups, and consequently also affect the stability of the groups unevenly (Yeung 2005).

However, the intersection of a set of social contexts occurs in each person. Some of the pioneering works in this area have already shown that the distribution of personal relationships in several contexts of interaction usually means that the personal network is segmented into different fields of activity (Boissevain 1968). In turn, it is reasonable to believe that participation in many different social circles results in less dense personal networks, since the individuals mentioned by ego are less likely to know each other. Therefore, the structure of personal networks reflects the way in which each person is linked to *multiple relational contexts*.

Consequently, the duality of relationships and contexts can interact with each other in complex ways. To illustrate it with a specific assumption, the density of a whole network referred to a specific context of interaction could be in dialectic tension with the distribution of the density of the personal networks of its members. In other words, even in a located interaction, other external contexts of belonging are present in the dynamics of interindividual relationship.

3 The decoupling of relationships

Nevertheless, relationships are not always tied to a context. Over time, some relationships become independent of the social environment in which they originated. That

is, they experience a process of “decoupling” (White 2002, 2008). Other relationships, in contrast, disappear or go into a latent state when the individual stops frequenting the contexts in which those relationships preferably took place. Many relationships are formed at school, at university, in the workplace, in the neighborhood, and in different organizations (Fischer 1982; Grossetti 2005, 2018). However, throughout the life cycle some relationships acquire their own entity, gain autonomy with regard to the original interaction context, and are maintained in different contexts or regardless of the context. This decoupling of relationship from the preferential or initial interaction environment also has a strong structuring power of the personal network. These are usually strong relationships, with comparatively high levels of multiplicity, which take a central place in the space of individual sociability. They have a “life of their own” to the extent that a shared interpersonal history is traced. Accordingly, the decoupling process reveals the existence of decontextualized and *transcontextual* relationships.

Normative personal transitions provide an exceptional opportunity to observe how personal networks evolve when the person changes context (Maya-Jariego et al. 2018). They do not only allow us to study which relationships continue, which ones are interrupted, and which ones begin, but it also makes it possible to combine collective and individual analysis. When a group of individuals leaves at the same time an interaction context in which they have been linked, a process of dismemberment with regard to the whole social network begins (Maya-Jariego et al. 2020b), which in turn is reflected in changes in the structure of the personal networks of each one of them. It is also an opportunity to observe decoupling processes. In personal networks, some of the most important relationships for the individual are linked to different social circles at the same time, so they can be more resistant to circumstantial changes and come along with the individual throughout their biographical itinerary.

In this article, we analyze the duality of contexts and relationships in a group of secondary school students who complete their studies. In a high proportion, they start studying at the university and a process of gradual disaggregation of the network of peers that they had formed while studying at high school begins.

4 This study: the combined analysis of personal networks and the whole network of a cohort of individuals in personal transition

The secondary school is a social focus in which contextualized relationships take place. The cohort of students who start their studies at the same high school usually share

academic and sociability activities in the same setting over at least four years. The opportunities for continued interaction translate into the formation of clusters of relationships. However, each of these students is linked in turn to other social foci, such as the family home, sport clubs or cultural associations. As a result, personal networks are a reflection of the multiplicity of relational contexts in which each student participates.

As we have already exposed, the interaction located in a specific context, in this case the high school, intersects with other contexts of interaction through the personal networks of its students. In this study we simultaneously explore (1) the whole network of a cohort of secondary school students and (2) the personal networks of each of its members, as well as their mutual dependence. The first refers to contextualized relationships (in high school), while the second represents in each individual case the multiplicity of contexts in which the students participate (either inside or outside the high school).

High school is an institution in which teenagers spend much of their time. Consequently, in this context a dense network of relationships is usually formed during the period of their studies at high school. However, after completing high school, this set of contextualized relationships begins to disaggregate. Some of the interpersonal links that remain possibly correspond to the friendly relationships that have been formed in that period, more resistant to dissolution.

At the individual level, personal networks are also exposed to change. For example, more heterogeneous or less dense networks are likely to be more prone to change during personal transition. On the other hand, each individual has a unique immediate social environment, formed by a set of direct and indirect relationships (Alba and Kadushin 1976), whose distribution in social circles will be subject to a certain reorganization.

