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Follow thy neighbor: Connecting the social and the spatial networks on Twitter

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ABSTRACT

This paper compares the social properties of Twitter users' networks with the spatial proximity of the networks. Using a comprehensive analysis of network density and network transitivity we found that the density of networks and the spatial clustering depends on the size of the network; smaller networks are more socially clustered and extend a smaller physical distance and larger networks are physically more dispersed with less social clustering. Additionally, Twitter networks are more effective at transmitting information at the local level. For example, local triadic connections are more than twice as likely to be transitive than those extending more than 500 km. This implies that not only is distance important to the communities developed in online social networks, but scale is extremely pertinent to the nature of these networks. Even as technologies such as Twitter enable a larger volume of interaction between spaces, these interactions do not invent completely new social and spatial patterns, but instead replicate existing arrangements.

1. Introduction

Internet Communication Technologies (ICTs) have reconfigured the role of distance in social relationships. Email, mobile phones, and online social networks allow relationships that would have previously been neglected or discontinued to be more easily maintained. These weak ties, or acquaintance based relationships that were often discontinued when an individual relocated or their interests evolved are now maintained as a digital community linking an individual to those they interacted with previously. Weak ties differ from strong ties such as familial or friendship relationships that an individual maintains throughout life. An individual generally maintains more weak ties in their personal network than strong ties as less time and energy are needed to maintain these connections. Both weak ties and strong ties often emerge out of spatial proximate social interaction, but can be maintained with online interactions. Twitter, a popular microblogging social network, is one example of a weak tie online social network that allows millions of users to establish digital communities that incorporate a combination of offline contacts and online contacts of interest and maintain relationships that otherwise would have faded.

This paper uses Twitter as an example of a weak tie network to understand how distance impacts social relationships and networks. Communities on Twitter (Gruzd, Wellman, & Takhteyev, 2011) form through users following other users they either know already or whose interests are relevant to them. As most Twitter users disclose their location and contacts, this provides scholars with a way to measure the geography of digital networks established by millions of users around the world. We use this established online social network to ask: what is the relationship between the physical distance of virtual connections established by one's Twitter contacts and the social connectivity among those contacts?

This paper contributes a new way of integrating physical and social distance online to understand the geography and transitivity of communities connected through Twitter. This paper will proceed as follows: Section 2 introduces scholarship integrating geography and the Internet; Section 3 introduces literature pertaining to Twitter and social capital as well as our data collection and geocoding procedures; Section 4 introduces terms and means of measuring spatial and social geographies of Twitter and compares these measures. In Section 5 we conclude that Twitter is reflective of "social neighborhoods" that exist offline through replicating existing social patterns. We determined that networks existing at less than 500 km are stronger and more effective in disseminating information.

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2. Geography, the Internet and community

A large part of the early thinking on digital communities and its consequences can be labeled as 'naïve' with hindsight. Many thinkers – especially in the popular media – thought that the Internet would make geographical differences smaller and smaller. Even relatively recent, the oft cited Friedman (2007) defends this idea in his 'world is flat' thesis. A decade before Friedman, Cairncross (1997) made a similar claim already: not only does history end (cf. Fukuyama, 1992), the death of distance is near. After humankind gets rid of distance, telecommunications will help dissolve the differences between rich and poor; between small and large. This death of distance discourse in popular media is closely related to what Graham (1998) calls the substitution perspective on cyberspace. It argues that attachment to 'place' is replaced by new technologies: cyberspace is thus replacing 'human' space. This perspective is often used by those who feel technological change is endangering social functions, leading to placelessness (Leamer & Storper, 2001). Online communities are alleged to form a complete substitute for the sense of belonging that place offers (Crang, Crosbie, & Graham, 2007).

The distance destroying capability of technology has been disputed by other scholars who note the geographical dependence in the uses of the Internet (Adams & Ghose, 2003). Geography remains relevant to transport costs, the ongoing evolution of digital divide, borders, and cultural differences. Additionally, co-presence remains a key element in the development of social capital, and building new relationships is greatly aided by spatial proximity, while the social depth of knowledge exchange declines across distance (Leamer & Storper, 2001; Morgan, 2004). Thus, geography is very much alive in the digital cities of the 1990s, the place-based review sites of the early 2000s (e.g. Yelp, Google Maps), and the hyper-local social network sites of the late 2000s (Foursquare, Facebook Places).

