Bringing 19th Century documents into the 21st century via social network analysis

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Abstract

The social networks of U.S. Ministers in Korea from 1883 to 1905 were explored, and NodeXL was used to analyze official despatches. The findings evince a particular social structure that facilitated the burgeoning of Protestant missions, expansionism, and U.S. diplomacy in Korea at the turn of the 20th century. Though the author is aware of Horace N. Allen, the first American Protestant missionary to Korea as well as subsequent missionaries' impact on Korean Protestantism, the social network analysis in this paper was delimited by using historical documents from the three volumes of *Korean-American Relations*.

KEYWORDS: Social Networks, Social Network Analysis, Historical Sociology, Horace N. Allen, Korean Protestantism

Sociologists and Social Structure

Sociologists are fundamentally interested in connecting visible symptoms with "invisible forces." These "forces" refer to human interactions that are often hidden, taken-for-granted, and reified. For example, Marx noted that people made choices but not under conditions of their choosing. Whereas psychologists and micro-economists emphasize individual choices sociologists emphasize the conditions whereby (usually group) choices are made. Sociologists have thus used the phrase "social structure" or "structure" with respect to conditions. Wilson (2009, p. 4) posited that "*Social structure* refers to the way social positions, social roles, and networks of social relationships are arranged in our institutions, such as the economy, polity, education, and organization of the family." I contend that the creation of social structure entails the interplay of 1) the conditions of choosing, 2) individual agency, and 3) contingency or randomness. This paper explores how sociologists and social scientists may delineate social structure via social network analysis (SNA) via the official U.S. despatches from 1883 to 1905. Horace N. Allen, the first American Protestant missionary to Korea, is then placed within this analytical framework.

Networks and Relations not Groups and Categories

In 2005, the Committee on Network Science for Future Army Applications (a division of the National Research Council) stated in their publication, *Network Science* (2005, p. 11): "If there is

one word to describe society in the early 21st century, it surely must be 'connected.'" SNA is one way to explore how people are "connected." About forty years ago, White, Boorman, and Breiger (1976, p. 730) stated that "during the past decade, the network metaphor has become increasingly popular with social scientists." However, the authors claimed that "all sociologists' discourse" employed categorical descriptions such as "group," "status," and "society" (they have noted some counter-examples). These terms depicted aggregates of people rather than actual interactions; this distinction was similar to the one between additive matrix models and intersectional approaches (Collins, 1999). Therefore, many sociologists have continued to speak of "social structure" via individual and group categories such as race, sex, income, or education without accounting for relationships. Over five decades ago, James Coleman (1959, p. 28) noted that "survey research methods have often led to the neglect of social structure and of the relations among individuals." Marin and Wellman (2011, p. 13) wrote:

> Individuals indisputably possess particular attributes. To study the effects of attributes such as race, gender or education… researchers sort individuals based on their attributes and determine which outcomes are disproportionately common to individuals with particular attributes. This endeavor treats causation as something that comes from within individuals, with common attributes acting independently on individuals to produce similar outcomes. By contrast, social network analysts argue that causation is not located in the individual, but in the social structure.

SNA is an attempt to delineate a particular social structure (Wellman, 1983, p. 157):

> Network analysts… concentrate on studying how the pattern of ties in a network provides significant opportunities and constraints because it affects the access of people and institutions to such resources as information, wealth, and power. Thus network analysts treat social systems as networks of dependency relationships resulting from the differential possession of scarce resources at the nodes and the structured allocation of these resources at the ties.

Since Allen was the first American Protestant resident missionary in Korea, his tenure provides a good example regarding the creation of a social structure. Given the substantial amount of socio-historic literature regarding the emphasis on spiritual or social forces (cf. Kim 2013, pp. 1-2) regarding the inception of Protestantism in Korea at dawn of the 20th century, this paper emphasizes SNA.

The "Newness" of SNA: Sociology and Physics?

On a cultural level social networks became popularized with the use of media such as Facebook and Twitter. As an academic subject, those with backgrounds in mathematics and physics have increased the popularity of SNA (Carrington & Scott, 2011). Some have argued that SNA research became "highly visible" at the turn of the 21st century (*Network Science*, 2005, p. 14). Accordingly, Urry (2004, p. 111, emphasis mine) noted that a "manifesto for a *new social physics*"

emerged in the field of SNA. Watts (2003, p. 13) stated that "a new science" depicts "the *science of networks*" because "unlike the physics of subatomic particles or the large-scale structure of the universe, the science of networks is the science of the real world."