In this study, we use a longitudinal database of the social network and personal networks of a cohort of students at the end of high school, to explore the changes that occur in the duality of contexts and relationships. Thanks to a hybrid design, we investigate the co-determination of interaction contexts and relational structures. With the specific case of students who finish their studies at the high school, we pose two research questions for exploratory purposes:

1. Do the different types of personal networks condition the position that students occupy in the complete social network of their high school classmates?
2. Do the structural properties of personal networks depend on the position that students occupy in the entire social network of their high school peers?

By combining both analysis strategies we intend to contribute to a better understanding of the contextualized nature of relationships.

5 Empirical context: data and methods

The Albero study consisted in the longitudinal follow-up of final year students from a secondary school, before ($n = 69$) and after ($n = 57$) completing their studies. In the two observations, 17 months apart, the whole network of respondents was drawn and the personal network of each of them was obtained. In the second wave, 12 students could not be contacted or declined to participate, so that the fraction of missing data at t_2 was 0.17 at the dyadic level.

Information about the psychological sense of community and the frequency of interurban movements was also collected. Specifically, the 12-item Sense of Community Index (Chavis et al. 1986) was applied to evaluate the degree of identification with the town of residence (Alcalá de Guadaíra) and with the capital in which most of them would carry out their university studies (Seville). They also indicated the frequency of weekly visits to Seville. A detailed description of data, instruments, and procedure is available in Maya-Jariego et al. (2020a). Both relational matrices and survey data are available in Zenodo. <https://zenodo.org/record/3532048#.XrvLXsBS82y>

The participants constitute a homogeneous group of 17-year-olds ($M = 17.2$, $SD = 0.66$), who live with their parents and who have lived all their lives in the same city. When they started their university studies, they began a metropolitan lifestyle, with continuous interurban displacements to Seville. In the second wave, 84% of the respondents were already university students. Consequently, while in the first wave the majority lived in Alcalá de Guadaíra, where they spent most of the time, in the second wave more than half commute to Seville 5 times a week, adopting a metropolitan lifestyle.

5.1 Obtention of the whole network and name generator of the personal networks

To generate each whole social network, the respondents were given a list of 77 students enrolled in the last year of high school, asking to indicate the type of relationship for each case, according to the following values: 1, "his/her name sounds familiar"; 2, "I know him/her"; 3, "we talk from time to time"; 4, "we have a close relationship"; and 5, "we are friends."

To obtain the personal network, a multiple social support name generator was used (Barrera 1980) and each respondent was asked to complete the list of names up to 45 *alters*. Through six specific questions, respondents were asked

to name the people "with whom they talk about personal matters," "who provide material help," "who give advice," with whom they "share the way of thinking," that "provide instrumental support" or with which they get "company" and share their leisure time. This allows obtaining a list of the main providers of emotional, informational and instrumental support. Second, to reach the target of 45 *alters*, the list is completed by respondents with comparatively weaker links names. The establishment of a fixed number of names facilitates the processing, standardization, and comparability of data (Maya-Jariego 2018; McCarty 2002). The values of the alter-alter relationships range from 0 (not known) to 2 (well known).

5.2 Data analysis

In the whole network, strong ties (≥ 4) were examined, that is, those cases in which the alter-alter dyad has "a close relationship" or "are friends." In personal networks, which by definition constitute a particularly relevant subset of personal contacts for each respondent, acquaintance relationships (≥ 1) were used as a cut-off point, that is, those cases in which each alter-alter dyad, at least, "know each other." In both cases, a cut-off point that maximized the identification of cohesive subgroups and interindividual differences in the structural properties of personal networks, respectively, was chosen.

The relational data were analyzed with UCINET 6.698 (Borgatti, Everett, and Freeman 2002) and the survey data were analyzed with SPSS 26. The visualizations were made with Netdraw (Borgatti 2002). In the whole networks, three indicators of individual centrality were calculated for each respondent: indegree, outdegree and betweenness. For its part, each personal network was summarized with the indicators of average centrality (Average Degree, Average Closeness, Average Betweenness, Eigenvector), density, number of cliques and number of components.

