

Relevance of Time Geography to Spatio-Temporal Constraints on Social Networks

SHIH-LUNG SHAW

Department of Geography
University of Tennessee, Knoxville

Email: sshaw@utk.edu

Hägerstrand's time geography examines human activities under various constraints in a space-time context (Hägerstrand, 1970). Space and time are connected through the concept of *space-time path* that tracks an individual's sequence of activities at different locations over time. The *space-time prism* concept, on the other hand, delimits a feasible spatio-temporal opportunity space that an individual could conduct his/her activities under capability, authority, and coupling constraints. Although time-geographic concepts were developed mainly for human activities in physical space, these concepts are relevant and applicable to human activities in virtual space enabled by information and communication technologies (ICT) such as the Internet and mobile phones. For example, people who do not have access to a smartphone face more capability constraints on social networking than those who have a smartphone with an unlimited data plan. Different social networks often have their own policies on user access, information sharing, among others. These are examples of authority constraints. Instant chats still require all parties involved be available online at the same time, which represent a coupling constraint. It is clear that time-geographic concepts have potential of helping us gain better understanding of spatio-temporal constraints on social networks. However, some classical time-geographic concepts need to be modified and extended to accommodate the changing nature and characteristics of human activities and interactions in virtual space. Among many possible directions of extending time-geographic concepts for studying spatio-temporal constraints on social networks, I would like to focus on the following challenges in this position paper:

- (a) **Interconnected Physical and Virtual Spaces:** Physical space and virtual space are not independent from each other. They interact and influence each other. For example, time zones around the world certainly place some constraints on online social networks as people still need to sleep. Although ubiquitous computing and communication have been discussed for years, we are not there yet (or may never be there due to considerations other than technology). Locations of information and communication infrastructure in physical space can influence where we can have access to activities in virtual space. On the other hand, interactions with other people via online social networks can shape our activities and schedules in physical space. Our understanding of these interactions between physical space and virtual space is rather limited. The constraint concept and a space-time context suggested in time geography can help us formulate a spatio-temporal framework for studying how human activities in physical space constrain their online social networking activities and vice versa.

- (b) **Use Time-Geographic Concepts to Analyze Individual Spatio-Temporal Constraints on Social Networking Activities:** Many social network sites (e.g., Facebook) offer information such as user names and date/time of postings. Such information could be used to build space-time paths of social networking activities and interactions. With recent progress in space-time GIS research based on time-geographic concepts, it is feasible to manage, analyze, and visualize individual activities and interactions in both physical and virtual spaces (Shaw et al. 2008, Shaw and Yu 2009, Yu and Shaw 2008). Online chats and postings among friends can be represented as virtual links among the space-time paths of involved parties. We can then visualize and analyze the spatio-temporal activity patterns of individuals as well as the spatio-temporal interaction patterns among individuals. Such studies could help shed light on the operation of spatio-temporal constraints and their effects on social networks at both individual and group levels. Alternatively, we could conduct surveys to collect data of both physical and virtual activities from individuals and then construct a space-time GIS database involving both physical and virtual activities. This would permit researchers to investigate mutual interactions (including spatio-temporal constraints) among online social networking activities, other virtual activities, and physical activities.
- (c) **Linkages between Virtual Locations and Physical Locations:** Hägerstrand (1970) discussed the concept of *bundle* within the context of coupling constraints. An individual forms a bundle with other individuals and/or entities when they need to be coupled together to perform a specific activity. This concept is directly applicable to social networks, except that they are bundled at a virtual location rather than at a physical location. This brings up an important consideration of linking virtual locations with physical locations since social networks are tied to both locations. For example, a message posted on Facebook may lead to a get-together among a group of friends at a physical place if their spatio-temporal constraints defined by Hägerstrand's space-time prism concept permit them to be at that location during a specific time period. Some important research questions include, for example, the definition and representation of virtual locations. We could argue that locations of nodes and links in a virtual network are not relevant according to a topological perspective. This is true if we only are interested in the connectivity and flows between different nodes on social networks. However, when we chat with a friend who is 1,000 miles away, we are unlikely to suggest "let's meet at a nearby Starbuck store an hour from now." It therefore is important to consider the research needs of analyzing topological relationships on a meta-network versus research needs of understanding spatial-temporal constraints at the individual and small group levels that time geography could make valuable contributions.

References:

- Hägerstrand, T. 1970. What about people in regional science? *Papers of the Regional Science Association*, 24(1): 6–21.

- Shaw, S-L. and Yu, H. 2009. A GIS-based time-geographic approach of studying individual activities and interactions in a hybrid physical-virtual space. *Journal of Transport Geography*, 17(2): 141–149.
- Shaw, S-L., Yu, H. and Bombom, L. 2008. A space-time GIS approach to exploring large individual-based spatiotemporal datasets, *Transactions in GIS*, 12(4), 425–441.
- Yu H and Shaw S-L. 2008, Exploring potential human interactions in physical and virtual spaces: A spatiotemporal GIS approach. *International Journal of Geographical Information Science*, 22(4): 409–430.