I list some of the more popular SNA authors who have backgrounds in mathematics or physics: Duncan J. Watts, *Small Worlds: The Dynamics of Networks between Order and Randomness* (1999) and *Six Degrees: The Science of a Connected Age* (2003); Albert-Laslo Barabasi, *Linked: The New Science of Networks* (2002); and, Mark Buchanan, *Nexus: Small Worlds and the Groundbreaking Science of Networks* (2002) and *The Social Atom* (2007). As stated in *Network Science* (2005, p. 14), "the two most cited papers on complex networks have been cited more than 1,500 times, according to Google Scholar (Watts & Strogatz, 1998; Barabasi & Albert, 1999)." Watts and Barabasi were also on the committee that published *Network Science*. SNA has also become popularized via: health professionals, Nicholas Christakis and James Fowler, *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives* (2009) and Thomas Valente, *Social Networks and Health* (2010) and journalists Malcolm Gladwell, *The Tipping Point: How Little Things can make a Big Difference* (2002) and Steven Johnson, *Emergence: The Connective Lives of Ants, Brains, Cities, and Software* (2002).

Where are the Sociologists?

Regarding the "new" popularity of SNA one may ask, what about Granovetter's study on weak ties, Merton's "Matthew Effect," or Simmel's work on dyads and triads? Consider Parsons' (2005 [1951], p. 15) definition of a social system:

> A system of processes of interaction between actors, it is the structure of the *relations* between the actors as involved in the interactive process which is essentially the structure of the social system. The system is a network of such relationships.

In fact, Simmel (1950: 10) claimed that the interactions of individuals ("sociation") were like the "interactions among the atoms of society." Just as some sociologists have emphasized the "me" (socialized self) over the "I" (unsocialized self) Simmel was interested in the social process of interactions. Accordingly, Simmel (1950, p. 11) claimed: "Society certainly is not a 'substance,' nothing concrete, but an *event*: it is the function of receiving and effecting the fate and development of one individual by the other." There is no question that Simmel's work on dyads and triads was a precursor for SNA (as were Leonhard Euler and Paul Erdos' work regarding graph theory). However, although Simmel evinced "mathematical logic" he lacked the "mathematical form" (Marin & Wellman, 2011, p. 15). Those who first conceptualized SNA lacked the requisite computer technology to make further advances. Though computer technology has closed the gap between sociologists and physicists regarding SNA, Cederman (2005, p. 865) claimed that the "theoretical foundations are still relatively poorly understood and many theoretical possibilities remain unexplored by computational scholars."

John Scott is one of the most vocal sociologists to critique the "new social physics." He has taken exceptional offense to Buchanan's comments in *Nexus* (2002, p. 19): "For the first time in history, scientists are beginning to learn how to talk meaningfully about the architecture of networks of all kinds, and to perceive important patterns and regularities where they could see none before." Scott (2011, p. 55) claimed that certain physicists such as Buchanan "know little or nothing of sociological work that preceded them, and they present themselves as initiating a scientific revolution in sociological analysis." About one hundred and fifty years ago, Comte (1868, p. 44) claimed that "all observable phenomena" must begin with "the most general or simple" and progress to greater levels of complexity. Comte differentiated the study of humans via ontology and social interactions, or, "Physiology" and "Social Physics." Even social anthropologist S. F. Nadel (1958, pp. 129 and 16) made a comparison between "physics" and "networks" and "social relationships."

Scott (2011, p. 61) argued that sociologists who conducted SNA research were discounted for "not being 'real' scientists [and] cannot be expected to know how to study the social world scientifically." Further, the current SNA nexus between sociologists and physicists appears to be inchoate (Urry, 2004). One of the debates regarding SNA was if it was a method or a theory and thus if it had any predictive powers (via probabilities or inferences). Over half a century ago, Nadel believed that the state of network studies were mired in qualitative descriptions and could not be employed as a "model" because there was no predictive element (Nadel 1958, pp. 151 and 155). Further, because network analysis could not account for time order, this "descriptor" tended to create a "blind" spot (Nadel, 1958, p. 127). For Nadel, what made network analysis "really information" was its potential to account for some type of time order (Nadel, 1958, p. 154). In 1954, Raymond Firth (1954, p. 5) claimed that network diagrams were "static" and this contributed to the "uncertainty of its [SNA] application." Marin and Wellman (2011, p. 22) stated: "Unlike a theory, social network analysis provides a way of looking at a problem, but it does not predict what we will see." Paradoxically, it was reported in *Network Science* (2005, pp. 28 and 33) that network science entailed "predictive models of the phenomena" throughout various disciplines and that there was no standard definition regarding "network science."

