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Peer interactions and second language learning: The contributions of Social Network Analysis in Immersion/Study Abroad vs Stay-at-Home environments

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Abstract:

Social networks play a vital role in the attainment of individuals, including processes such as that of SLA. While the importance of learners' social network configuration has been recognised by a number of researchers, and some studies have even attempted to recreate students' social graphs, so far none of them has operationalized the communication in a quantifiable manner that would allow measuring the degree of the influence of students' interactions on their L2 progress.

Student networks may provide many opportunities for communication in the target language, with intensive, contextualised input and "pushed output", but the high degree of variation in L2 progress reported in existing studies calls for closer investigation into the interactional behaviours favouring or inhibiting L2 development. In this chapter we demonstrate how the computational (mathematical formulations of social graphs with dynamic processes) and anthropological (the building and functions of the network) tools of Social Network Analysis (SNA) in a mixed-method study design supported by questionnaires and interviews can contribute to the understanding of the influence of peer interaction dynamics and social graph topology on measurable outcomes among immersion/SA sojourners in comparison to stay-at-home students. Particularly, we focus on the moderating role of social networks (mesoscopic explanatory variable)—in turn influenced by immersion in the TL culture (macroscopic explanatory variable)[1]—on L2 progress (microscopic response variable).

The chapter begins by introducing the rationale behind a social network analytic approach first in the realm of pedagogy in general, and then in the context of second/third language acquisition. We present theories making a case for the recognition of the role of multilayer social networks (mainly their communication and organisational dimensions) in both aforementioned contexts, before moving on to a presentation of the quantitative branch of SNA. This conceptual introduction focuses on the ways of operationalising social graphs and the common metrics used in the calculations, supported by illustrative examples that will render the notions intuitive to the reader. We show that social networks can impact both positively and negatively on L2 acquisition, depending on the context and the network layer involved.

Subsequently, we showcase a few illustrative findings from a current research grant project investigating the influence of peer interactions on SLA in two different contexts: participants in intensive summer language courses ("immersion" scenario), and stationary foreign language majors ("no immersion"). We show some patterns emerging from both types of contexts, demonstrating the role that mobility to a target language country plays in network dynamics, and how both factors together moderate language attainment.

Finally, the quantitative findings are juxtaposed with insights from interviews with teachers and students in both contexts, which shed light on differing motivations and group dynamics among participants in "immersive" and "non-immersive" contexts. We also discuss the rationale behind merging SNA with qualitative data.

Computational and anthropological Social Network Analysis provides fresh insights into the link between social relations and language acquisition (especially L2 production), demonstrating how social network configuration and peer interaction dynamics during the learning process are stronger predictors of L2/L3 performance than individual factors, and offers a novel methodology for investigating the phenomena.

Introduction: Influence of networks on behaviour

Human behaviour is often influenced by everyday social interactions, often conceptualised in the form of a graph or network, where the individuals are nodes, and their relationships constitute ties. The nodes ("actors") in such a network select with whom they want to interact over time. Their decisions are driven by a number of sociological and psychological factors which can determine interaction frequency, network density, members' closeness and popularity. Hence, social networks are highly dynamic and complex systems (Kalish & Robins, 2006; Selden & Goodie, 2018; Pagan & Dorfler, 2019). They play a vital role in the attainment

[1] The data reported in this chapter come from a bigger project, where we also investigate the influence of microscopic explanatory variables such as motives and personality profiles.

of individuals, including processes such as that of second language acquisition. Social Networks have been applied in many fields (Jarynowski *et al.*, 2019):
- sociological theories (small world effect, homophily, information flow, socialisation, social norms, weak ties, triangle closure, etc.),
- psychological theories (social influence, etc.),
- economic theories (game theory, exchange theory, the Mathew effect, etc.),
- anthropological/ethnographic theories (social animal, functional theory, altruism, magical thinking, etc.),
- political science (external field, role of media, etc.),
- linguistics (language diffusion—e.g. Paradowski & Jonak, 2012; etc.),
- pedagogy (social action, peer learning, etc.).

People's relationships significantly affect their capability to learn (Cross *et al.*, 2001; Battistoni & Fronzetti Colladon, 2014). Various research has indicated that social networks constitute an essential factor in collaborative learning environments (Turoff *et al.,* 1995; Haythornthwaite, 2002). From a social network perspective, learning is perceived as a social and collective outcome of conversations, common practices and social connections (Brown & Duguid, 1991). Learners, embedded in social networks, share and actively construct knowledge through ongoing social exchanges and collaborations (Cohen & Prusak, 2001). Social networks also remain an important source of social support, which in turn influences wellbeing (Pinquart & Sorensen, 2000; Zhu *et al.*, 2013). For instance, in adolescent peer groups networks do not need be linked to striving for academic achievement. In such groups formed by teenagers the significance soars of popularity, status, and search for support and values alternative to those shared in the family; peer networks are thus considered a value in themselves, often set in the context of leisure, and need not be linked to striving for academic achievement (Coleman 1961; 1985).

The social network approach underlines the role of structure and composition of individual ego networks, considering factors such as the number and diversity of network contacts and strength of ties (Acock & Hurlbert, 1993; Song & Lin, 2009; Perry & Pescosolido, 2010). Thiele and collaborators (2018) emphasise that more popular (i.e. central) students in social networks get better grades because of their superior access to information, knowledge, and social support (*cf.* also Cho *et al.*, 2007; Smith & Peterson, 2007; Rizzuto *et al.*, 2009; Hommes *et al.*, 2012; Gašević *et al.*, 2013). Hence, the way individuals are situated in social networks is predicted to influence their learning process.

Networks in education

The importance of social interaction in the learning process can be traced back to the origins of constructivism, with John Dewey emphasising the importance of creating knowledge through experience and the inextricable link between knowing and doing (Dewey, 1916). While Dewey's ideas referred mostly to teacher-student relationships, the Vygotskyan concept of the Zone of Proximal Development assumes that learning is more likely to occur in the context of problem solving "under adult guidance or in collaboration with more capable peers", as opposed to independent problem solving (Vygotsky, 1934/1978:86). Research on collaborative learning, rooted in Vygotsky's ideas, shows that exchanging ideas and collective work towards a common goal lead to longer retention of information (Johnson & Johnson, 1989) and develop critical thinking more significantly than individual work (Gokhale, 1995). At the same time, peer learning, which occurs when one learner guides others through a task (in contrast to collaborative learning which assumes that all learners in a group work together to solve a problem), can lead to significant gains not only in academic achievement, but also self-esteem,

peer amity, or enjoyment of the subject (Slavin, 1990; Yarrow & Tooping, 2001; Rohrbeck *et al.*, 2003).

Scientific interest in the relationships between learners in a group and their implications led to the development of research methods that could recreate the structure of the group. In his pioneering work on the New York Training School for Girls, Jacob Moreno used sociometric data to show that the reason behind a high number of runaways among the school's pupils lay in the individual position in the structure of relationships (Moreno, 1934). On the basis of sociograms, he changed the assignment of pupils into residential cottages, which in turn reduced the number of runaways. This study laid the foundations of sociometry, a method of reconstructing group structure through information on different types of relationships between the group members, such as amity, trust or popularity. The first sociometric studies looked at the distribution of popularity and friendship choices, demonstrating that, for instance, physical closeness is a factor determining the formation of relationships in a dormitory (Festinger *et al.*, 1950), and that as the familiarisation process intensifies, small groups develop a tendency to share the same attitudes (Newcomb, 1961). Further research aimed to characterise people performing certain roles in the network (e.g. more dominant individuals tend to occupy central positions; Hare & Bales, 1963) and looked for determinants of friendship choices (e.g. Bukowski & Newcomb, 1984).

