Bridging applied linguistics and complexity science: The contributions of Social Network Analysis

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Social networks play an important role in the behaviour and attainment of individuals [1, 9, 10, 11]. We present two studies investigating the influence of peer interaction dynamics and social graph topology on measurable SLA outcomes [2, 3, 4, 5, 6] among Erasmus exchange students at one university in Germany (n=40) and participants in an intensive summer course of language and culture in Poland (n=181).

To comprehensively characterise the structure of the learner networks, following the administration of a specially constructed PEERLANG questionnaire, we used established metrics such as node degree, closeness, betweenness, other centrality measures as well as local clustering coefficients, with their generalisations to weighted graphs (incorporating the contribution of both the number and strength of interactions), alongside community detection algorithms. The topological data were then overlaid over independently collected socio-biographical data and learning outcomes to carry out multi-faceted analyses of the mutual influence of individual and social factors. To determine how these were associated with performance, we used dimensional reduction and performed multiple linear regression.

In the German course, we find among others i) that the best predictor of (both self-reported and independently measured) progress is reciprocal interactions between students *in the language being acquired*, ii) that outgoing interactions in the TL are a stronger predictor than incoming interactions, iii) a clear negative relationship between performance and interactions with same-L_1 speakers, iv) a significantly underperforming English native-speaker dominated cluster, and v) that more intense interactions take place between students of different levels of proficiency.

In the Polish course, participants' patterns of social embeddedness in TL communication turn out to be significantly moderated by their i) *individual* (but not course-group level) entry TL competence (positively) and ii) psycho-situational portrait, while iii) negatively by competence in *lingua-franca* English. iv) Outdegree centrality in the TL is also negatively impacted by the intensity of communication with the teacher in a (non-L_1) non-target language. v) The influence of the network is strongest in the domains of pronunciation and lexis, where the simplest measure of degree centrality (number of an individual's social ties) *in TL* positively correlates with progress, while betweenness (popularity or control) *in total communication* is significantly anticorrelated. vi) This mirrors the influence direction—on global TL progress—of closeness centrality (ease of access to other students). Combined with the detrimental impact on SLA of a high in-degree, this suggests that for language acquisition, the structural properties of the network matter more than processes such as information flow.

Social network analysis provides new insight into the link between social relations and language acquisition [7, 8, 12], showing how social network configuration and peer interaction dynamics are stronger predictors of L_2/L_3 performance than individual factors such as attitude or motivation, and offers a novel methodology for investigating the phenomena.

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