Possible New Frontiers: Historical Documents and SNA

If SNA is "new" regarding the interaction between sociologists and mathematicians and physicists, the field is even "newer" with respect to historical documents. Stark and Bainbridge's (1980, p. 1392) rationale exemplified the initial state of historical sociology and religion: "In this paper we have attempted to use a variety of data to make firmer the evidential base for the thesis that social networks play an essential role in [impacting social structure]." The authors made qualitative connections but lacked a) linking all of the nodes via b) primary documents and c) using any type of SNA software. In their defense, however, there were relatively few scholarly works that employed SNA and historical sociology (Clark, 1992 & 2000; Padgett & Ansell 1993). I

am not aware of any SNA research that analyzed primary sources, included *all* of the actors and links (within the set of papers or manuscripts), and employed SNA measures and respective software. Rather than including "all" of the nodes (actors), certain researchers picked and chose which nodes to include in their studies. For example, one heavily-cited scholar (about 200 citations with respect to articles, book chapters, and a major manuscript) is Elizabeth Clark. In addition to her selective sampling there exists a perennial gap between ideas and computer technology. This gap precluded Clark's innovative ideas from going beyond a few sociograms and very rudimentary SNA density measures (1992, p. 39 and 2000, pp. 98-109). (For current definitions and calculations of "network density" cf. Valente (2010, p. 129), Prell (2012, p. 167), and Kadushin (2013, p. 29).) In 2000, Clark's article was published in *Semeia* which devoted the entire issue to the intersection of social networks and historical theology. In fact, the particular issue (56) was titled, "Social Networks in Early Christian Environment: Issues and Methods for Social History." However, as basic as Clark's employment of SNA was her research was the most "sophisticated" among all of the articles. Some recent socio-historic works may be partial exceptions: Berg 2005, Schor (2007 & 2010), and Doosselaere (2009).

Bringing 19th Century Documents into the 21st Century via Social Network Analysis

Horace N. Allen was the first American Protestant missionary to Korea. Almost immediately after his transfer from China to Korea in 1884, Allen began a transition from missions to politics. Kim (2013) provided a detailed analysis based on the Allen MSS and other primary documents concerning how Allen filled structural holes (Burt 2004) and employed social capital (Coleman, 1988; Portes, 1988; Small, 2009) for personal and national advancements with respect to Korea, Hawaii, and the U.S. For this paper, I used (a redacted set of) official U.S. despatches between 1883 and 1905 and NodeXL (http://nodexl.codeplex.com). In 1951, 1963, and 1989, the official correspondences between "the U.S. diplomatic representatives in Korea and the State Department from 1883 until 1905" (Burnett, 1989, p. ix) were published in three respective volumes: *Korean-American Relations: Documents Pertaining to the Far Eastern Diplomacy of the United States, Volume I, The Initial Period, 1883-1886*; *Korean-American Relations: Documents Pertaining to the Far Eastern Diplomacy of the United States, Volume II, The Period of Growing Influence, 1887-1895*; and *Korean-American Relations: Documents Pertaining to the Far Eastern Diplomacy of the United States, Volume III, The Period of Diminishing Influence, 1896-1905*. Two sets of data were analyzed by creating in- and out-degrees for 1) individual names and 2) official titles. Both data sets entailed a total of 672 edges (ties) and were used to compute directed sociograms and SNA metrics.

The editors of the three volumes redacted redundant material within each official letter and regarding entire despatches. The complete despatches and other official communication concerning the U.S., Korea, and Hawaii can be found at The National Archives at Atlanta,

Georgia. Due to various constraints, this paper analyzed all of the entries that were published in the three volumes of the *Korean-American Relations*. Thus, the "complete network" was not without editorial redaction (bias).