To analyze personal networks, summary indicators of their structural properties are usually used (McCarty et al. 2019). Cohesion, relational integration, and fragmentation of networks are three factors that seem to efficiently represent structural variability (Lozares et al. 2013; Maya-Jariego and Holgado 2015). In previous studies, the existence of three different factors of cohesion, integration and fragmentation of networks has been observed (Maya-Jariego 2021; Maya-Jariego and Holgado 2015). To operationalize them, in this study we use, respectively, the indicators of centralization, the number of cliques and the number of components. Low centralization is a sign of high connectivity in the personal network and reflects the degree of structural cohesion. The cliques show the existence of subgroups in personal networks and reflect the contexts of interaction in which the

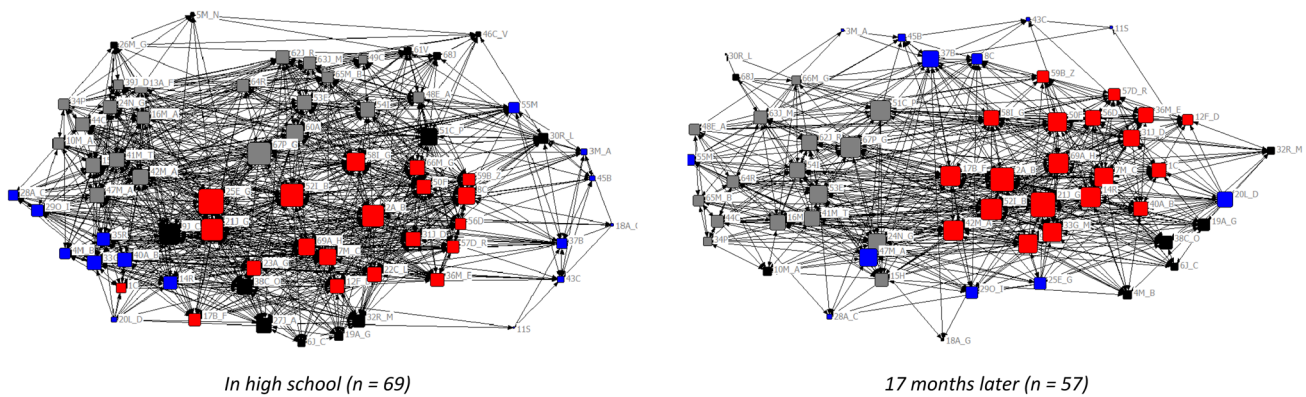


Fig. 1 Evolution of the social network of respondents, before and after completing secondary school studies. The size of the node represents degree centrality. The colors represent the four factions identified in the graph. The distribution of the nodes follows multidimensional scaling

individual participates. The number of components reflects the fragmentation of the network.

In a first descriptive phase, the structural cohesion indicators of the whole network were calculated, the core–periphery structure was assessed, and faction analysis was applied. For each respondent, individual centrality measures in the social network and in the personal networks were obtained. The analyses were replicated in the two observations, and in each case, mean comparisons for related samples were made.

In a second phase, we perform k-means cluster analysis with longitudinal data of personal networks. Two indicators of structural cohesion were used as criterion variables in each observation: average degree and average betweenness. The calculations were made with 10 iterations, updating means and a convergence criterion of 0.02. Exploratory analyses were carried out to verify the distribution of cases by categories, before opting for the 3-cluster solution.

Finally, we performed a cross-validation of the classification of personal networks with factions and core–periphery categories of the whole network. In this way, we can check the combinatorial of the changes in the personal networks with the changes in the social network. As an element of contrast, the regression coefficients between the levels of personal networks and whole networks were calculated with longitudinal data.

6 Results

6.1 Descriptive data of the evolution of social network

The whole network of people surveyed in the secondary school ($n = 69$) has a density of 0.286, a degree centrality of 0.369 and an average degree of 19.478. Follow-up data 17 months later ($n = 57$) show a slight decline in network

cohesion, with small decreases in density (0.249), degree centrality (0.307), and average degree (13.947). In the same comparison, the diameter increases from 4 to 5. It can be considered a friendship network in decay, which is fragmenting and partly dissolving as more time passes since the completion of high school.

The evolution toward a less cohesive network is represented in Fig. 1. Nevertheless, the exploratory descriptive analyses revealed that both the core–periphery structure and the configuration in four defined factions remained stable between both observations. The core of the core–periphery structure is formed by the 39.13 percent of the nodes in the first observation and by the 38.59 percent in the second. For its part, the allocation to the factions

Table 1 Changes in individual centrality measures in the whole network and in the average centrality indicators of personal networks