As researchers set off to introduce graph theory into sociometric enquiry, together with mathematical and statistical indices, classical sociometric study evolved into computational analyses of student networks (Wasserman & Faust 1994). It then allowed investigating the influence of classroom networks on learning outcomes. For instance, DeLay *et al.* (2016) showed that relationship-building intervention results in improved scores in writing and math performance in primary school students. Cho *et al.* (2007) observed higher final grades among students occupying central positions in the network, while Rizutto *et al.* (2009) found social network density (i.e. the overall amount of links between all the members of the group) to be among the predictors of academic performance. A study by Gašević and colleagues (2013) looked at the number and character of social ties of university students and found that social capital gained via cross-class networks is positively associated with academic performance. Interestingly, also studies into out-of-class collaboration and friendships between students show that these factors can be associated with academic performance. Hommes *et al.* (2012) found that high centrality in informal social networks of students (friendship network, network of providing information to students, and network of receiving information from students) was associated with better learning outcomes.

Since network analysis proved to be a valuable tool in studying cross-cultural relationships due to the integration of (macro-level) social and (micro-level) psychological processes (Weimann, 1989; Smith, 1999), educational scientists employed it to investigate the experiences of international students from both macro and micro perspective. The former is often used to describe the structure of the global student mobility network (e.g. Shields, 2013) and the factors determining it (Chen & Barnett, 2000; Barnett *et al.*, 2016). The latter looks at the composition of student networks, particularly focusing on networks formed between international and host country students (Rienties, Heliot, *et al.*, 2013; Rienties, Hernandez Nanclares, *et al.*, 2013; Rientes & Nolan 2014). It also looks at the relationship between networks formed by international students and affective variables such as satisfaction, well-being, or sense of community. For instance, Hendrickson, Rosen and Aune (2011) showed that international students whose friendship network contains students from the host country demonstrate higher levels of satisfaction and lower level of homesickness, while Tanaka *et al.* (2002) demonstrated that the ethnic and linguistic composition of international students' networks has an impact on their adjustment.

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Student migrations – the Polish context

According to Isabelli-García, Bown, Plews and Dewey (2018), there are various immersion contexts: i) formal language classrooms in an at-home (AH) institution, ii) intensive short immersion (IM) programmes, and iii) study abroad (SA). In this study we operationalise various immersion types comparing AH and IM modes only [Tab. 2].
According to the Polish *Act on the Education System* (Dz.U. [Polish Journal of Laws] of 2017 No. 256, item 59, as amended), students with limited Polish proficiency may attend a remedial course in the Polish language if they can still follow rest of the program in standard classes. Otherwise, they should attend a 1-year preparatory class dedicated only for migrants, which partly follows the standard learning programme, but concentrates on linguistic and cultural skills. The problem of limited Polish proficiency will be increasing due to migration and Poland's current grappling with the greatest demographic transformation since the interwar period. For example, in Greater Poland Voivodship alone, the number of migrant pupils in preschools (age 3-6, non-obligatory) and primary schools (grades 1-6) has been increasing exponentially [Fig. 1].

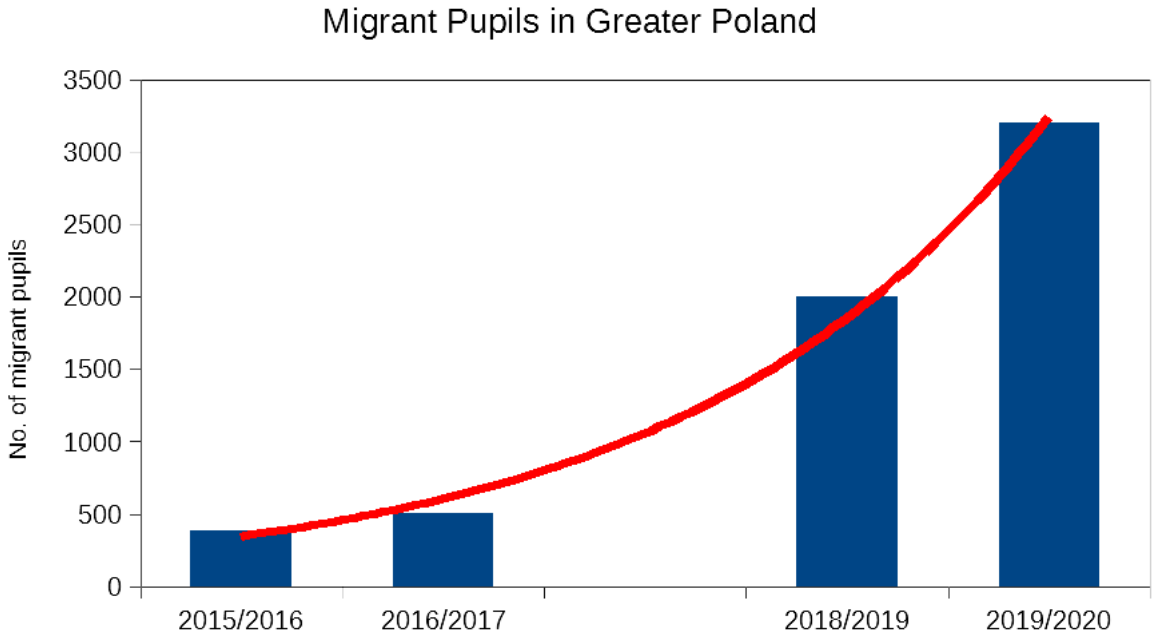

Fig. 1. The number of migrant pupils in preschools and primary schools in Greater Poland Voivodeship [Data from Czerniejewska, 2019]

There has also been a significant, though this time linear increase in the number of foreign university students in Poland.

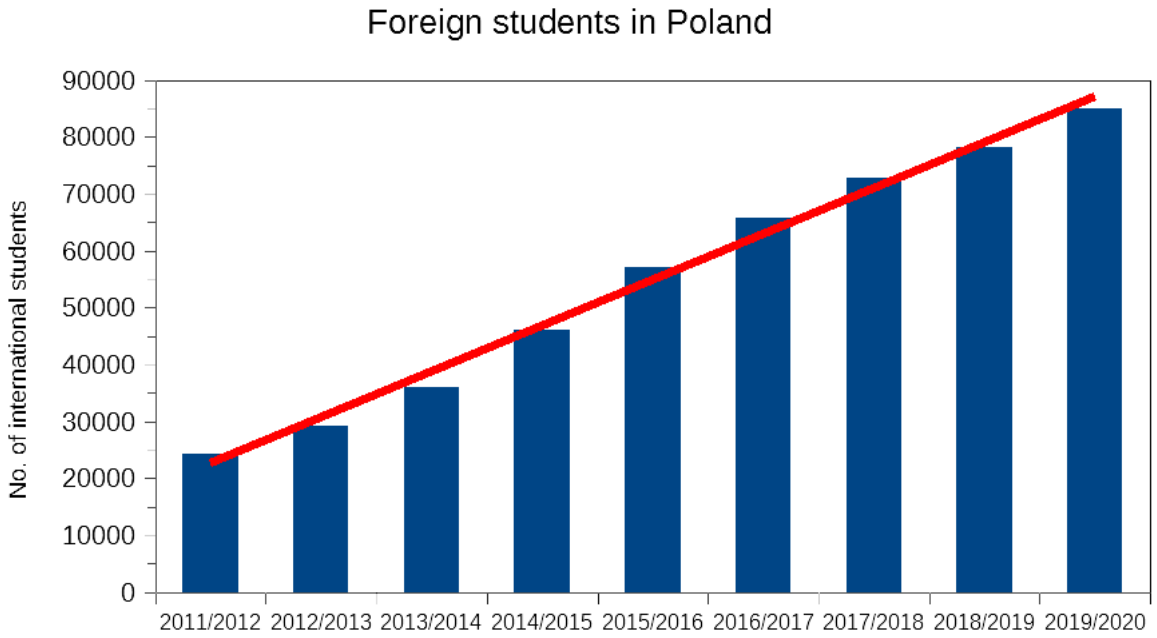

Fig. 2 The number of foreign students at Polish universities [Data source: Statistics Poland 2019]