Findings

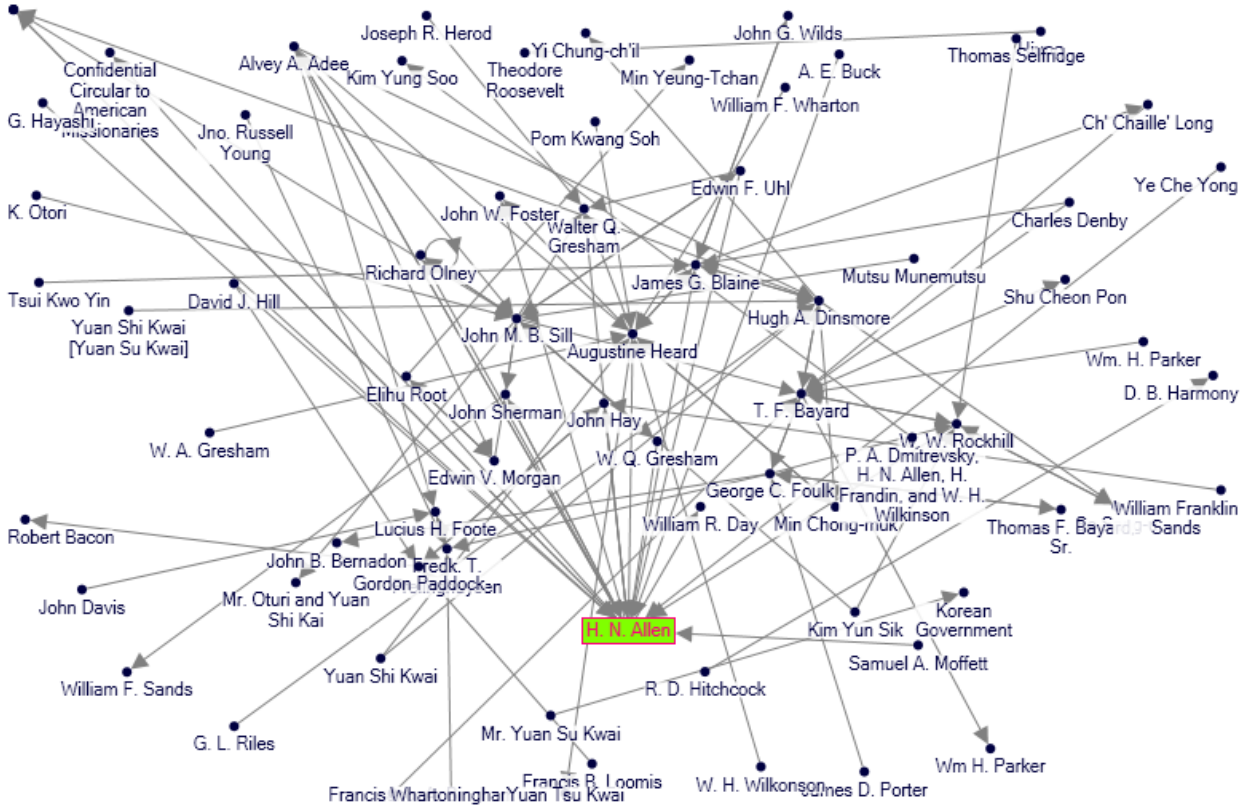
In a prior paper regarding Allen's nexus between the U.S., Korea, and Hawaii, Kim (2013, p. 1) argued:

> To date, only two scholars (historians) have attempted to research thoroughly the Horace N. Allen Manuscripts (MSS) regarding the first American resident missionary in Korea. This paper makes an important contribution because to my knowledge no study has perused the entire Allen MSS and woven a single theme that connects Allen's actions in both Korea and Hawaii. Research on the development of Protestantism in Korea can be generally separated via religious and non-religious factors. In this paper, I emphasize how socio-historic contexts, expansionism, and various missionary activities allowed Allen to fill structural holes and employ social capital for personal and national advancements. I argue that Allen's social connections facilitated America's missionary and expansionistic endeavors in Korea and Hawaii at the turn of the 20th century.

The ability of U.S. Ministers and particular actors such as Allen to fill structural holes and employ social capital can (now) be tested by using NodeXL and the official despatches from *Korean-American Relations, Volumes I-III*. Two sociograms (by Names and Titles) have been provided to help visualize the structural locations of Allen and other actors.

Korean-American Relations: *Documents Pertaining to the Far Eastern Diplomacy of the United States, Volumes I-III*