	In high school		17 months later		
	M	DT	M	DT	T
<i>Social network</i>					
Indegree	19.47	7.88	13.94	7.15	5.233***
Outdegree	19.47	8.97	13.94	8.19	4.226***
Betweenness	53.87	41.61	31.29	31.67	4.567***
<i>Personal networks</i>					
Density	0.63	0.19	0.57	0.16	2.928**
Cliques	63.68	62.67	68.35	11.20	-0.524
Components	1.47	1.22	1.35	1.14	1.187
Av. degree	41.02	11.20	36.84	9.75	3.025**
Av. closeness	53.07	16.47	51.68	16.69	0.567
Av. betweenness	1.57	0.45	1.77	0.64	-2.181*
Av. Eigenvector	18.56	1.13	17.71	4.04	1.677

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2 Distribution of cases and final centers of personal network clusters

Clusters	Criterion variable				Description
	<i>In high school</i>		<i>17 months later</i>		
	Av. degree	Av. betweenness	Av. degree	Av. betweenness	
Cluster 1 (<i>n</i> = 18)	34.815	1.780	26.184	2.204	They are the personal networks with the least structural cohesion, which is reinforced in the second observation
Cluster 2 (<i>n</i> = 13)	56.980	1.024	46.270	1.465	They are the personal networks with the most structural cohesion, although a reduction between both observations is noticed
Cluster 3 (<i>n</i> = 26)	37.347	1.710	39.503	1.628	It is the intermediate cluster in the first cohesion, although an increase between both observations is noticed

The procedure converged in 5 iterations

Table 3 Cross-validation of clusters of personal networks with the core/periphery categories in the social network

Clusters	Model core-periphery				Description
	<i>In high school</i>		<i>17 months later</i>		
	Core	Periphery	Core	Periphery	
Cluster 1 (<i>n</i> = 18)	38.9	61.1	26.7	73.3	Individuals with less cohesive personal networks are significantly on the periphery in the second observation
Cluster 2 (<i>n</i> = 13)	61.5	38.5	63.6	36.4	Individuals with cohesive personal networks remain at the core of the social network in both observations
Cluster 3 (<i>n</i> = 26)	30.8	69.2	44	56	In a group the cohesion of their personal networks increases while their peripheral role in the social network decreases

In each cell the percentage of each cluster that is distributed between the core and the periphery is indicated. The cells that are represented above the theoretical expectation are highlighted in grey, according to the Chi-square residuals calculation

remains the same in 77.19 percent of the cases, with a Kappa coefficient of 0.69 ($p < 0.0001$).

6.2 Description of individual changes in the personal network and in the whole network

In Table 1, we have summarize the changes observed at the individual level throughout 17 months of follow-up, both in the whole network of the students surveyed and in the sample of their personal networks. In the whole network, there is a decrease in indegree ($t = 5.233, p < 0.001$), in out-degree ($t = 4.226, p < 0.001$) and in betweenness ($t = 4.567, p < 0.001$). Personal networks show a decrease in structural cohesion, with a significant decline between observations in density ($t = 2.928, p < 0.005$) and average degree ($t = 3.025, p < 0.004$). Accordingly, a significant increase in average betweenness of personal networks is observed ($t = -2.181, p < 0.033$).

Based on these last two indicators, we elaborate the classification of clusters of Table 2. There are two groups that experience a reduction in the structural cohesion of their personal networks. These are the individuals with the most cohesive

personal networks (cluster 2) and those with the least cohesive personal networks (cluster 1). Curiously, the respondents with intermediate scores are the only ones who see an increase in the level of cohesion in their personal networks in the second observation (cluster 3).

Table 4 Regression coefficients of the personal network in high school on the social network 17 months later

Personal network (in high school)	Social network (17 months later)				
	R	R2	B	B	T
<i>Outdegree</i>					
Av. degree	0.413	0.170	0.302	0.413	3.359***
Av. betweenness	0.430	0.185	-7.723	-0.430	-3.537***
<i>Indegree</i>					
Av. degree	0.284	0.081	0.181	0.183	2.198*
Av. betweenness	0.306	0.094	-4.796	-0.306	-2.386*
<i>Betweenness</i>					
Av. degree	0.330	0.109	0.932	0.330	2.589*
Av. betweenness	0.375	0.141	-26.024	-0.375	-3.003**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5 Distribution of cases and final centers of the clusters

Clusters	Criterion variables			Description
	Modularity	Subgroups	Isolates/Dyads	
Type 1 ($n=26$)	0.089	1.885	7.885	Networks with one or two cohesive subgroups and a high density. With a scattered periphery
Type 2 ($n=21$)	0.206	2.571	4.810	Network with two or three cohesive subgroups and a periphery of isolated actors
Type 3 ($n=22$)	0.348	2.500	0.909	Compact network with two or three cohesive subgroups

Respondents who have started university studies in the second observation are more represented in clusters 2 and 3, while in cluster 1 there are comparatively more students who are still in high school or who have opted for other alternatives to university. Specifically, 76.9 percent of cluster 2, 65.4 percent of cluster 3, and just 38.9 percent of cluster 1 study at university.