The ethnic composition of migrant populations in Poland seeking education for themselves (as university students) or their children (primarily in preschools and primary schools) is similar. Up to 65% of the migrants come from the former republics of the Soviet Union (especially Ukraine), but another important category is pupils/students raised in families with Polish roots abroad (up to 15%; Kłopot & Trojanowski, 2018; Czerniejewska, 2019; Statistics Poland, 2019). Networks of migrants seem to significantly differ from those of local citizens, mainly due to the well-known phenomenon of homophily, i.e. the tendency to associate with similar others (Lazarsfeld & Merton, 1954; Aiello *et al.*, 2012; e.g. speakers of Russian are more likely to mingle with other Russian speakers while speakers of Polish to associate with other Polish speakers). In our data this is reflected for instance in the role of Russian as a *lingua franca* among students in Poland (see also Fig. 6; *cf.* (Aleksandrowicz-Pędich, 2019).

Social networks and L2 acquisition (in the context of immersion/Study Abroad): State-of-the-art

Social network influence seems particularly relevant in the context of second language acquisition, especially in study abroad (SA). Immersion in the target culture is thought to provide favourable conditions to advance second language development as it increases opportunities for interaction and L2 use with native speakers and other target language users (Coleman, 2015; McManus, 2019). Acquiring new academic knowledge, interpersonal and intercultural skills, and second language proficiency in the immersion setting may lead to more robust L2 results in comparison with language learners in a non-immersive context (Ingraham & Peterson, 2004; Isabelli-García, 2006; Banks & Bhandari, 2012; Mitchell *et al.*, 2015). Every year a growing number of students spend part or even all of their studies as temporary sojourners in a different country and Poland is one of the fastest growing study destinations.
Research has indicated that an increase in the amount of contact in the target language enhances learners' oral production ability (Freed *et al.*, 2004; Segalowitz & Freed, 2004; Isabelli-García, 2006) and fosters the acquisition of sociolinguistic and sociocultural knowledge (Lafford, 1995;

Lapkin *et al.*, 1995; Marriott, 1995; Regan, 1995; Siegal, 1995). Through this interaction learners can acquire more advanced communicative skills (Isabelli-García, 2006).

Research has provided insight into the types of social networks learners engage in while abroad and, consequently, the types of input available to them (Dewey, Bown, & Eggett, 2012; McManus, Mitchell, & Tracy-Ventura, 2014; Gautier & Chevrot, 2015; Dewey, 2017; McManus, 2019), as well as the relationship between the social networks and L2 acquisition (Baker-Smemoe, Dewey, Bown, & Martinsen, 2014; Mitchell, Tracy-Ventura, & McManus, 2017). Dewey and colleagues (Dewey *et al.*, 2012; Dewey, Belnap, & Hillstrom, 2013) indicated that students involved in a greater variety of social activities in which they have to interact in the L2 have better-developed social networks and become more proficient when speaking in L2 during SA than those who are less active and whose social interaction remains restrained. Baker-Smemoe with colleagues (2014) concur with these results, remarking that learners who are the members of many different social groups and who have closer relationships with native or expert users of the target language evince greater language development. These findings are consistent with previous research by Fraser (2002) and Whitworth (2006), who indicated that learners who during study abroad participate in various social activities such as football teams, internships, music bands, etc. demonstrate greater progress in L2 reading and writing than learners who reduce their interactions to the traditional class group.

DuFon and Churchill (2006) remarked that the formation of social relationships may be significantly affected by attitudes and motivation. A similar conclusion was drawn by Isabelli-García (2006, 2010), who observed that learners with higher motivation develop more extensive social networks and show greater progress in L2 proficiency than their counterparts who do not engage in social interaction. In addition to these findings, Dewey and colleagues (2013) revealed that another positive predictor of progress in L2 speaking when abroad is the intensity of relationships between the L2 learner and native speakers within a particular social network.

Other significant factors taken into account in the research of L2 learning in the study abroad context are the frequency of interactions between network members and the proportion of languages they use to communicate. Dewey (2008) as well as Coleman and Chafer (2010) noticed that L2 learners maintaining strong ties with their L1 contacts (i.e. with family and friends at home through email and over the phone) fail to establish strong social networks with L2 users in the target culture and experience more linguistic difficulties due to the more limited opportunities for interaction in the L2. Similarly, in his longitudinal studies McManus (2019) found that L1 interaction prevailed throughout the entire duration of the SA sojourn. These findings show that individuals sharing one's L1 represent the largest group of learners' social network contacts while abroad, but they prevail only in the context of virtual interaction (e.g. via Facebook, Skype, text messaging), whereas at work/university and in organised free-time contexts more frequent are contacts using the L2. The results indicate that L2 interaction frequency varies depending on the social context and the type of social network (McManus, 2019). Research also shows that learners who despite linguistic difficulties report speaking more with social network members who are L2 native users feel they become more proficient than those who report speaking less with native speakers (Whitworth, 2006; Dewey *et al.*, 2012). For this reason, Dewey (2008) emphasises that maintaining strong ties with the home and weaker ties with local target language users may negatively influence linguistic progress during study abroad.

Frequent interaction involving L2 use may thus contribute to L2 proficiency. McManus (2019) indicates that higher frequency of L2 interaction is associated with higher lexical complexity scores in L2 speech, whereas frequent contacts with L1 users are related to lower lexical complexity scores in L2 speech. Similarly, previous studies by Hernández (2010) showed that the amount of time learners spent on speaking the target language out of class was a significant predictor of oral proficiency gains. However, Mendelson (2004) did not find a clear association

between L2 use and proficiency gains. She noticed that students participating in a longer SA program reported more interaction in target language and more gains in speaking than their counterparts participating in a shorter (one-month) SA programme. Freed (1990) also found no relationship between second language use and proficiency development, but she noticed that less advanced learners in France benefitted more from interaction with native speakers than more proficient learners. The lack of consistency between these studies suggests that the frequency of L2 interaction and progress in proficiency might be influenced by variables such as initial language proficiency, length of time abroad, or amount of time spent using the target language (Dewey *et al.*, 2012; Dewey *et al.*, 2014).

Existing studies on the role of social interaction in L2 acquisition and proficiency indicate that social networks may play an important role in promoting language use and language gain. However, research investigating this phenomenon is still infrequent (Dewey *et al.*, 2012). Moreover, in-depth investigation of social networks requires combining quantitative and qualitative research methods. Isabelli-García and colleagues (2018) emphasise that even though quantitative research can to a large extent explain the effects of social networks on L2 gains during study abroad, such studies only provide a limited explanation, which could be complemented by additional qualitative research. Analyses of individuals' stories and experiences can provide more detail on the associations between social networks, L2 use and L2 proficiency. Techniques such as ethnographic observation or interviews could lead to a better understanding of the nature of social network influence on L2 progress in the context of study abroad (Dewey *et al.*, 2012; Borràs & Llanes, 2019).