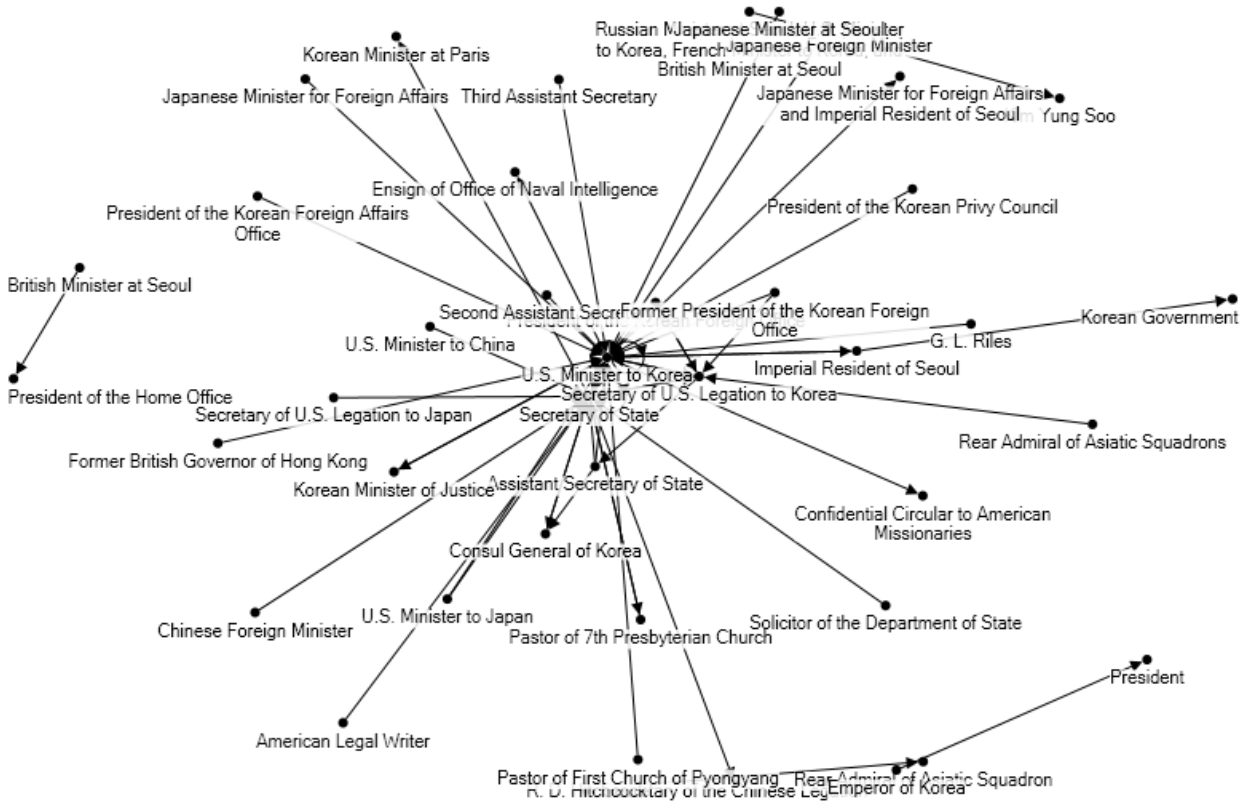
Names



Had only the Allen MSS been analyzed, it should be expected that Allen would have the highest SNA metrics regarding his importance to fill structural holes. This is because an "ego network" would have been created whereby Allen would have been the center (Allen kept letters that *he* wrote and received). Accordingly, it should also be expected that ties between particular officials (their structural positions) would have evinced the greatest SNA scores regarding an analysis of *Korean-American Relations*. However, the importance of the position does not guarantee that the person (Allen) would have the highest scores. NodeXL is able to substantiate the importance of a particular social location within a given structure.

Korean-American Relations: *Documents Pertaining to the Far Eastern Diplomacy of the United States, Volumes I-III*

Titles



Burt (2005, p. 4) proposed that a person's structural location created "advantages" if he or she was able to connect other actors. Further, the ability to connect structural holes fostered "social capital." According to Valente (2010, p. 93): "Degree, closeness, and betweenness constitute the three main centrality measures, but at least seven other centrality measures have been developed, including eigenvector centrality (Bonacich, 1972; Seary & Richards, 2003), entropy (Tutzauer, 2007), information (Stephenson & Zellen, 1989), flow (Freeman et al., 1991), power (Bonacich, 1987), and complement (Cornwell, 2005)." I draw attention to the three major centrality measures of degree, closeness, and between-ness.

First, perhaps the simplest way to ascertain centrality is degree centrality which counts the in- and out-degrees. That is, how many ties does a node have? A greater number of ties would imply that the particular actor (location in the network) had a greater level of being connected, and thus influence in the network. Prell (2012, p. 99) stated: "Indegree centrality is often used as a measure for *prestige* or *popularity* and outdegree centrality as a measure of *expansiveness*."

Degree Centrality (Maximum Scores)

Graph Metric	Names	Titles
Maximum In-Degree	12	19
Average In-Degree	1.52	1.317
Maximum Out-Degree	11	9
Average Out-Degree	1.52	1.317

Allen's in- and out-degrees were 12 and 11, respectively (for detailed NodeXL output cf. the Appendix). Thus, based on Names, Allen had the highest number of ties in the directed network. Further, based on Titles, the U.S. Minister to Korea had scores of 19 and 9, for in- and out-degrees, respectively. As Allen held this position from 1887 to 1905, based on degree centrality, Allen appeared to have connected structural holes more than any other person in this particular network. Unfortunately, the degrees are presented as non-redundant ties and thus may not account for the frequency or intensity of the ties.

Second, closeness centrality measures the shortest distances between nodes. Because there were no significant differences in these measures, either by Names or Titles, I will merely note that the network was "close" since the scores are relatively low. Third, SNA can measure if an actor filled a structural hole by measuring betweenness centrality (Freeman, 1979; Valente 2010, p. 87; Prell, 2012, p. 12; Neal, 2013, p. 78). Valente stated: "Betweenness centrality captures the notion that a person with strategic contacts… inhabits a strategic position in the network even if his or her volume of contacts is not large." For example, if a person was removed from the network, would his or her absence create a structural hole? The greater the betweenness centrality score the greater importance the actor (via Name or Title) has in connecting the other nodes within the network.