The three levels of cohesion that clusters represent are verified with density data of personal networks, both in high school ($t = 23.335$, $p < 0.0001$) and 17 months later ($t = 32.114$, $p < 0.0001$). Cluster 2 has the highest density, with 0.86 (at t1) and 0.71 (at t2). Cluster 1 has the lowest density, with 0.52 (at t1) and 0.41 (at t2). Cluster 3 has intermediate scores, with 0.59 (at t1) and 0.62 (at t2). Otherwise, it is such a homogeneous group that no sociodemographic differences are observed in systematic comparisons.

6.3 Cross-validation of the personal networks with the whole network

As given in Table 3, we have crossed the three clusters of personal networks with belonging to the core or the periphery in the whole network. Cluster 2 (with the most cohesive personal networks) is significantly represented in the core of the whole network, both in high school and 17 months later. In contrast, cluster 3 is significantly represented at the periphery in the first observation and cluster 1 in the second.

This is countersigned by membership in factions. Cluster 2 is significantly represented in the faction with more centrality (in red in Fig. 1), in both observations. Cluster 1 is significantly represented in one of the peripheral clusters in the second wave (in blue in Fig. 1).

The bivariate correlations show a positive association of the average degree centrality of the personal networks with the individual centrality measures in the whole network (as stated in Appendix 1). Regression coefficients indicate that measures of structural cohesion of personal networks during

high school significantly predict the respondent's position in the whole social network 17 months later.¹ Data are shown in Table 4.

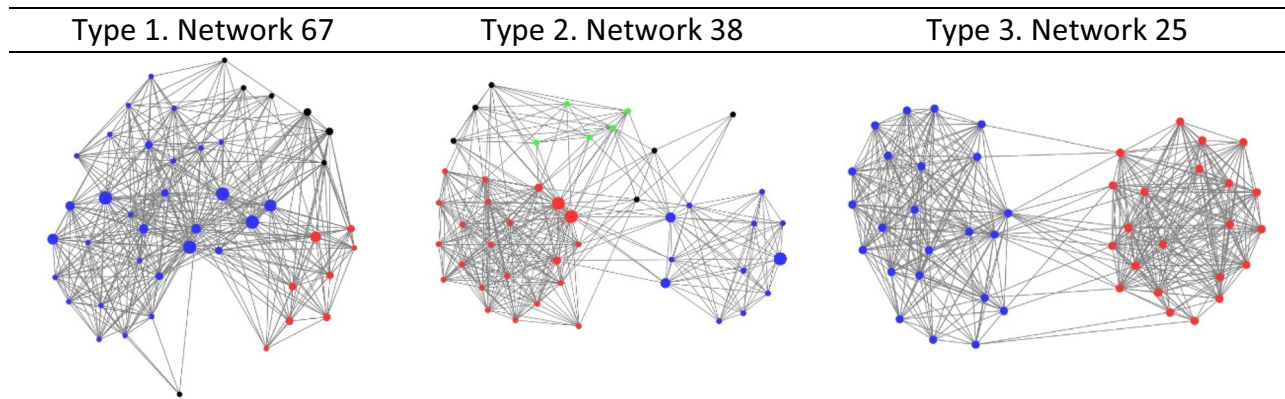
In summary, data allow us to identify three profiles of respondents. The group with the densest personal networks remains at the center of the whole social network even though a general process of decline in the cohesion of the student cohort has begun. At the other end, students with less dense personal networks see their peripheral position in the whole network strengthened. Finally, it is interesting to observe that a group with intermediate indicators in the personal network slightly improves its relative position in the social network. Therefore, the completion of studies seems to generate a different structure of opportunities depending on the individual situation of each student.

6.4 Exploring individual differences in modularity and cohesive groups

In the previous sections, we have verified that there are individual differences in the structure of personal networks, which are associated with different positions of the participants in the whole social network. Next, we classify personal networks using the existence of cohesive communities and subgroups as criteria. This way is possible to identify the underlying structure of personal networks from the regularities detected in the data and facilitates comparison between different population segments. For this, we apply the subgroup identification procedure developed by Vacca (2020). It is a particularly pertinent strategy for describing social circles and contexts of interaction.