While the importance of learners' social network configuration has been recognised by a number of researchers, and some studies have even attempted to recreate students' social graphs, so far none of them has operationalized the interactions in a quantifiable manner that would allow measuring the influence of students' interactions on their L2 progress. In this chapter we demonstrate how the tools of Social Network Analysis (SNA) in a mixed-method study design supported by questionnaires and interviews can contribute to the understanding of the influence of peer interaction dynamics and social graph topology on measurable outcomes among SA sojourners in comparison to stay-at-home students.

Social Network Analysis

A social network is a form of representing relationships (links/edges, directed or not) between persons (nodes) in the learning process. The most important agents are the students themselves as peers; however, other significant stakeholders such as teachers, partners, family and friends may also be considered, given the typical substantial number of interactions not only within, but also across and beyond the classroom group. Networks can be applied in the form of ego networks (Lizardo, 2017; see Fig. 3) when a respondent is asked about her/his alters, or sociograms/full networks, where the alter-alter links are also available. Here, unlike in most of the existing research, we focus mainly on the full network approach, because interactions of individuals over time allow to better apprehend processes such as SLA.

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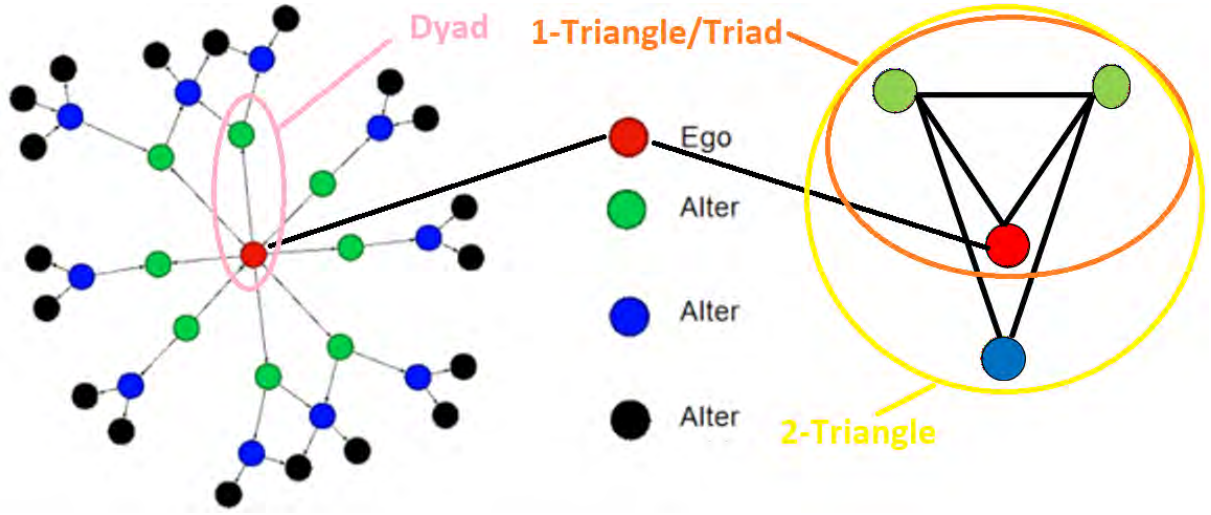


Fig. 3. Visualisation of an ego network

The history of social network research has two main cores: i) mathematical, beginning with sociograms and graph theory (Moreno, 1937), where the relationships between pupils in a classroom were mapped to understand the processes taking place on such a network, and ii) ethnological, starting with active observational studies by Malinowski (1922), who described sets of relationships within a tribe (such as kinship) to understand the working of societies.
In the SLA context nodes are people, and edges – direct links between them reflecting relationships or dependencies of various kinds.

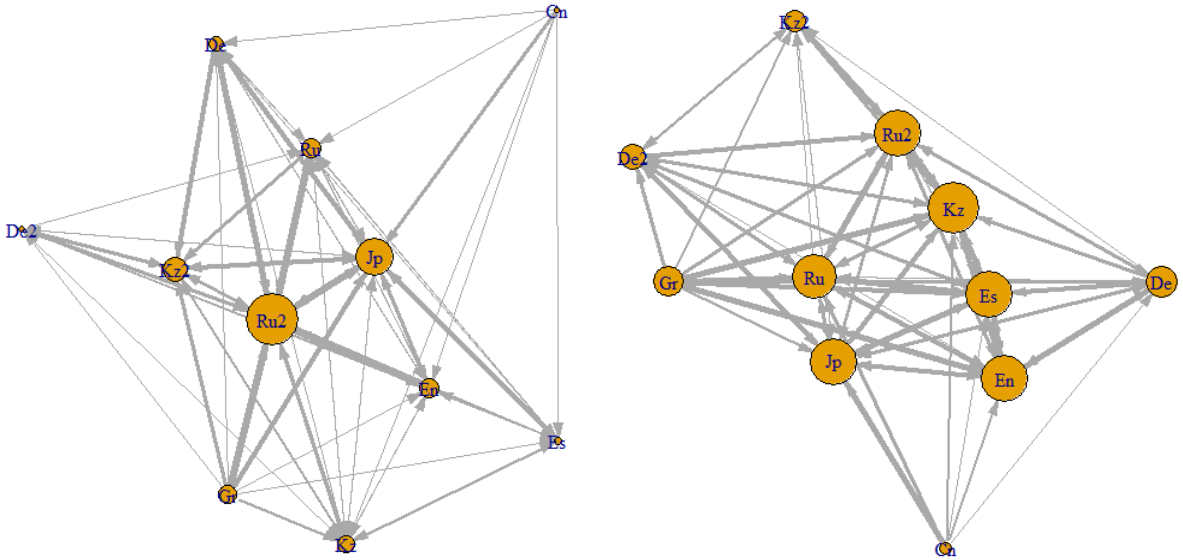


Fig. 4. Interactions in one group of students learning Polish; Left: interactions in the TL only, Right: Interactions in any language. Weights correspond to link thickness.

Networks are usually considered from the perspective of functional and structural social theories. In the former, networks form and evolve to play roles in society, and the most important are processes taking place on them; in the latter, networks are the outcome of social acts, and the most important are the networks themselves. Social networks form a multilayer structure. For instance, according to Merton (1968), there are three main network layers:
- network of power (e.g. how dependencies and transactions are distributed),
- network of communication (e.g. how information flows), and
- network of friendships (e.g. how altruism and social ties are formed).

Each network layer has its own properties. Among adolescent peers, friendship networks are considered a value in themselves (often in contrast to family ties or the formal classroom setup), and can be negatively linked with academic achievement (Coleman, 1961).

Temporal networks and their evolution

A social network is a temporal object (Holme & Saramäki, 2013) and evolves in time (in terms of both links and nodes). In the case of SLA, usually each class group forms in phases (initiation, early and late stages). For example, initially two people who know each other form a dyad. In the first phase many new links form. In the early stage the network is consolidating and triangle closure (structural balance) processes take place (if person A is connected with C and B with C, it is likely that persons A and B will form a link in future). In the late stage group members may join or leave, but the dynamics is much slower.

At each stage of evolution networks can be described by their density, which counts the fraction of observed links out of all the possible links (in a fully connected graph, where everybody is connected to everybody else). Team tasks can be better solved by a well-connected group (Simon *et al.*, 2015).

Networks host processes such as language unification (Kucała, 1960) or the spread/adaptation of new forms (Paradowski & Jonak, 2012). For example, social networks of migrant students could be responsible for the adoption of linguistic manners (by imitation or social influence), so networks can help understand language variation and change. Processes can also affect the network itself; for instance, if a person who is not satisfied with the language course and is complaining a lot gets isolated from other peers.

