Network, Personality and Social Capital

Jayant Venkatanathan, Evangelos Karapanos
Madeira Interactive Technologies Institute
University of Madeira
Funchal, Portugal

{vjayant, e.karapanos}@m-iti.org

Vassilis Kostakos, Jorge Gonçalves
Department of Computer Science and Engineering
University of Oulu
Oulu, Finland

{vassilis, jgoncalv}@ee.oulu.fi

ABSTRACT

We present a study on the relationship between social network structure on Facebook and social capital, and how this relationship is moderated by personality traits. The findings suggest that one's number of friends does not necessarily have an effect on the amount of bridging social capital. Conversely, the extent of structural holes and isolated friends in the network have an effect on bridging social capital. In addition, individuals low on agreeableness benefit more from isolated friends in terms of bridging social capital. In terms of bonding social capital, introverts benefit more from networks with higher transitivity. Women overall report higher bonding social capital, but there are no significant gender differences when it comes to leveraging one's network structure for bridging or bonding social capital.

Author Keywords

Social networks, ego networks, social capital, personality.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

In our work we seek to understand the extent to which modern social networking systems can help individuals in their daily interactions through various means and support. In particular, we present a study that examines the relationship between individuals' social network structure on Facebook and social capital.

Previous studies [2, 10] found the structure of the networks around individuals predicted their success in an organization. This lead to the hypothesis that on account of their social ties and the structure of the network of these ties, certain individuals had access to more and a broader range of resources. In other words, these individuals had access to more and a broader range of social capital. The effect of the access to this social capital was therefore

manifested in the overall outcome of higher success levels within the organization.

Social capital is the value of relationships between individuals and groups, and the resources and support that an individual has access to on account of his or her social ties. Social capital today is generally described using the constructs of *bridging* and *bonding* social capital [8]. Bridging social capital refers to the social capital created from bonds across individuals of different backgrounds. While these ties may lack in depth, they provide individuals with a broader horizon and open opportunities for new resources and information. Conversely, bonding social capital is created in bonds within individuals of a closed group such as family and close friends. These ties provide substantial and strong emotional support.

Previous work on network structure and social capital highlight two issues. First, it is not clear which kind of social capital, bridging or bonding, is associated with the network structure around individuals and their success in the organization. At the time, researchers drew from concepts such as the strength of weak ties [7], arguing that success was largely the result of bridging social capital, as we refer to the term today. While network structure might influence bridging social capital, one can expect that bonding support within these organizations might also have influenced the outcome of these individuals' success. Hence this raises the following question: *Can the structure of social ties around an individual independently help us predict the constructs of bridging social capital and bonding social capital?*

Second, individual differences can play a role in how positional advantages offered by network structure are leveraged. For example, certain individuals may have no inhibitions in approaching a distant tie for help in obtaining a job, while others might not be comfortable doing so. Thus, opportunities to leverage network ties and structure need not necessarily turn into social capital. Therefore, in addition to understanding how network structure influences social capital, it becomes important to understand: *how do individual differences in personality affect the leveraging of network structure for social capital*?

To answer these two questions we take advantage of the large-scale and granular availability of social network data on Facebook. Past research examining the relationship between network structure and outcomes of social capital has typically made the implicit assumption that the

direction of causality is from the former to the latter [Eg. 2, 6]. While these two variables are likely to influence each other to an extent, we assume that the dominant direction of causality is from network structure to social capital. Recent work has studied how social capital is leveraged on Facebook through the types of activities individuals engage in [3, 4, 12]. However, no work, to our knowledge, has examined how the network structure of social ties around individuals, as captured by online social networks, influence bridging and bonding social capital.

STUDY

Our study examines the effect of network structure in Facebook on social capital. We collected data from participants who gave us access to their list of friends on Facebook. From this data we were able to reconstruct their social network and calculate a number of metrics regarding their position in the network. Each participant also responded to standardized questionnaires of social capital [11] and the big five personality traits [9].

Participants

Participants were recruited through announcements and email lists in a university in Portugal and on social media targeting English speakers. Participants were also asked to rate their fluency in English. A total of 97 individuals (59 male) from 11 countries successfully completed the survey with an average age of 28 years old (sd=5.0). Participants had on average 303 friends (SD=178, max=875, min=9). Participants with less than 20 friends (N=2) were removed as they exhibited very little network structure and were likely to bias the results.

Measures

Network Analysis Metrics

A typical feature of social networks is that they consist clusters of dense connections linked by occasional bridge connections between the clusters. The "holes" in the network between these dense clusters or between individuals who are not interacting are referred to as structural holes [1]. The concept of structural holes is of interest in our current context since individuals who act as bridges between structural holes can benefit by having access to information and resources circulating in different clusters, and by acting as intermediaries between these clusters of people who are not directly interacting with each other. Structural holes were quantified through the use of the following metrics:

- *Effective Size* captures the relationship between number of friends and number of ties between them in the ego network. The fewer the ties between the ego's friends, the greater the effective size of the ego network (for the exact definition the reader may refer to [2]).