Specifically, with three criterion variables, we analyze the subgroup structure of personal networks. First, the Girvan–Newman modularity algorithm (Girvan and Newman 2002) makes it possible to detect subgroups of actors with high internal density and less connection between groups. To do this, it follows an iterative process of eliminating the ties with the greatest intermediation. Second, we calculate the number of subgroups of three or more actors existing in the partitions detected in the previous step. This makes it possible to differentiate between cohesive

¹ In reverse, only two significant associations of centrality were found in the whole network in the first observation and the structure of personal networks in the second. Specifically, indegree is a significant predictor of average degree ($\beta=0.267$, $p < 0.05$) and outdegree is a significant predictor of average betweenness ($\beta=0.320$, $p < 0.05$).



Note. The color represents modularity, and the size of the node indicates the number of types of support that each node provides to Ego.

Fig. 2 Three examples of personal networks. *Note* The color represents modularity, and the size of the node indicates the number of types of support that each node provides to Ego

networks based on core–periphery structures and others based on factions or differentiated social spaces (Vacca 2020). Finally, the number of isolated nodes or dyads was also counted. This gives information on the degree of fragmentation of the personal network.

In Table 5, we present the clusters obtained with the *k*-means procedure with the three criterion variables mentioned above. The solution with three clusters was the best adjusted to the available data and showed the highest silhouette index.

Type 1 is characterized by comparatively low modularity, with a number of cohesive subgroups close to two. It also has the highest number of isolated *alteri* of the three clusters. Broadly speaking, these are dense networks with little differentiation in defined social spaces. A fairly frequent structure in this profile consists of a large cohesive group and a smaller one, with a high number of ties between them. Cases of a single cohesive group can also be observed.

Types 2 and 3 are characterized by greater modularity and greater differentiation into social subgroups. The difference between the two is that Type 3 has the least number of isolated nodes: that is, it is the type with the lowest level of fragmentation. In Vacca's (2020) terminology, Type 2 is a “weakly bi-factional” structure while Type 3 is “strongly bi-factional”. As we see in Fig. 2, the networks oscillate between cohesive structures around a nucleus (Type 1) and others in which a differentiation of defined social circles seems to emerge (Type 2).

The three types differ in the indicators of centrality and cohesion. Type 1 has a higher mean in degree centrality and

eigenvector than Type 2 ($F=4.008$, $p<0.05$ and $F=4.365$, $p<0.05$), as well as a lower betweenness centrality than Types 2 and 3 ($F=12.393$, $p<0.01$). Finally, Type 3 networks present a significantly lower number of cliques than type 1 ($F=4.737$, $p<0.05$).

From a longitudinal point of view, type 1 networks show a decrease in average degree ($t=3.608$, $p<0.01$), and density ($t=3.853$, $p<0.01$) between the first observation and 17 months after. In Types 2 and 3, no changes are observed in the measures of centrality and cohesion, except in the eigenvector indicator, which increases in both cases ($t=6.200$, $p<0.01$ for Type 2 networks, and $t=4.546$, $p<0.01$ for Type 3). In all three cases, a decrease in out-degree, indegree and betweenness in the complete social network is observed.

Finally, while in Type 1 networks there is a decrease in the sense of community with respect to Alcalá ($t=2.292$, $p<0.05$) and in group 3 there is an increase in the sense of belonging to Seville ($t=-2.818$, $p<0.05$), in group 2 no difference is observed in this regard. A more detailed description of the changes in the Sense of Community Index is available in Maya-Jariego et al. (2018).

7 Discussion

In this study, we observe how the interpersonal relationships of a group of secondary school students evolve after completing their studies. To do this, we conduct a follow-up of both the social network of the cohort of students and the personal networks of each of them. At both levels, a decrease

in density and in other indicators of structural cohesion was observed. In the case of the whole network, this reflects the disaggregation process that began at the end of studies, when they stopped attending high school as a context of interaction (Maya-Jariego et al. 2020b). In the case of the personal network, it represents the individual ecological transition process, which coincides with an increase in heterogeneity in the composition of their immediate interpersonal environment (Maya-Jariego et al. 2018).

However, the two processes are interrelated. On the one hand, the whole network does not disappear immediately, but remains active, although in a decontextualized way. The friendships that have been forged during high school accompany the respondents throughout the first phase of the normative transition. This not only slows down the disaggregation of the social network as a whole, but possibly decelerates the personal transitions that occur at the individual level. That is, keeping in touch with the reference group seems to delay the changes that each student experiences at the end of secondary education.