Methods and measures

Ego network information (Żak & Zbieg, 2014) can be collected using several techniques: picking contacts (alters) from a list, annotating contacts from memory, or drawing the contact network by placing alters on circles of intimacy. The most popular form of annotating interactions between study participants is a paper-and-pencil self-reported survey, which usually yields a directed weighted network. Recently, Internet-based self-report surveys have been getting increasingly applied. On the other hand, recorded interviews and focus groups as well as passive (e.g. filming) and active observation (for instance by the teacher, researcher, or participatory observation by one of the students) are important for ethnological perspectives.

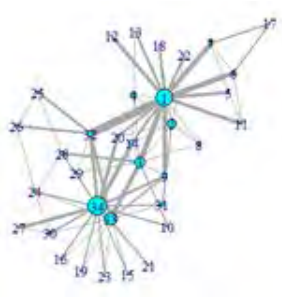
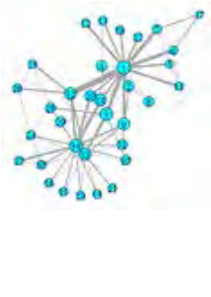
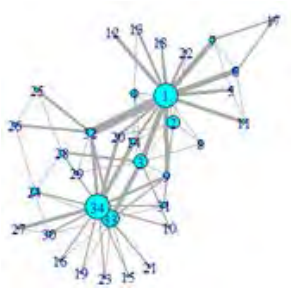
Network properties: Centrality and community structure

Gauging the importance of nodes (e.g. persons) with respect to the number and weight of links to other persons as well as depending on the particular structure of those linkages is possible owing to a battery of measures referred to as network centralities. The main centrality measures are:

- (weighted) degree (out/in) centrality, which is simply the number of (outgoing, incoming, or overall) links (with weights) held by each node;
- closeness centrality, which measures the node's average inverse distance to all other nodes. It reflects so-called structural centrality;
- betweenness centrality, which counts the number of times a node lies on the shortest path between other nodes. It tells us how important a given node is in information flow;
- PageRank centrality, which is a score based on a node's connections and these connections' connections (it is an extended variant of EigenValue centrality). It tells us how important a node is based on the importance of its alters. It is relatively well-known because it was introduced in Google search engine.

Centralities can be linked with actor (person) attributes such as test achievement (Grunspan *et al.*, 2014).

Table 1: Most commonly used centrality measures exemplified on the legendary Zachary karate club network, with node sizes corresponding to the given centrality (Zachary, 1977). With the exception of betweenness, links can be weighted and directed.

Degree	Betweenness	Closeness	PageRank
out: number of links to alters in: number of links from alters all: sum of out/in	number of times the node lies on the shortest path between the other nodes	inverse distance of the node to all the others	number of links to the node weighted by the attraction and centrality of the linkers
			

Very often most of the nodes can be a coherent subgraph (the giant component, or a few components) in which the nodes are connected to each other. The most central nodes lie in the core and the least central ones on the periphery of the network. Communities (Fortunato, 2010) are subsets of nodes such that connections between nodes inside these structures are denser than with rest of the network. Communities can arise via network evolution for instance due to homophily and in some scenarios can lead to school segregation (see the current case in Stockholm; Spaiser *et al.*, 2018).

Apart from centralities, nodes can also be assigned different roles and positions (Ferligoj *et al.*, 2011). A hub is the most central node, a star has many incoming links, a bridge is a node linking various communities, a broker has high betweenness, leaves are peripheral (connected to rest of the network only by single links). The identification of social roles allows the teacher to better manage the classroom (To whom to give notes or send a text message to distribute further? How to identify sides if a conflict emerges between groups?).

Groups of nodes/persons are referred to as motives. A dyad is a pair of nodes connected only with each other; a triangle (2-triangle, …, *n*-triangle) is a situation where two nodes A and B share the same friend C (and so on), a clique or cluster is a group of nodes where everybody is connected with everybody else, and a community is essentially a subset of the network such that links among the nodes within the community occur more often than links with the rest of the network.

The study

In the present study, we focus on the moderating role of social networks (mesoscopic explanatory variable), in turn influenced by motivations, personality profiles divided into psychological (Selden & Goodie, 2018) and motivational dimensions (microscopic explanatory variables) and immersion in culture (macroscopic explanatory variable), in multidimensional L2 progress (microscopic response variable).

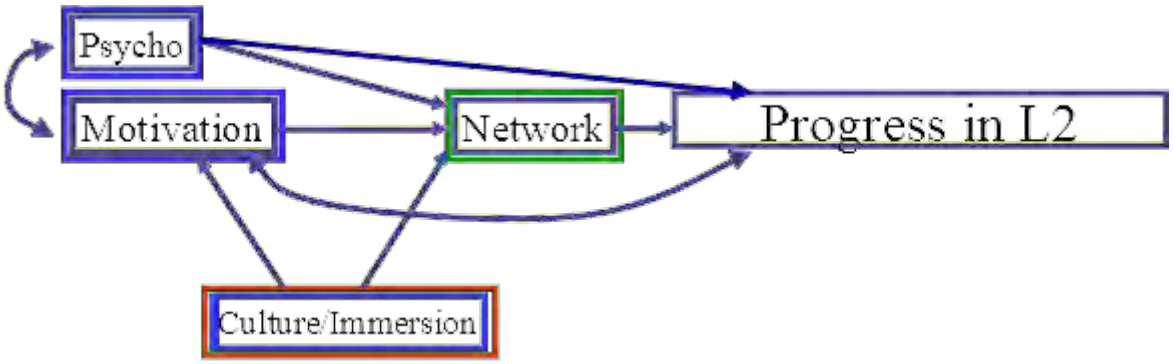


Fig. 5. Conceptualisation of the investigated SLA process.

The study reported in this chapter constitutes part of broader research project and contains the quantitative analysis of students observed in two contexts: Study Abroad/Immersion (IM) and stay-at-home (AH). The former group consisted of 332 learners of Polish as a second/foreign language during four-week long summer courses over two years held in Warsaw, Poland. The courses had an intensive character with 15 full hours of classes per week, supplemented with 45 hours per week of extra-curricular activities (e.g. film screenings, translation workshops, lectures, or board game meetings)[2]. Course participants were grouped in classes according to their TL level, ranging from A0 to C1. On average, the classes consisted of 11 students. The AH cohort consisted of 140 first-year students of an Applied Linguistics undergraduate programme at one of the universities in Poland. The programme is divided into two tracks: first foreign language (English, French, Spanish, German, or Russian) and second foreign language (English, French, Spanish, German, Russian, Swedish, Japanese, or Polish Sign Language). The groups chosen for the study were learning Japanese (123 students) and Swedish (17 students) as their second FL with 9 full hours of classes per week. At the moment of conducting the research, after one year of classes, the participants' TL level increased roughly from A0 to B1. Quantitative data was obtained via questionnaires distributed at the end of the course in the case of SA students, and at the end of the academic year in the case of AH learners. The questionnaire measured the influence of individual and group factors on language outcomes and included items about communication in different contexts and languages as well as psychosocial variables. The participants were also asked to fill out an ego-network questionnaire, where they declared the direction, intensity and language(s) of communication with every other group member, which in turn served to reconstruct the networks formed during the courses. Finally, participants' entry and final grades and tests were utilized to measure progress made in the target language.