In short, geographers insist that "The net cannot float free of conventional geography" (Hayes, 1997 in Zook, Dodge, Aoyama, & Townsend, 2004) and emphasize that it is impossible for Internet users to completely disconnect from the material world in which we are embedded. Thus the social networks represented through platforms like Twitter and Facebook have a geography that blends digital and material dimensions. Online networks can function as a hub of camaraderie among individuals with unique interests unrepresented in the material community around them (such as online support groups or sexual fetish sites); or as a precursor to interactions in the material world (such as online dating sites or job seeking sites). Although online, these social networks are still intrinsically connected to the offline world and subject to similar social, cultural, linguistic and economic constraints.

However, as computers are increasingly used for social interactions that connect people and organizations around ideas, the geography of social relationships becomes more complex. Wellman (2001) examined computer networks that function as social networks and found that email connections increase social capital as ties—the bonds between individuals, are maintained with respect to geography. When distance increases email replaces face to face communication for strong tie relationships. These individualized "fragmented community networks" are reinforced by email, which allow existing offline communities to "sustain interactions across vast distances" (Juris, 2004).

ICTs enable complex social geographies of use, with interactions in cyberspace simultaneously influenced by physical proximity as well as a network distance in cyberspace (Li, Whalley, & Williams, 2001). This network distance in cyberspace is not mutually exclusive from the distances traversed in the material world; network and physical distances are related, reflexive and co-constructive. And it is precisely this nexus that makes studying the geography of Twitter networks so relevant.

In March, 2012, Twitter was the second largest online social network in the world with 500 million registered users and 100 million active users (Twitter Blog, 2011). Twitter as a microblogging service allows users to set up profiles with a self description of 160 characters and select a group of individuals to 'follow'. When the user visits the site they can peruse through the 140 character updates, 'tweets,' that each of the users they follow has sent out. Users select those they follow, 'friends,' but they do not select those who follow them, 'followers.' The combination of 'followers' and 'friends' are considered the ties with whom a user communicates. These ties are the focus of this paper.

3. Understanding the geography of Twitter

Twitter, along with many of the ICT technologies that pre-date it, enables users to connect and communicate around mutual interests and needs rather than just spatial proximity (Civin, 2000; Zuckerman, 2008). Twitter users establish social ties "based on shared interests instead of shared place", especially for interests lacking a critical mass in material space (Hampton, 2004, p. 218). While this gives users the potential ability to bypass local constraints and connect to individuals in geographically distant spaces (Graham, 1998), it is doubtful that it renders geography meaningless in the constitution of social networks. This relation between online social network and the underlying 'real world' geography has been of interest to many geographers. For example, in a special issue of Cartography and Geographic Information Science on 'mapping cyberspace' (Tsou & Leitner, 2013) several authors explored this same relationship of new, digital data with 'real' world phenomena. Li, Goodchild, and Xu (2013) show that the digital data footprint is very much related to various variables derived from the US census. Kent and Capello (2013) show that, even with a small number of available tweets on a wildfire in Wyoming, careful handling of this data can result in useful, hyper-local, insights. Similarly, in their study of a Lexington, KY riot through Twitter data, Crampton and et al. (2013) show both the place-based nature as well as the scale-jumping that online social networks can exhibit.

Email networks are strong tie networks that increase social capital through a one-to-one relationship. Twitter-based relationships are less of a strong tie relationship, as the many-to-many structure of communication does not necessarily build social capital. Similar to email networks, Twitter does not require reciprocal ties. A user can follow a user without that user following them back. For example, a Twitter user may follow a public figure they admire and want updates from without ever meeting them. Unlike email, the effort required to establish a tie is much lower on Twitter (a matter of pushing a button), thus twitter networks contain several weak tie relationships.

Although requiring less effort to maintain, weak ties within a network can be more useful than strong ties. Granovetter (1973, 2005) suggests that weak ties provide 'bridges' to parts of a network that would otherwise not be connected. This provides new and novel information while strong ties only connect to well-known parts of the network (they are less likely to be a 'bridge') and thus often yield redundant information. Twitter networks are generally comprised of a combination of weak ties and strong ties. For a tie to develop between users, geographic proximity is not necessary per se. Although these connections may seem inconsequential, these weak ties generate a constant stream of information that can build social capital at both the local geographic level and within networks of interest at a variety of scales. Twitter as a social network gives us a unique opportunity to understand how people connect across space and build networks online.

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