On the other hand, the diversity of personal networks is related to the existence of different individual itineraries. Those individuals with more cohesive personal networks can maintain greater connectivity in the whole network as well. In fact, we proved how some indicators of centrality of the personal network were significantly associated with the position of the respondent in the whole network almost a year and a half later. According to the results, we could hypothesize that students with less cohesive personal networks are more prone to change when the normative transition begins.

Consequently, personal networks can be especially useful in analyzing individual differences. For example, in our study we verified the existence of a small group for whom the completion of their studies becomes an opportunity to improve their relative position in the social network. It is a subgroup with intermediate indicators in their personal networks, which illustrates the diversity of circumstances that can be found in the same group. We also proved marked differences in the evolution of students depending on the density of their personal networks.

In any case, in our study we observed a covariation between the structural cohesion of personal networks and individual centrality in the whole network. In fact, they may be mutually reinforcing processes. As the whole network disaggregates, opportunities for students to diversify their personal networks increase. In turn, as personal networks diversify, relationships are distributed among alternative spaces and it becomes more costly to maintain links with the social network configured at high school.

Our results are in line with those of other previous studies that have shown that educational transitions of a normative nature seem to reduce stability in friendship relationships (Suitor 1987; Temkin et al. 2018), and that, in general, have a significant impact on the evolution of personal networks (Bidart, Degenne and Grossetti 2015; Bidart and Lavenu 2005). In turn, there is evidence that personal networks have a significant impact on the transition from studies to work (Engberg and Wolniak 2010; Holland et al. 2007; Strathdee 2001), and affect the presence of depressive symptoms, behavior problems and delinquency (Kiesner et al. 2003). This could be useful to instruct teachers on how to manage such social dynamics at High School, and to develop strategies that promote productive peer relationships in educational institutions (Farmer et al. 2010). Especially if we consider that the educational cohort has a key impact on the members that compose it, as is the case in the trajectories of continuity or abandonment of studies (Eckles and Stradley 2012).

7.1 The duality of contexts and relationships

With this research, we have proved that educational institutions, at certain ages, are key foci of activity in the formation of relationships and, consequently, in the structural properties of the social network. In fact, its impact extends over time in so far as many of the relationships originated in the educational context take time to dissolve, or to pass into a dormant state. Even a few of these relationships can come along with the individual throughout their life cycle, or an important part of it. Therefore, through the process of decoupling, contexts leave a trace on the personal networks of individuals in the medium and long term.

However, there are relevant individual differences depending on the link that each person maintains with different social circles. Personal networks vary in the type of articulation between the cohesive groups in which the individual participates (Vacca 2020), which translates into divergent personal itineraries. Consequently, through the individuals connected in a specific situational interaction, the multiple meso-social structures of belonging are articulated. For example, families, voluntary associations, or sport clubs can have an indirect influence on interactions that take place in high school, through the combination of social circles with which each student connects. That is, the meso-social structures are present in the opportunities for individual interaction.

7.2 The relevance of cohesive subgroups in personal networks

The formation of cohesive subgroups is a key element in the appearance of individual differences in personal networks. Therefore, it can be used in the construction of typologies (Maya-Jariego 2021). While some individuals tend to develop dense and integrated personal networks, in others more or less defined subsets emerge, corresponding to different contexts of interaction. This positions them differently to face the changes derived from personal transitions or alterations that occur in the social context. Consequently, the distribution of personal relationships in different interaction contexts improves the ability to resist the difficulties that any personal transition process normally entails.

7.3 Relationships are embedded in social and institutional contexts

Social networks depend on the cultural context in which they originate, so it is necessary to examine the links between networks and contexts (Basov and Kholodova 2022; Drouhot 2017; Habinek et al. 2015). Although research designs that assume that all members of a social network come from the same context are common, the truth is that network members are drawn from multiple social contexts, and that these social contexts in turn influence the structural properties of personal networks (Mollenhorst et al. 2011). Thus, the opportunities for interaction in the workplace, home, sports clubs, associations, or the neighborhood contribute to the creation of new relationships. And conversely, the lack of meeting opportunities is a frequent reason why many personal relationships are interrupted (Mollenhorst, Volker and Flap 2008, 2014).