The qualitative study discussed in the present chapter comprised 9 IM students from the 2019 cohort representing 6 groups (thus 6 networks). The interviewees' TL level ranged from A1 to C1. Polish was not their second, but third or fourth language. Therefore, at the participants' request, all but two interviews were carried out in English. The participants came from Ukraine (3 students), Germany (3), the United Kingdom (1), Russia (1) and Turkey (1). The second group of participants were majors in Swedish, out of whom 7 agreed to participate in individual interviews, and 4 in a focus group interview. The interviews were carried out in the participants' L1, i.e. Polish.

Table 2: The population

	Immersion context	Non-immersion context

[2] Extra-curricular activities can significantly contribute to the formation of friendship networks among international students (Hendrickson, 2018).

Population	332 international students taking part in an intensive 4-week summer course of Polish; two different years 13 teachers of Polish	123 first-, second- and third-year undergraduate Applied Linguistics students majoring in Japanese 17 first-year undergraduate Applied Linguistics students majoring in Swedish 2 teachers of Swedish
Sociometric data	53% women Mean age: 27 main L1s: German 15.4%, Chinese 10.2%, Russian 8.4%, English 6.6%, Georgian 3.9% Motivation: studying in Poland 31%, interests 18.1%, family reasons 13%, work 11.7%	80% women Mean age: will be filled in L1: Polish 94% (others: Ukrainian, French, Czech and English, Russian, Vietnam, Spanish) Motivation: interests 51%, studying 21%, TL culture 18%
Quantitative measures	332 questionnaires measuring the influence of personality and group factors on language attainment 193 tests comparing students' TL competence at the beginning and at the end of the course 332 ego-network questionnaires	140 questionnaires measuring the influence of personality and group factors on language attainment 140 course grades comparing students' TL competence at the beginning and at the end of the course 140 ego-network questionnaires including 123 in a longitudinal format
Qualitative measures	9 interviews with course participants 13 interviews with course teachers	7 interviews with course participants 2 interviews with course teachers Focus group interview

Results

Qualitative SNA/Mixed methods

As a part of the general debate concerning the value of mixed-methods research in the social sciences, the potential has been advocated of combining qualitative and quantitative methods in network research (Crossley, 2010; Edwards, 2010). Networks as a study subject seem to profit particularly well from a mixed methodology, as it enables obtaining both the "outside" view of the network, i.e. its structure, and the "inside" view of the network, i.e. its perception and the character of the interactions that generate the ties (Edwards 2010:5). Despite the predominance of quantitative-oriented approaches among SNA researchers, some of the early anthropological network studies were of a qualitative nature (Barnes, 1954; Bott, 1957; Young & Wilmott, 1957). However, since then, qualitative enquiry into personal networks has been rather scarce, which has recently prompted researchers to call for an addition of the qualitative perspective to so-called formal SNA (Emirbayer & Goodwin, 1994; Mische, 2003; MacLean, 2007; Crossley, 2010). Network structure, which is the main concern in quantitative SNA, provides limited information on the dynamics and variability of network ties, as well as on how these ties are conceptualized by the research participants. Crossley notices that "a network is not simply a set of actors plus a set of ties but a *world* in which identities, expectations, rituals,

shared feelings and meanings emerge" (2010:18; emph. in original). Therefore, in order to complement qualitative data and provide a more nuanced picture of network structures and functions, our study also employed a mixed methodology.

The most common qualitative methods, with roots in classical anthropological studies, include *ethnography* and *in-depth interviews*. In SNA, the former was used for instance by Bott (1957) to study family networks, while Heath and colleagues (2008, 2009) employed the latter and interviewed 107 individuals across 16 different ego networks to investigate whether decisions of (non)participation in higher education may be influenced by "networks of intimacy" consisting of family and close friends. Moreover, spatial proximity and living conditions such as sharing the same dormitory is shown to increase the probability of creating ties within student classes (Sowa, 1967). Qualitative SNA also developed more specific network-related tools, such as *walking interviews*, which enable the researcher to gain insight into the spatiality of the network of a given individual (Emmel & Clark 2009), and *participatory mapping*, where the researcher obtains the visual representation of the ego-network directly from the participant who is asked to draw it (Emmel 2008).

Due to the character of the present study, which involved an investigation of 35 different networks, semi-structured interviews were employed as the main method of qualitative enquiry. These were conducted with both IM (9 interviews) and AH students (7 interviews) and concerned participants' conceptualization of TL progress, the extent to which they used TL in an out-of-class context, and the nature of their interactions with classmates. Additionally, as inconsistences in one's thinking are more easily spotted during a discussion than a monologue (Kleiber 2003), a focus group interview was carried out with 4 students in the AH context[3]. It aimed to scrutinise the interaction dynamics between the participants, as well as their perception of the influence of peer networks on language learning.

To compensate for the lack of an observation component, interviews were carried out with the teachers who witnessed the formation of the networks and their subsequent dynamics during the course. They were conducted in 14 groups, hence providing information about 14 networks (13 IM courses, 1 AH course). As the group in the AH course was taught simultaneously by two teachers, the interviews were carried out with 15 teachers, with an average professional experience of 10.6 years. They were asked about the character of student interactions, the structure of the networks formed during the course (with potential cliques, hubs, stars or leaves), and TL progress made both on individual and group level. They also provided information about the voluntary use of TL among the students during breaks, social activities, or before the start of the lesson.

An *emic* view of the networks

The qualitative study yielded information on how students perceive the networks formed during the course. While the study focused on the easily quantifiable communication network, the interviews showed that the *emic* conceptualization of the network is much broader, especially among the AH students. The students believed in the importance of relations with other group members for language practice, but they more often referred to the impact these relations have on the atmosphere in the classroom and the motivation of individual students. Language progress was attributed to study effort made by each learner individually, not in collaboration with others. The respondents also referred to different platforms of communication, mentioning that communication between the whole group (network) continues after classes on social media (mostly for utilitarian purposes, such as exchange of course materials), with some clusters or dyads additionally having their separate channels.

[3] For practical reasons, it could not be conducted with the IM students.

As far as the network of language practice is concerned, on a declarative level, all the interview participants from the IM course believed that interacting with fellow students is important for foreign language development. However, only one IM interviewee tried to use the TL all the time and had a strong conviction about the role of language production in the language learning process (*cf*. the Output Hypothesis; Swain, 1985, 2000). Other participants were theoretically aware of the importance of practising speaking skills, but did not follow through during the course:

> *I think [speaking in the TL is] actually necessary to do, because if you don't speak with others, you don't get to really use what you learned and you don't learn to have new things and if you only learn with yourself you have very compromised understanding of how the language works. (…) So I think that's absolutely necessary to talk to other people to learn the language. (…) I mostly speak with people I ever travelled with here, and they mostly speak German and I speak with my roommates. One of them is Polish, but to get by - because she has a very busy day - we mostly switch to English, to get things over more quickly, 'cause it would be annoying for her if she asked me something and I wouldn't understand. And the people in my class, we also mostly use English when we talk, because it's just the universal thing that everybody already speaks. So if something is to clarify, so then we're just there, because it's easier.* [F, 18; interview in the original language]

This is an exemplary instance of a value-action gap (also known as the belief-behaviour gap), which leads to a discrepancy between the attitudes and practices of individuals (Godin *et al.*, 2005). The fact that students know that speaking practice may significantly enhance their TL development, but at the same time they are influenced by socio-affective factors such as anxiety, their cultural background, or perceived competence, may lead to an ambivalent state of willingness and unwillingness to speak (MacIntyre *et al.*, 2009; MacIntyre *et al.*, 2011; Savaşçı, 2014).