- *Constraint* is high in a small network of contacts who are close to one another, or strongly tied to one central contact. High constraint networks exhibit fewer structural

holes while low constraint networks exhibit more structural holes [2].

- *Betweenness centrality* captures the relative importance of an ego in the quick transmission of information within the ego network [5].

In addition we examine the following metrics in relation to social capital:

- *Degree centrality*: The number of friends in the ego network.

- *Isolated friends*: The number of friends in the ego network with no other common friend with the ego.

- *Transitivity* : The probability that any two friends of an individual in the ego network are in turn friends.

- *Density* : The ratio of the number of links and the total number of possible links in an ego network.

Social Capital

Bridging and bonding social capital was measured with an adapted version of Williams' (2006) Internet Social Capital scales [11], consisting of six items for bridging social capital (Cronbach's alpha= 0.581, items 1, 2, 4, 7, 8 and 10 of the original scale; examples:"I am willing to spend time to support general community activities" and "Interacting with people reminds me that everyone in the world is connected") and five items for bonding social capital (alpha= 0.654, items 1, 2, 3, 8 and 10; examples: "There are several people I trust to help solve my problems." and "The people I interact with would help me fight an injustice.").

Personality Traits

Personal traits were measured with the 10 item questionnaire of the big five inventory (10-BFI) [9]. It consists of two items for each of the five personality traits:

- *Extraversion* refers to the tendency for the individual to be outgoing and sociable (alpha= 0.519).

- *Neuroticism* refers to the tendency to experience anxiety and negative emotions. (alpha= 0.649).

- *Conscientiousness* is the extent to which an individual is orderly, self-disciplined and strives for achievement. (alpha= 0.57).

- Individuals high on *Agreeableness* are socially flexible, trusting and adjusting. (alpha= 0.045). The alpha value for this trait is unusably low. Further examination showed that participants uniformly rated themselves very high on one of the two items. Hence that item was dropped, leaving us with a single item for this trait. The item used in the analysis for the agreeableness trait is "I see myself as someone who tends to find fault with others" (reversed).

- *Openness to experience,* or simply *openness*, refers to overall curiosity, and artistic and scientific creativity (alpha=-0.086). The low alpha value for this scale similarly makes it unusable. As in the case of

agreeableness, participants uniformly rated themselves high on one of the items, and this item was dropped. The single item used for the analysis of openness is "I see myself as someone who has few artistic interests" (reversed).

Most of the scales show alpha values only on the border of acceptability. Since we use single items to measure agreeableness and openness, we must interpret the results involving these traits with caution. Accounting for fluency in English and country had no effect on the reliability of any of the scales, hence these variables were subsequently discarded. Before proceeding further with analysis, all participants' scale ratings were converted to normalized z-scores. Degree, betweenness and constraint had heavy-tailed distributions and hence were converted to log-scale.

RESULTS

An independent samples t-test showed that females reported significantly higher bonding social capital than males(t(93) = -2.36, p<0.05; Males: mean -0.21, sd 0.95; Females: 0.28, sd 1.02). There was no significant effect of gender on bridging social capital (p>0.1).

Network structure

Regression analysis showed that there was a significant effect of betweenness on bridging social capital (t(93) = 2.0, b=1.17, p<0.05, model adjusted r-sq = 0.03) and a marginally significant effect of constraint on bridging social capital (t(93) = -1.88, b=-.34, p<0.1, model adjusted r-sq=0.03). We also found a significant effect of the number of isolated friends on bridging social capital (t(93)=2.81, b=0.31, p<0.001, model adjusted r-sq=0.07). These are shown in Figure 1. We found no significant effect of degree on bridging social capital.
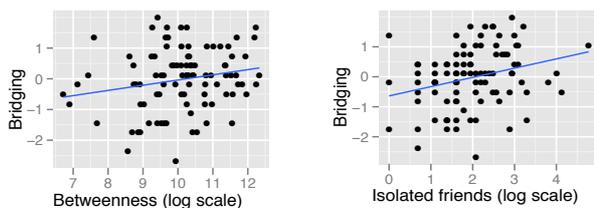

Figure 1. Left: Betweenness vs Bridging social capital Right: Isolated Friends vs Bridging social capital
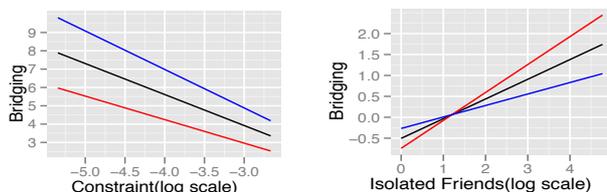

Figure 2: Left: Constraint Vs Bridging. Red - low conscientiousness (z-score=-1). Blue - high conscientiousness (z-score=+1). Right: Isolated Friends Vs Bridging. Red - low agreeableness (z-score=-1). Blue - high agreeableness (z-score=+1)
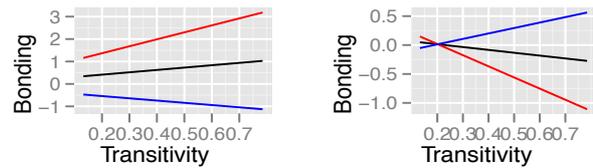