Betweenness Centrality (Maximum Scores)

Graph Metric	Names	Titles
Maximum Betweenness Centrality	2038.91 (Allen)	780 (U.S. Minister)
Average Betweenness Centrality	139.04	34.488

Allen had the greatest scores in Betweenness Centrality by Name (2038.91) and Title (U.S. Minister, 780). A final measure to be discussed is Eigenvector Centrality, which "measures the centrality of a node based in part on the centrality of its neighboring nodes" (Valente, 2010, p. 93, Valente & Prell, 212, p. 102 claimed that Eigenvector Centrality uses "symmetric data").

Eigenvector Centrality (Maximum Scores)

Graph Metric	Names	Titles
Maximum Eigenvector Centrality	0.088 (Allen)	0.142 (U.S. Minister)
Average Eigenvector Centrality	0.013	0.024

Unsurprisingly, Allen by Name and Title had the maximum Eigenvector Centrality scores. Therefore, based on the NodeXL analysis, Allen was strategically located within his network. Based on various measures he did connect structural holes and possessed high levels of social capital. However, SNA is not a methodological panacea. As noted, it can be descriptive and lack "predictive" powers. And like any other type of quantitative data, without theory it may be difficult to differentiate meaningful signal(s) from the noise. Given the (potential) usefulness of SNA, there is much room for further research.

Future Research

This paper was based on data from the *Korean-American Relations*. Perhaps the simplest extension of this SNA study would be to incorporate other primary sources (nodes) such as the Allen MSS (again, accounting for an ego network). Further, various persons in the Allen MSS also have primary sources that have been archived, such as government officials in Korea, the U.S., and Hawaii, subsequent Western missionaries that arrived after Allen, and those engaged in business ventures (most notably the Hawaiian Sugar Planters' Association). Accordingly, more nodes could be mapped via business, political, and missionary clusters and thus expand the social structure. However, creating sociograms and ascertaining various metrics may not solve the problem of creating static analyses and thus counter the actual intent of SNA, which is an attempts to account for actual relationships (rather than recognizing and or conflating groups and categories with structure).

Dynamic SNA

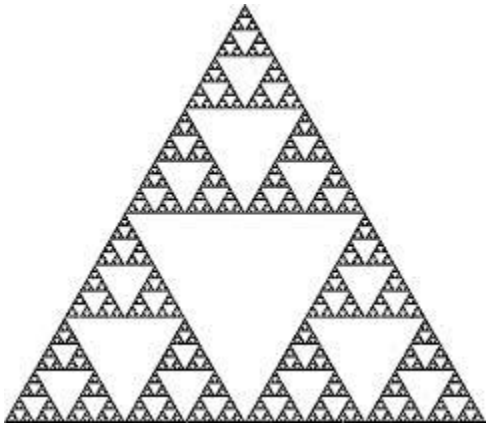
One of the critiques of SNA is that it merely describes the social locations of actors without providing any explanation of how the structure emerged. Thirty years ago, Wellman (1983, p. 179) claimed that "network analysts have not yet produced a general theory." While debates continue whether SNA is a theory or method, a new(er) strand of SNA has emerged, dynamic SNA (DSNA). If SNA provides a snapshot then DSNA provides a video clip. DSNA attempts to account for some type of time order (Scott, 2013, p. 139). It is one thing to say that actors are connected and it is another matter to account for when actors became connected and how they developed their social structure; location matters and so does timing. According to Hanneman and Riddle (2011, p. 339): "Increasing attention is being given to the dynamics of networks, with particular attention to understanding how the embedding of actors in a particular place in a network at one time may effect change in their attributes or behavior and how the attributes and behaviors of actors at one point in time may shape the pattern of ties that are built and dissolved over time."

In light of the potential benefits of DSNA, I concur with *Network Science* (2005, p. 7): "The differences between static and dynamic networks are, however, not clearly understood, and our understanding of dynamic network effects is primitive." I received an email (and subsequent

permission to quote) from Zak Neal, the author of *The Connected City*, on March 27th, 2013: "Dynamic network analysis is still relatively new, within the last 5 years or so. So the methods for it are not entirely worked out, and at this stage are primarily the domain of mathematicians and computer scientists." The NodeXL manual (2011, p. 84) stated that "the Dynamic Filters feature allows you to remove vertices and edges from the graph pane in real time using sliders that represent attribute or metric data." Unfortunately, I was not able to figure out how to re-enact "real time." Theoretically, since I have coded all of the in- and out-degrees with dates, a diachronic SNA is possible; real-time sociograms could be visualized based on time order.