A quantitative analysis reveals dependence between network properties and subjective and objective progress in the L2. In the Polish (IM) scenario there are significant non-trivial relations between network centralities TL subjective and objective TL progress. A statistically significant positive relationship was found between progress in Polish and degree centrality in the Polish-language communication network, and negative relationship with mediating/flow centrality (betweenness) in all languages. This can mean that in the process of language acquisition the topological structure of the network is more important than properties that are more important for information flow. Interestingly, high in-degree centrality is associated with less progress in Polish. This may be due to different competitive social processes occurring simultaneously over the stay in the foreign country (for instance, according to Coleman, 1961, adolescents seek and establish contact with peers as an end in itself, independently of academic objectives). The influence of the network is strongest in the domains of pronunciation and lexis, where the simplest measure of weighted degree centrality (number of an individual's social ties) in TL positively correlates with progress (R^2>0.2), while betweenness (popularity or control) in total (all-language) communication is significantly anticorrelated. Combined with the detrimental impact on SLA of a high in-degree, this again suggests that for language acquisition, the structural properties of the network matter more than processes such as information flow.

In the non-immersed Japanese cohort there are no statistically significant (above multiple test random effect) relations between network centralities and TL subjective progress, with R^2<0.1 in all dimensions of subjective improvement.

<u>The structure of the student networks</u>

The main criteria that influenced the formation of friendships within the groups (networks) among the students in the IM context was nationality and/or sharing a *lingua franca*. Both the interviewed students and their teachers identified smaller clusters which formed within the groups, with an exception of one group described as exceptionally well-integrated as a whole:

> *But I just have to say that it is an exceptional group, exceptionally well-integrated. Maybe because it wasn't numerous, but culturally diverse, they are really well-integrated and I think it also influenced their progress. However, there were two or maybe even three people who have more linguistic experience, one person said they were an interpreter, the other I think studied linguistics. So it also influences the speed of language learning.* [F, teacher; interview carried out in Polish, trans. own]

Its members intensively socialised after class, also attracting students from other groups. The students and teachers explained the exceptional activeness of this group with the following factors: i) low number of students (7), ii) linguistic experience and strong motivation, iii) after-class socialisation from the very beginning of the course, and iv) nationalities – each student was from a different country (Kazakhstan, Mexico, Ukraine, Iraq, Lithuania, France, and Saudi Arabia).

We found language segregation (homophily) in both the IM and non-IM contexts. In the Swedish group we discovered a potentially Russian-speaking cluster [Fig. 6], which will be additionally explored in qualitative results later on.

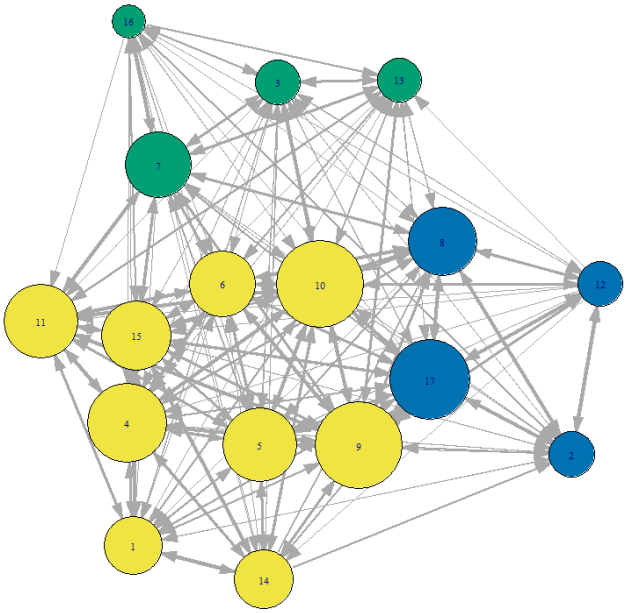


Fig. 6. Green and yellow clusters identified by group interview participants. The blue cluster (potentially Russian-speaking) found no full reflection in the qualitative research, suggesting it may have been 'invisible' to the students volunteering to take part in the interview and focus group.

The members of the AH group assessed their level of intra-group integration favourably, especially in comparison with other language groups in their study programme. However, the analysis of the interviews corroborates the quantitative findings, which detected the formation of three clusters (Fig. 6 above). The blue cluster consisted of 2 Polish and 2 Ukrainian students. Students belonging to the other clusters as well as the teachers characterised this clique as gathering the most withdrawn, quiet and shy students, not a cohesive group of friends. One member of the cluster stated that she did not socialise with the group at all, but that she had

recently developed a closer relationship with one peer because they participated in an out-of-class event together. The green cluster, consisting of 4 female students, spent time together during breaks and after classes. As far as the largest cluster is concerned, the 5 out of 9 of its members who were interviewed did not identify themselves as belonging to this larger group; instead, they mentioned 2 or 3 students with whom their relationship was particularly strong.
We also managed to implement pattern recognition techniques. A Principal Component Analysis (PCA) of 25 questions (psychological and motivational part of the questionnaire; Fig. 5) in the AH scenario, where we can observe educational experience, motivational and psychological components, explained 41% of the variance, but in the IM scenario, where such a clear distinctive separation did not appear, only 32%. More homogenous group (in terms of the cultural background) could lead to a more predictive perspective due to an easier recognition of patterns.

The TL-speaking network

The network of communication in the TL was not particularly strong among the participants in either context for a number of reasons. Firstly, three out of the seven participants interviewed in the IM course pointed out that the students often sought contact with their co-nationals, or with other people speaking their L1. They could not imagine using TL among a group of people who fluently speak another language, as in the case of a Turkish student living in Germany:

> *It just didn't occur to me, like naturally, to be speaking Polish with Germans. I've been living in Germany for 4 years and it's not like... I just wouldn't come up with speaking Polish. And for them it's also weird, they all speak German to each other anyways, because they're Germans.* [F, 26; interview in the original language]

Nationality-based divisions were also identified by teachers as the main criterion that divided the class into sub-groups. Even if cross-cultural network connections were made within groups, this mainly happened thanks to English, which served as a *lingua franca* between the students. The AH students did not seem to take advantage of the potential of peer-to-peer interaction in the TL. They used the TL with course peers in short exchanges, claiming it would be "unnatural" to do so more extensively. Some preferred to practise speaking the TL during tandem language exchange meetings, hence with people who were not their classmates. These findings illustrate the homophily hypothesis postulating that individuals strive for the least possible effort required for interaction and therefore interact with people of similar characteristics (Lazarsfeld & Merton, 1954; Lin, 2001, McPherson *et al.*, 2001, Aiello *et al.*, 2012).
Another reason which prevented respondents from using TL was the conviction that their level was too low to talk about complex matters in a clear and precise way. In their opinion, the ultimate goal of informal conversations is not practising the TL, but socialising, getting to know each other, or exchanging complex thoughts and feelings:

> *For me it's really hard to be in a setting where I'm not fluent in a language and still try to speak it, to socialize with people. It just doesn't happen. For me that's not socialization, it's not fun, you know? (...) Say, in German, when somebody's not fluent in German, let's just switch into English and not push each other. Because I don't wanna think about talking when I'm talking. I just wanna focus on content.* [F, 26]

Moreover, due to the fact that the TL level of almost half of the IM course participants was low (49% of the 137 students in the summer course were on A1 and A2 CEFR levels), lack of

speaking practice could have been caused by high anxiety. Such students were more confident to use Polish in informal contexts when combined with the consumption of alcohol (*cf.* Renner, Kersbergen, Field & Werthmann, 2018). The only respondent who used the TL to a large extent in all contexts was a C1-level student in the highest-level (C1) group. He was also the only participant who requested the interview to be conducted in the TL. Interestingly, he claimed that the other students in his group resented using the TL for communication.