Consideration given to social and spatial contexts (Burger and Buskens 2009; Doreian and Conti 2012), together with the institutional factors (Chua 2012), allows a better comprehension of relationships. In addition to the effects of space on relationships, they contribute to a better understanding of spatially bounded populations, and generally improve explanations of behaviors and health outcomes (Adams, Faust, and Lovasi 2012). They also modulate the impact of relationships on the psychological sense of community as well as feelings of attachment to the neighborhood and the city (Luo et al. 2022). Hence, obtaining data on the context of relationships is considered useful to develop effective network analysis tools (Gliwa and Zygmunt 2014; Rettinger et al. 2012). Indeed, it has been stated that network analysis

should not be limited to the study of structure, incorporating the contexts in which people spend their lives (Small 2017).

Ultimately, relationships are embedded in densely populated interaction spaces that condition individual behavior (Small 2017). In our case study, the high school entails a series of institutional norms, with a set of expectations that govern the behavior of the actors that compose it, as well as the relationships that they maintain with each other. High school not only offers a place for interaction, but also provides a set of rules about the hours, the type of activity and the level of commitment expected from the participants. This makes it a scenario where many exchanges take place that occur unplanned, or that arise incidentally or spontaneously (Small and Sukhu 2016).

With our study, we have revealed how institutionalized interaction contexts (in this case, high school) shape social networks, while individual differences in the structure of personal networks are reflected in turn in the position that each student occupies in the reference cohort. Consequently, high school is not only a place where relationships are formed, but it leaves its mark on the characteristics of personal networks and the way in which graduates make their transition to university studies or the job market. Similarly, we found that personal networks (corresponding to multiple contexts of interaction) partially overlap with context-specific social networks. The contexts through which an individual is transiting leave their mark on the characteristics of their interpersonal environment.

7.4 Limitations and future research

The originality of this research consisted in the simultaneous longitudinal analysis of a whole network and the personal networks of its members. However, given the small cohort of students, we resorted to descriptive analysis strategies and, in some case, exploratory. Furthermore, the follow-up was limited to two observations. Both a greater number of cases and a greater number of observations would serve to contrast to what extent our results are generalizable.

Our case study consisted in the follow-up of a normative transition over a year and a half. It is likely that in non-normative transitions, which do not affect the whole group simultaneously, at least in part, a different process of change is observed from the one described in this research. On the other hand, conducting the follow-up for a longer period of observation would allow us to check the changes when the disaggregation process is more advanced.

The secondary school was identified as a central setting for the group of students analyzed. The relative relevance of the interaction contexts determines their potential influence

on individual itineraries. Although it is likely that high school is more important for some students than for others, it would also be of interest to explore the duality of contexts and relationships in other settings with less impact on the formation and maintenance of relationships by the population studied.

In our study, we observed that people with more cohesive personal networks also maintained a better connection with the whole network of fellow students over time. However, in our analyses we could not differentiate whether this was due to cliques that had not dissolved or to individual tendencies in interpersonal relationship style. These are the kinds of questions that the combination of data from personal networks and whole networks could help answer in the future.

8 Conclusion

The completion of secondary education studies is a turning point for young people, who stop frequenting a central focus of activity in their daily lives. However, the change is not abrupt. In the short term, many of the friendly relationships with classmates keep going (that is, they decoupled from the interaction context), and the rate of changes experienced at the individual level decreases. In the long term, the network progressively disaggregates and fragments into small groups, creating new opportunities for relationships. For its part, the structural cohesion of personal networks seems to be a decisive factor in individual differences in the evolution of the ecological transition. Those individuals with a high level of average betweenness in their personal networks may experience a higher rate of changes in their relationships.

Table 6 Correlation table of personal networks and whole networks in each wave

Whole networks	Personal networks			
	<i>In high school</i>		<i>17 months later</i>	
	Av. degree	Av. betweenness	Av. degree	Av. betweenness
<i>In high school</i>				
Outdegree	0.273*	-0.177		
Indegree	0.262*	-0.249*		
Betweenness	0.259*	-0.170		
<i>17 months later</i>				
Outdegree			0.281*	-0.017
Indegree			0.164	-0.173
Betweenness			0.262*	-0.176

* $p < 0.05$

Appendix 1

See Table 6.

Author contributions IMJ participated in the fieldwork, performed data analysis, participated in the research design, and wrote the manuscript. DH participated in the fieldwork, performed data analysis, participated in the research design, and revised the manuscript.

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Declarations

Competing interests The authors declare no competing interests.

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