Figure 3: Transitivity vs Bonding. Left: Red - low extraversion (z-score=-1). Blue - high extraversion (z-score=+1). Right: Red - low openness (z-score=-1) . Blue - high openness (z-score=+1)

Additional examination with personality traits showed a marginally significant interaction of conscientiousness with constraint (t(91)=-1.87, b=-.41, p<0.1, model adjusted r-sq=0.04). In particular, the inverse relationship between constraint and bridging social capital was stronger among individuals with higher conscientiousness. There was also a significant interaction of agreeableness with the number of isolated friends in predicting social capital (t(91) = -1.99, b=-0.20, p<0.05, model adjusted r-sq=0.09), and the positive relation between bridging social capital and the number of isolated friends was stronger among those with low agreeableness (Figure 2). There was no significant effect of density or transitivity and no significant interaction between any network metric and gender in predicting bridging social capital (p>0.1).

Further analysis showed that effective size had a marginally significant positive effect on bonding social capital (t(93) =1.71, b=0.001, p<0.1, model adjusted r-sq=0.02), and so did degree (t(93) = 1.93, b=0.35, p<0.1, model adjusted r-q = 0.03). The number of isolated friends had no significant effect on bonding social capital.. Extraversion showed a significant interaction with transitivity in predicting bonding social capital (t(91)= -2.92, b=-2.05, p<0.01, model adjusted r-sq=0.08). In particular, introverts with higher network transitivity had higher levels of bonding social capital. In addition, openness showed a marginally significant interaction with clustering in predicting bonding social capital (t(91)=1.90, b=1.43, p<0.1, model adjusted r-sq=0.03). These interactions are shown in Figure 3. There was no significant effect of density and no significant interaction between any network metric and gender in predicting bonding social capital (p>0.1).

DISCUSSION

Overall, the study found network structure affecting both bridging and bonding social capital. While women reported higher bonding social capital, the findings show no evidence of gender differences when it comes to leveraging one's network structure for bridging or bonding social capital.

The findings revealed a positive effect of the extent of structural holes (measured by betweenness and constraint) in individuals' ego networks and bridging social capital. This is in agreement with the arguments put forward in prior literature to explain the effect of structural holes with success in organizational networks [2, 10].

Moreover, this positive effect of structural holes on bridging social capital was higher for conscientious individuals. An interpretation for this is that since conscientious individuals are self-disciplined and strive for achievement, they are better able to leverage the diversity of their network facilitated by higher structural holes, to obtain bridging social capital. The positive effect of structural holes on bonding social capital can be explained by the fact that individuals having networks with more structural holes are likely to have access to diverse ties for bonding needs who can provide different perspectives to a problem, or address distinct communication needs. However, these two results were only marginally significant, and hence should be treated with caution.

The positive effect of the number of isolated friends on bridging social capital confirms that such ties are likely to open up opportunities for new information and ideas. Interestingly, less agreeable individuals were likely to obtain higher bridging social capital from isolated friends. As expected, the number of isolated ties had no effect on bonding social capital, as these ties are likely to be weak ties and hence less likely to be a source of bonding support.

The number of friends of an individual had no effect on bridging social capital. This might suggest that merely increasing the number of friends does not lead to an increase in bridging social capital, unless that increase is through the addition of individuals from diverse backgrounds or communities (which is reflected in the measures of structural holes and isolated friends). There was a positive effect of the number of friends on bonding social capital, but this was only marginally significant.

Finally, introverts benefitted in terms of bonding social capital from higher transitivity. Since high transitivity networks consist of more closely knit clusters, this might suggest that introverts are better able to tap from closely knit networks for bonding needs.

CONCLUSION AND LIMITATIONS

This paper raised two questions: a) does network structure on Facebook predict social capital, and if so, b) is this relationship moderated by personality differences? Overall, the study suggests that the number of friends does not necessarily translate to bridging social capital, but the extent of structural holes and isolated friends in the network, along with personality, affect bridging social capital. In addition, introverts benefit in terms of bonding social capital from networks with higher transitivity.

One has to be cautious though in generalizing these results given the limits of our sample. First, due to the limited sample size, we were unable to inquire into higher order interaction effects, such as the extent to which individuals that are high on both conscientiousness and extraversion are able to leverage their network structure for social capital. Secondly, a methodological drawback of the study is that participants were self-selected as they responded to an online survey call. This might have lead to a possible non-response bias in our sample, whereby the sample Facebook users who chose not to respond to our announcements for the study might have shown an overall difference from our participants in network structure, personality or social capital. Last, some of the scales showed very low reliability scores. While small item scales have the benefit of lower participant fatigue, low reliability can be expected for questionnaire scales containing only few items per construct, such as the personality traits questionnaire used in this study. Hence, these results need to be interpreted with caution.

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