At the same time, during the focus interview four AH students complained about the lack of real-life speaking practice during the lessons. They mentioned that it was restrained to role-play activities, which were based on the use of fixed phrases in typical situations, e.g. a doctor's visit or airport check-in. They said the lesson they enjoyed the most consisted of natural, 90-minute long conversation among the group about topics of their choice, such as their hobbies or future plans. What is more, all participants agreed that if they were granted one additional TL lesson per week, they would use it for speaking practice via real-life conversations.

Comparison of immersion vs lack of immersion

The main differences between students in the IM and AH context include student motivations, the use of networks and perception of language progress (see Table 3). As for motivation towards learning the TL, immersion course attracted learners with more precise goals, especially academic and professional ones. Also, for 13% of 232 IM participants, the fact of having Polish ancestors and/or Polish partner constituted the main motivation. On the other hand, AH students' motivations towards learning the TL were not as precise as in the case of the IM students, which was visible in both quantitative and qualitative part of the research. Students were learning the TL because of own interests or prior knowledge of the TL, or the circumstances they found themselves in ("I had to choose something on the beginner level"). Due to low motivation, two interviewees did not plan to continue learning the TL after the end of the academic year. However, both AH teachers emphasized the unique motivation and enthusiasm of their students, somewhat contrary to attitude exhibited in interviews by students themselves (imprecise motivation, random choice of the language track). In the teachers' view, the engagement of learners stemmed from the fact that the TL is not a widely studied language in Poland and the opportunity to study it attracted the most interested, determined and linguistically talented students.

The different perceptions of student network were more emphasised by AH students. They perceived network in terms of friendship, mutual support and learning in different contexts: during classes, in virtual communication, in informal meetings, etc. IM students referred more consistently to network as a platform to communicate and practise the TL (even though they did not put their beliefs into practice). Both groups did not use the TL for similar reasons. If they did, it was in similar contexts (informal meetings, higher levels of proficiency).

When asked about the progress made during the course, the IM interviewees talked most frequently about considerable lexical gains (7 in 9 respondents). However, the students did not observe their progress while actively interacting with others, but in receiving input in out-of-class contexts, which they can profit from thanks to being in an immersive environment (reading Polish magazines, going on a museum tour, etc.). In the AH group, the students saw progress mostly in speaking ability on rare occasions when they could communicate with native speakers. The respondents mentioned events such as the visit of the ambassador of Sweden or a conversation with Swedish tourists. Therefore, progress-via-interaction is perceived by IM and AH students similarly: in out-of-class context. Due to the fact of being in an immersion context, the opportunities to interact in the TL are more numerous and potentially more extensive for the IM students.

Table 3. Immersion vs lack of immersion

	Immersion	**No Immersion**
Course type	SA, IM	AH
Intensity	15h/week + 45h/week of extra-curricular activities	9h/week
Participants	Linguistically, culturally diverse	Linguistically and culturally homogenous
Environment	Synergy with environment in TL	No/very little interaction with environment in TL
Migration	Already happened	Sometimes not planned for the future
Motivations for TL learning	Work, higher education, family reasons, personal interest in TL culture	Personal interest in TL culture, random choice
Role of interaction	Important in terms of practicing TL and socializing	Important in terms of atmosphere and motivation
Progress	Vocabulary	Speaking
Verification of progress	Observed while receiving input in out-of-class contexts (reading magazines, going on a museum tour, etc.).	Observed on rare occasions when speaking/listening to native speakers
Contexts of TL use	Parties Higher levels of proficiency	Parties Short exchanges
Reasons for not using TL	Nationality-based divisions / lingua franca Low level Socialization > practicing TL	"Unnatural" among co-nationals Low level
Group homogeneity	International students (heterogeneous) with different properties and more difficult pattern recognition ability (PCA – 32% variance explained only)	Mostly local students (homogeneous) with similar properties and easier pattern recognition ability (PCA – up to 41% variance explained)
Influence of network on TL progress	Significant, but non-trivial centralities effect on L2 progress, with R^2 >0.2 fits	Non-significant centralities effect on L2 progress, with R^2<0.1 fits

Conclusions

Cumulative evidence has shown that immersion/SA does not always lead to substantial learning. Peer interactions in the narrow sense of communication as well as in a wider sense of social capital can definitely boost TL learning. However, competing processes such as pressure to gain popularity, adolescent riot (Coleman, 1961) or segregation (Spaiser, 2018) could confound the effects of the network. Dewey, Belnap, and Hillstrom (2013:87) assert that while meaningful social interactions are significant, "there is not yet a definitive answer regarding what factors influence social interaction most, how best to prepare learners for these interactions, or how to foster interaction during residence abroad" and emphasise the need for additional research in this area; a necessity reiterated in a 2018 synthesis of the state-of-the-art on language learning in SA contexts (Isabelli-García, Bown, Plews & Dewey, 2018). Justly so: despite the crucial influence of social interactions on SLA, so far few studies have attempted to

explain how the patterns and dynamics of out-of-class communication among exchange students (and between them and domestic students) influence their L2 development. Equally importantly, while the extant studies have signalled the importance of social interactions for L2 development and sometimes hypothesised trends, they have not deepened the intuitions as they formulated no concrete hypotheses on the exact patterns and dynamics of the interactions and their influence on language learning outcomes (see Paradowski, Chen, Cierpich & Jonak, 2012, for a rare exception). Until we do so, we are not in a position to find answers crucial to fully understanding the phenomenon of second language acquisition.

Despite the interest among SLA and SA scholars and the increasing use of the phrase "social networks" in publication titles, these studies focused mainly on communication with the host family and other members of the local culture, and never operationalised the contacts to allow a reconstruction of the connected, directed social graph and subsequent computational analyses of the impact of its structure and interaction dynamics on language development. Where the social network measures hitherto applied in published studies do sometimes allow visualising the ego-network of the participants, they do not attempt a reconstruction of the connected social graph (thus the ego-networks obtained are necessarily undirected), are time-consuming, and only look at L2 interactants, hence fail to provide necessary information on the quantity, quality and dynamics of respective language use. Zappa-Hollman and Duff (2015) offered an elegant visualisation of the individual network of practice of a Mexican university student in Canada, but the relationships were neither quantified nor broken down into individual interactions. Sabawi and Yıldız's (2016) sample (n=11) was too modest to allow statistically significant conclusions, and despite the paper title, they only looked at each student's contacts without reconstructing the graph of relations or applying a computational network analysis. Recently, Gautier (2019) adopted a longitudinal approach with three data collection points in a sample of language learners in France, using measures such as density and centrality as well as cluster analysis, but looking at undirected and unweighted graphs. More approaches to SLA are needed that will be able to rigorously operationalise and map students' social embeddedness, and explain the observed relationships in a coherent model. The methodology of computational and anthropological SNA outlined in this chapter has the potential to bridge this gap and explore the relationships between social interaction dynamics and L2 development. […]

Quantitative research alone can only provide an incomplete picture of the phenomena at hand. Neglect of insights from a qualitative angle could be compared to reading only alternate pages of a book: while a discerning reader might succeed in putting much of the story together and "careful study of a particular even or odd page may be necessary at times, the whole story cannot be conceptualized without both" (Isabelli-García, Bown, Plews & Dewey, 2018:470). To lend validity to the research, achieve a better, more comprehensive understanding of the dynamic effects of peer interactions on language gains, and thus account for more of the variance, research should combine quantitative with qualitative approaches via a mixed methods design. This will help provide *emic* (learner-) rather than merely *etic* (researcher-focused) insights and perspectives. This will allow a better understanding of the different social factors and individual differences which affect the interaction dynamics.

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