However, integrating time order creates a fundamental challenge by intersecting structure, agency, and *contingency*. I wonder if (D)SNA is limited due to social structure's inherent nature of emergence (relationships are dynamic not static). Per Bak (1996, p. 8), one who helped coin the phrase "self-organized criticality" noted: "in the soft sciences, where contingency is pervasive, detailed long-term prediction becomes impossible." The authors of *Network Science* (2005, p. 30) posited: "The central point is that the behavior of a network is determined both by the pathways (structure) and by the exchanges and interactions (dynamics). Moreover, the structure itself may be (and usually is) dynamic." For example, there are "phase transitions" in physical systems, "chemical reactions" in biology and chemistry, and "people" as nodes in sociology. Therefore, DSNA calculations must try to account for contingencies. A particular hurdle will be if SNA can move beyond a way of describing social phenomena and incorporate a mechanism to test hypotheses (Hanneman & Riddle, 2011, p. 336). However, by including a time element, "prediction" may be just as problematic as it is in other feedback systems that entail fractals, chaos, cellular automata, bifurcation points and path dependency, and self-organized criticality.

Nonetheless, there are still some possible explorations regarding DSNA. If a time order could be implemented, DSNA iterations may be able to show repetitive patterns. I wonder if given certain parameters, whether models of structure, agency, and contingency can be used with respect to probabilities and inferences. For example, there are at least three ways to create a Sierpinski Triangle; begin with an equilateral triangle and remove the center(s), the classic exercise of beginning with an equilateral triangle and rolling a die and marking the midpoint based on assigned vertices, or via cellular automata Rule 90 (Wolfram, 2002, p. 25). Any of these rules with will produce the Sierpinski Triangle (see picture). The obvious problematic is that an outcome like the Sierpinski Triangle can be made by at least three different rules. And a "simple" well-known bifurcation diagram that entails $f(x) = rx(1-x)$, $0<x<1$ and $0<r<4$, with enough iterations, will produce a fixed point, bifurcation points, or a chaotic region. Therefore, given an iterated outcome one does not know the exact pre-conditions. And, given the exact preconditions, one may not know the exact outcome(s).



Nonetheless, some pertinent questions should be explored in future studies. If DSNA could integrate a time element, could ratios of change be ascertained much like Feigenbaum's constant (4.669) regarding period doubling? With respect to Merton's "Matthew Effect," would DSNA also evince power laws (as noted by Pareto, Zipf, and Mandelbrot in their respective studies)? Does human behavior evince punctuated equilibrium (Eldredge, 1985), thus bringing some coherence to the three pillars of sociology and religion, Marx (religion as conflict), Weber (religion as change and social closure), and Durkheim (religion as cohesion)? Perhaps this paper does not create a methodological wormhole regarding 19th century documents and 21st century sociology. Nonetheless, I hope this paper does challenge sociologists, particularly those who study religion, to see the potential usefulness of (D)SNA.

Appendix
NodeXL Measures (Names)[1]

Vertex (Names)	In-Degree	Out-Degree	Between-ness Centrality	Closeness Centrality	Eigenvector Centrality	PageRank	Clustering Coefficient
H. N. Allen	12	11	2038.910	0.007	0.088	6.281	0.018
T. F. Bayard	8	5	902.067	0.006	0.030	3.477	0.011
Alvey A. Adee	1	6	860.429	0.007	0.044	1.947	0.033
Augustine Heard	9	5	830.6	0.006	0.057	4.063	0.038
John M. B. Sill	9	7	821.914	0.006	0.050	3.919	0.008
Hugh A. Dinsmore	6	6	736.890	0.006	0.032	3.451	0
W. W. Rockhill	5	3	695.986	0.006	0.029	2.043	0.067
George C. Foulk	3	5	568.886	0.005	0.012	2.308	0.067
James G. Blaine	6	4	515.490	0.006	0.038	2.384	0.024
John Hay	3	2	313	0.005	0.017	1.211	0
Lucius H. Foote	3	1	311.114	0.005	0.009	1.198	0
Fredk. T. Frelinghuysen	4	1	292	0.004	0.004	1.677	0
Edwin V. Morgan	2	2	266.4	0.005	0.013	1.121	0
John Sherman	3	3	264.812	0.006	0.028	1.408	0
Gordon Paddock	3	2	260	0.004	0.007	1.698	0
Walter Q. Gresham	5	0	215.071	0.006	0.042	1.641	0.0
David J. Hill	0	2	183	0.005	0.017	0.792	0
Elihu Root	1	2	130	0.004	0.002	0.932	0
Min Chong-muk	2	1	28.233	0.005	0.016	0.731	0
Yuan Shi Kwai	0	2	28.23	0.005	0.016	0.731	0
Ch' Chaille' Long	1	1	27.738	0.005	0.012	0.735	0
Charles Denby	0	2	27.738	0.005	0.012	0.735	0
Edwin F. Uhl	1	3	27.083	0.005	0.032	0.988	0.333
Richard Olney	3	2	27.083	0.005	0.03	0.989	0
W. Q. Gresham	1	2	27.083	0.005	0.025	0.709	0
So Sang-u	2	1	15.738	0.005	0.011	0.733	0
Kim Yun Sik	0	2	12.5	0.005	0.014	0.717	0

[1] 3 names and 33 titles with a centrality score of "0" were removed.

