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journal homepage: [www.elsevier.com/locate/jebo](http://www.elsevier.com/locate/jebo)Directed trust and trustworthiness in a social network: An experimental investigation<sup>☆</sup>Yohanes E. Riyanto<sup>a,\*</sup>, Yeo X.W. Jonathan<sup>b</sup><sup>a</sup> Division of Economics, School of Social Sciences, Nanyang Technological University, 14 Nanyang Drive HSS 04-70, Singapore 637332, Singapore<sup>b</sup> Department of Economics, University of Warwick, Coventry CV4 7AL, United Kingdom

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## ABSTRACT

Trust and trustworthiness are important in social relationships. Levels of trust and trustworthiness are likely to depend on “social” utility; the magnitude of which is influenced by the social context governing individual relationships. Social networks are an example of such a social context. This paper investigates how social networks influence trust and trustworthiness by blending social network analysis with experimental economics methodology in two separate experiments. We show that trust and trustworthiness are higher for individuals who are more closely connected; in both cases, this relationship tapers off beyond second degree friendships. We also find that people tend to trust more central (popular) individuals. However, being more central (popular) has little influence on one’s levels of trust and trustworthiness. We find these effects on trust to be only partially driven by the expectation of trustworthiness. We thus document evidence of a bias toward more closely connected and more popular individuals.

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## 1. Introduction

Social capital, which can be defined as informal cooperation-enhancing values or norms shared collectively by members of a group or a society (Fukuyama, 1995), plays a significant role in a wide range of social and economic outcomes<sup>1</sup> Robert Putnam, who is regarded as one of the world’s leading authorities on social capital, describes it as “connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them” (Putnam, 2000, p.19).

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<sup>1</sup> For instance, social capital promotes economic growth (Knack and Keefer, 1997), influences political participation (DiPasquale and Glaeser, 1999), enhances children’s welfare (Putnam, 2000), improves judicial efficiency (Porta et al., 1997), reduces the crime rate (Akcomak and ter Weel, 2012), and is positively related to a nation’s financial development (Guiso, Sapienza, and Zingales, 2004).

Trust and trustworthiness<sup>2</sup> are two key sources of social capital that can help reduce relationship friction in socio-economic transactions by promoting social cohesiveness. The former can be defined as the extent to which one believes in other people's reciprocal tendencies, while the latter is the willingness to return an act of trust displayed by others. As highlighted by Putnam, social networks are important aspects of life which play a significant role in determining trust and trustworthiness. Social network traits like social distance and centrality may thus crucially determine the magnitude of trust and reciprocity/trustworthiness displayed by their members.

Despite the importance of social network factors, few economic experiments have examined behavior exhibited within *real-life social networks*, most have focused on random and anonymous interactions between selected participants. Our study seeks to fill this gap in the literature by blending the methodology of experimental economics with social network analysis: we examine trust and trustworthiness in a laboratory setting, utilizing real-life social network data. Specifically, we focus our analysis on how trust and trustworthiness are influenced by specific network traits of individuals in dyads that include; geodesic distance and centrality (own and partners'), the latter of which can be interpreted as popularity. In the analysis, other than investigating the role of social network traits on trust and trustworthiness, we also examine how past experiences of trust and trustworthy behavior influence future trust and trustworthy behavior.

While "directed"<sup>3</sup> trust and trustworthiness should be expected, it is not clear the extent to which this is prevalent, or how indirect effects working through past experiences may play out. Furthermore, either one's own or someone else's centrality within the network could theoretically influence pro-social behavior, both in a negative and a positive manner. This study will thus give insights into the possible heuristics determining individuals' trusting and trustworthy behavior in response to someone else's centrality or social distance and how such behavior evolves with past experience.

The extent of "directed" pro-social behavior is also analogous to the decay factor in network games and may be important in predicting equilibrium behavior in other exchange settings. This could enable better evaluation of the potential impact of social policies (e.g., community building) on individual and collective pro-social behavior within social networks. Similarly, elucidating the effects of one's own and someone else's centrality or popularity is relevant for further theoretical work in this area; for example, such processes may be important for network formation/stability.

To this end, we conduct two different experiments, each using modified trust games, which utilize elicited real-life social network data. The first and second experiments were designed to examine trustworthiness and trust respectively. In both, we extracted the friendship network of the participants using a Facebook application Netvizz and used it to calculate their network relationships and characteristics. Participants then played a multi-period trust game, both as senders and receivers; they were provided with network information on randomly assigned partners<sup>4</sup> but not their exact identity; this helped us to control for reputation building. Further, there was an element of feedback between rounds that enabled us to examine the effects of past experience in combination with network information.

The above design of the two separate experiments allowed us to examine how own and partners' network characteristics are related to decisions about whether to trust and be trustworthy, as well as how the latter may interact with feedback from past experience.

In examining the impact of *geodesic distance* on trust and reciprocity, our paper relates to an existing empirical literature, which examines the impact of *low social distance* (in a perceived closeness sense) on cooperative behaviour (Orbell et al., 1988). A consistent finding<sup>5</sup> is that increased perceived closeness positively affects other regarding and cooperative behaviour like trust, reciprocity, and altruism. In the social identity literature, the finding of in-group bias in various experimental games is also consistent with this idea (Chen and Chen, 2011; Chen and Li, 2009; Goette et al., 2006; Smith 2011). The mechanism by which *geodesic distance* and *social distance* influence other-regarding and cooperative behavior could be similar to the one working through the social identity effect (i.e., via perceived closeness).

Our methodology is also connected to the relatively limited set of studies that involve economic experiments in real-life social networks: examples of such research include Baldassarri and Grossman (2013), Brañas-Garza et al. (2010), D'Exelle and Riedl (2010), Goeree et al. (2010), and Leider et al. (2009). However, these studies focus mainly on *altruistic behavior* in dictator games and their variants. They find that altruism decreases with social distance, as measured by the degree of friendship, although they differ in the extent of geodesic distance that they account for. In contrast, their findings on the effects of own centrality on altruism are mixed<sup>6</sup> In relation to this, Chandrasekhar et al. (2015) examine outcomes

<sup>2</sup> We take the terms trustworthiness and reciprocity to be interchangeable, in the sense that an individual who decides to reciprocate can also be considered to be deciding to be trustworthy.

<sup>3</sup> We borrow this terminology from Leider et al. (2009), using it to refer to decreasing geodesic distance within the network (degrees of separation) being associated with increasing levels of such (pro-social) behaviour.

<sup>4</sup> Note that this can be considered to be pseudo within individual treatment in that it is as if participants are assigned partners with random network characteristics.

<sup>5</sup> Increased perceived closeness to others could result from, among others; double blind vs single blind protocols (Cox and Deck, 2005), internet vs laboratory experiments (Charness, Haruvy, and Sonsino, 2007), manipulation of perceived physical distance and the possibility of communication (Fiedler, Haruvy, and Li, 2011), past interaction (Frey and Bohnet, 1997), greater mutual friends and the duration of acquaintanceship (Glaeser et al., 2000), and decreased anonymity when, for example, knowing the family name (Charness and Gneezy, 2008). Common characteristics that lead to a perceived in-group identity of partners can also be interpreted as increasing perceived closeness (Eckel and Wilson, 2002).

<sup>6</sup> Baldassarri and Grossman (2013) and Goeree, McConnell, and Mitchell (2010) find no significant effects for various centrality measures, while Brañas-Garza et al. (2010) find the opposite. D'Exelle and Riedl (2010) examine different social dimensions of networks in a rural village and find that own and partner's closeness and/or betweenness centrality in the network is significant in terms of generosity.

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