

ONLINE SUPPLEMENT - ROBUSTNESS CHECKS

We conducted extensive robustness checks to ensure that our results are not caused by assumptions made during data preparation, calculation of variables or model specification. During data preparation, we removed e-mails with more than one recipient from the analysis. While some earlier studies have used a four recipient threshold (e.g., Kossinets, and Watts, 2006), the literature does not yet provide a theoretical justification for a given threshold or an empirical analysis of the effect of varying number of recipients on the resulting network. We conducted robustness checks by selecting e-mails sent to two, three and four recipients and the results presented here are substantively identical to those obtained using these different thresholds, which is consistent with other studies using email data (see Kleinbaum, 2012).

A key variable in our model identifies the extent to which individuals occupy a brokerage position. We created multiple versions of this variable in order to empirically validate the robustness of our results to different specifications. First, we created a cross sectional matrix with the number of emails exchanged in each dyad over the observation period and calculated constraint (Burt, 1992) on this network. We also calculated constraint on matrices for which the network had been dichotomized at 1 (i.e., if a dyad exchanged 1 email or more, they were assumed to have a tie) and 14 (mean) email exchanges. We also followed Wuchty and Uzzi (2011) and used different methods of aggregation and dichotomization (based on volume, reciprocation and normalized) to calculate constraint scores. Furthermore, we calculated constraint on different sections of the data: instead of aggregating the whole eight months, we created two matrices of four months each and calculated constraint scores on different dichotomized versions of these. Finally, we used various dichotomized versions of the constraint variable, identifying the top 10 and top 25 brokers. The results presented here are substantively identical to those obtained using the different ways of selecting brokers mentioned above.

In the specification of our model, we chose an operationalization of the short-term as one week and of the long-term as a cumulative statistic accounting for exchanges that had occurred since the beginning of the observation period. For robustness, we also operationalized the short-term as 24 hours and the long-term as three months and the results obtained were substantively similar to those presented here. Finally, we controlled specifically for the amount of emails sent and received by the brokers and the results are similar to those presented here where we control for the degree distribution of the whole population (including the brokers).

Furthermore, we explored multiple alternative specifications of our models.

1. In Table OS.1, we use a statistic aggregating prior interactions and prior incoming interactions.
2. In Table OS.2, we present a model in which we only consider the embedded interactions, and we find that the parameter estimate for Embedded Tertius Iungens by Broker stays positive but becomes insignificant. This pattern of results is consistent with our theory, since the statistic now accounts for all email interactions that have occurred in the two-path, which includes those that have occurred in embedded interactions, but also unembedded interactions. We know from our main model that these patterns have opposite directions, which explains the non-significant parameter estimate when they are combined.
3. In Table OS.3, we present a model in which we only consider unembedded interactions, and we find that our result is replicated. The parameter estimate for Unembedded Tertius Iungens by Broker is negative and significant. This indicates that the overarching tendency of brokers is to intermediate information exchanges between individuals that are not connected with each other in the short-term.

TABLE OS.1

Parameter Estimates of Relational Event Models for the Email Event Sequence – Aggregated Prior Interactions and Prior Incoming Interactions (Standard Errors in Parenthesis)

	Model 1
Explanatory Variables	
Embedded Brokerage Interactions	
Tertius Iungens	0.082** (0.005)
Tertius Iungens by Broker	0.025* (0.011)
Unembedded Brokerage Interactions	
Tertius Iungens	0.37** (0.004)
Tertius Iungens by Broker	-0.144** (0.006)
Time Invariant Controls	
Both Free Lancers	0.075 (0.056)
Same Hierarchical Level	-0.044** (0.011)
Same Gender	0.106** (0.015)
Same Location	1.12** (0.022)
Same Language	0.02 (0.011)
Same Tenure	0.005 (0.01)
Same Function	0.353** (0.013)
Sender is Superior of Recipient	0.343** (0.028)
Sender is Subordinate of Recipient	0.062* (0.031)
Sender is a Freelancer	-0.177** (0.022)
Hierarchical Level of the Sender	0.008 (0.008)
Gender of the Sender	-0.065** (0.013)
Tenure of the Sender	0 (0)
Time Varying Controls	
Embedded Interactions	
Prior Interactions and Prior Incoming Interactions	0.149** (0.004)
Activity Sender	0.381** (0.007)
Popularity Recipient	0.391** (0.006)
Unembedded Interactions	
Prior Interactions and Prior Incoming Interactions	0.669** (0.004)
Activity Sender	0.072** (0.006)
Popularity Recipient	-0.017** (0.006)
Goodness of Fit	
Null Deviance	458,554
Residual Deviance	217,183
Observed Events (Potential Events)	75,308 (1,506,160)

** p<.01; * p<.05

TABLE OS.2

Parameter Estimates of Relational Event Models for the Email Event Sequence – Only Embedded Interactions Effects (Standard Errors in Parenthesis)

	Model 1
Explanatory Variables	
Embedded Brokerage Interactions	
Tertius Iungens	0.281** (0.004)
Tertius Iungens by Broker	0.007 (0.008)
Time Invariant Controls	
Both Free Lancers	0.32** (0.048)
Same Hierarchical Level	0.077** (0.01)
Same Gender	0.249** (0.013)
Same Location	1.236** (0.02)
Same Language	0.054** (0.01)
Same Tenure	-0.007 (0.009)
Same Function	0.387** (0.011)
Sender is Superior of Recipient	0.387** (0.025)
Sender is Subordinate of Recipient	0.145** (0.027)
Sender is a Freelancer	-0.071** (0.02)
Hierarchical Level of the Sender	-0.053** (0.007)
Gender of the Sender	-0.108** (0.012)
Tenure of the Sender	0.001** (0)
Time Varying Controls	
Unembedded Interactions	
Prior Interactions	0.374** (0.003)
Prior Incoming Interactions	0.287** (0.003)
Activity Sender	0.504** (0.005)
Popularity Recipient	0.444** (0.004)
Goodness of Fit	
Null Deviance	458,554
Residual Deviance	266,509
Observed Events (Potential Events)	75,308 (1,506,160)

**** p<.01; * p<.05**

TABLE OS.3
Parameter Estimates of Relational Event Models for the Email Event Sequence – Only
Unembedded Interactions Effects (Standard Errors in Parenthesis)

	Model 1
Explanatory Variables	
Unembedded Brokerage Interactions	
Tertius Iungens	0.572** (0.003)
Tertius Iungens by Broker	-0.324** (0.007)
Time Invariant Controls	
Both Free Lancers	0.219** (0.052)
Same Hierarchical Level	0.043** (0.01)
Same Gender	0.346** (0.014)
Same Location	1.423** (0.021)
Same Language	0.041** (0.011)
Same Tenure	0.02* (0.01)
Same Function	0.253** (0.012)
Sender is Superior of Recipient	0.868** (0.026)
Sender is Subordinate of Recipient	0.262** (0.029)
Sender is a Freelancer	-0.426** (0.022)
Hierarchical Level of the Sender	-0.2** (0.007)
Gender of the Sender	0.124** (0.012)
Tenure of the Sender	0.002** (0)
Time Varying Controls	
Unembedded Interactions	
Prior Interactions	0.452** (0.003)
Prior Incoming Interactions	0.356** (0.003)
Activity Sender	0.268** (0.006)
Popularity Recipient	0.209** (0.005)
Goodness of Fit	
Null Deviance	458,554
Residual Deviance	235,261
Observed Events (Potential Events)	75,308 (1,506,160)

** p<.01; * p<.05