NodeXL Measures (Titles)

Vertex (Title)	In-Degree	Out-Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality	PageRank	Clustering Coefficient
U.S. Minister to Korea	19	9	780	0.023	0.142	8.531	0.019
Secretary of State	12	7	466	0.019	0.094	5.283	0.038
Secretary of U.S. Legation	5	4	85	0.017	0.064	2.161	0.233
Imperial Resident of Seoul	1	2	62	0.014	0.025	0.950	0.667
Assistant Secretary of State	1	3	21	0.016	0.056	1.436	0.667

Edge Weight and Reciprocated Relationships (Names)

Vertex 1	Vertex 2	Edge Weight	Reciprocated?
H. N. Allen	John Hay	199	Y
George C. Foulk	T. F. Bayard	36	Y
H. N. Allen	John Sherman	30	Y
Hugh A. Dinsmore	T. F. Bayard	26	Y
John M. B. Sill	Walter Q. Gresham	25	N
Lucius H. Foote	Fredk. T. Frelinghuysen	21	Y
Augustine Heard	James G. Blaine	21	Y
John M. B. Sill	Richard Olney	21	Y
H. N. Allen	Walter Q. Gresham	20	N
H. N. Allen	Richard Olney	15	N
Augustine Heard	Walter Q. Gresham	14	N
Edwin V. Morgan	Elihu Root	13	Y
W. W. Rockhill	T. F. Bayard	12	Y
Hugh A. Dinsmore	James G. Blaine	11	Y
Fredk. T. Frelinghuysen	Lucius H. Foote	9	Y
Richard Olney	John M. B. Sill	8	Y
John M. B. Sill	John Sherman	8	Y
Hugh A. Dinsmore	Cho Pyong-sik	7	N
John Hay	H. N. Allen	7	Y
Augustine Heard	John W. Foster	7	N
H. N. Allen	William R. Day	7	N
T. F. Bayard	Hugh A. Dinsmore	6	Y
Alvey A. Adee	H. N. Allen	5	Y
H. N. Allen	James G. Blaine	5	N
James G. Blaine	Augustine Heard	4	Y

William F. Wharton	Augustine Heard	4	N
T. F. Bayard	George C. Foulk	4	Y
James G. Blaine	Hugh A. Dinsmore	4	Y
W. W. Rockhill	So Sang-u	4	Y
So Sang-u	W. W. Rockhill	4	Y
11 Names		3	
9 Names		2	
36 Names		1	

Edge Weight and Reciprocated Relationships (Titles)

Vertex 1	**Vertex 2**	**Edge Weight**	**Reciprocated?**
U.S. Minister to Korea	Secretary of State	493	Y
Secretary of State	U.S. Minister to Korea	55	Y
Secretary of U.S. Legation to Korea	Secretary of State	16	Y
U.S. Minister to Korea	President of the Korean Foreign Office	14	Y
Second Assistant Secretary	U.S. Minister to Korea	11	N
Assistant Secretary of State	U.S. Minister to Korea	10	N
U.S. Minister to China	Secretary of State	4	N
Former President of the Korean Foreign Office	Secretary of U.S. Legation to Korea	4	N
Secretary of U.S. Legation to Korea	President of the Korean Foreign Office	4	Y
Assistant Secretary of State	Consul General of Korea	4	N
5 Titles		3	
3 Titles		2	
1 Title		36	

Three Key Positions between the U.S. and Korea (1883-1905)

U.S. Minister in Korea	**Secretary of State**	**U.S. President**
Lucius H. Foote (5/13/83-6/12/86)	Frederick T. Frelinghuysen (12/19/81-3/6/85)	Chester A. Arthur (9/19/81-3/4/85)
William H. Parker (6/12/86-9/1/86)	Thomas F. Bayard (3/7/85-3/6/89)	Grover Cleveland (3/4/93-3/4/97)
Hugh A. Dinsmore (4/1/87-5/26/90)	James G. Blaine (3/7/89-6/4/92)	
Augustine Heard (5/26/90-7/1/93)	John W. Foster (6/29/92-2/23/93)	William McKinley (3/4/97-9/14/1901)
John M. B. Sill (4/30/94-7/17/97)	Walter Q. Gresham (3/6/93-5/28/95)	Theodore Roosevelt (9/14/01-3/4/09)

Horace N. Allen (7/17/87-6/8/1905)	Richard Olney (6/10/95-3/5/97)	
Edwin V. Morgan (6/26/05-11/24/05)	John Sherman (3/6/97-4/27/98)	
	William R. Day (4/28/98-9/16/98)	
	John Hay (9/30//98-7/1/1905)	
	Elihu Root (7/7/1905-1/27/1909)	

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