

## Database Submission

## The Evolving Social Network of Marketing Scholars

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The interest in social networks among marketing scholars and practitioners has sharply increased in the last decade. One social network of which network scholars increasingly recognize the unique value is the academic collaboration (coauthor) network.

We offer a comprehensive database of the collaboration network among marketing scholars over the last 40 years (available at <http://mktsci.pubs.informs.org>). Based on the ProQuest database, it documents the social collaboration among researchers in dozens of the leading marketing journals, enabling us to create networks of active marketing researchers. Unlike most of the published academic collaboration research, our database is dynamic and follows the evolution of the field over many years.

In this paper, we describe the database and point to some basic network descriptives that lead to interesting research questions. We believe this database can be of much value to researchers interested in the evolution of social networks over time, as well as the specific evolution of the marketing discipline.

*Key words:* social network; scientific collaboration; egocentric networks; scientometrics

*History:* Received: July 11, 2008; accepted: September 11, 2009; processed by Arvind Rangaswamy. Published online in *Articles in Advance* December 2, 2009.

## Introduction

Social networks are increasingly attracting the attention of marketing scholars and practitioners (Van den Bulte and Wuyts 2007). In the past four years, it has been identified by the members of the Marketing Science Institute (MSI) as the highest-priority research topic in marketing. Research in this area often examines the way various levels of personal networks aggregate to construct a social system. To analyze how networks form a certain social system, one must be able to document social contacts within the system, preferably from its inception. Such data are often hard to construct in large social systems, and so much of social network analysis has been conducted on relatively small networks, and most of them cover relatively short time frames, usually after the network is already formed and has become stable.

To examine larger networks, researchers have begun to take advantage of academic publication

databases, where the social network of collaboration among scientists is documented in detail. Indeed, recent advances in social network analysis have used the networks of academic collaborations in areas such as mathematics (Grossman and Ion 1995); biology, physics, and computer science (Newman 2001); neuroscience (Barabási et al. 2002); and economics (Goyal et al. 2006). An additional advantage of these inquiries is that they allow a better understanding of the mechanisms that drive the development and structure of the specific academic disciplines (Moody 2004). These attempts suffer, however, from a shortcoming: the documented networks are “snapshots” of a network rather than a fully documented evolution. One reason is that the networks used are built with data in established fields (e.g., biology, mathematics): the size and the fact that electronic documentation began only recently made it difficult to construct a dynamic picture of the network from its inception.

To address this issue, we hereby publicize the database composed in the context of the Marketing Connectivity Project (<http://www.complexmarkets.com/connectivity-data.html>). This database documents scientific collaboration in marketing from the time the modern marketing social network began to 2008. Based on the ProQuest database, the database documents the social collaboration among researchers in dozens of leading marketing journals, enabling us to create networks of active marketing researchers. Even though collaboration network analysis has been undertaken in other disciplines, our database is novel for several reasons. First, unlike most of the published academic collaboration research, our analysis is dynamic and follows the evolution of the field over many years. Therefore, one can make inferences regarding the evolution of a social system from a relatively small number of players to the more than 22,000 connected players at the end of 2008. Second, our data provide more richness in the descriptors of both links between authors and author “demographics.” Third, our database offers the first collaboration network data in the marketing discipline and thus allows novel descriptions of the evolution of marketing science compared with other sciences, which allows rich scientometric analyses of the marketing discipline. Such data were unavailable and are not trivial to replicate (as conceded in the limitations of Stremersch et al. 2007, who used a publicly available snapshot of our data).

We believe that this database offers unique research opportunities. It allows researchers of social networks to examine various questions that so far, because of a lack of data, remain unanswered. Befitting the increased attention within marketing for scientometric investigations (Grinstein et al. 2010, Maciejovsky et al. 2009, Pieters et al. 1999, Sawyer et al. 2008, Seggie and Griffith 2009, Stremersch et al. 2007, Stremersch and Verhoef 2005, Tellis et al. 1999), present and aspiring marketing scholars can use it to study the growth of our discipline, by either studying the growth of the network itself or by relating it to other concepts, such as productivity, diversity, innovativeness, or impact.

## The Data

This section first briefly presents the network definitions and characteristics, then the data collection procedures of the Marketing Connectivity Project, and then turns to the database structure and the choices made when constructing the database. Networks consist of nodes (typically people in case of social networks) and links (typically social ties). In scientific collaboration networks, nodes are defined by authors and links are defined by their joint papers. We count

for each year how many papers each pair of authors published together and the journal(s) in which they are published. This count defines a “temperature” of the collaboration link, and the tie strength of each pair is measured by the cumulative number of published papers. By defining a link as coauthorship, it is assumed that this kind of activity consists of interactions, communication, and knowledge sharing. The source for the database is the intersection of the ProQuest ABI/INFORM database, a large-scale business literature computerized database, and the Theoharakis and Hirst (2002) list of the top 40 marketing-related journals. We considered the top 40 journals out of the total of 55 journals that were the basis of the survey. Out of these 40 journals, five did not appear in ProQuest or appeared in a way that could not be used, and they were therefore deleted from our list. Our final list therefore contains the 35 journals listed in Table 1 (in parentheses: date of journal inception; date of first inclusion in ProQuest).

The dynamic nature of this database is evident when one considers the fact that although the current list applies to 35 journals, by the mid-1960s, only two marketing journals—the *Journal of Marketing* and the *Journal of Marketing Research*—were recorded in ProQuest. The rapid increase in the number of marketing journals covered by ProQuest follows the increasing penetration of this database and the increasing number of academic journals for marketing research. It is also consistent with the sharply increasing number of scholars with the years. This phenomenon may be one of the appealing aspects of our database because it allows the study of large dynamic networks. For each published study in the database, the following details are retrieved: the authors’ particulars, the journal, and the year of publication. Based on this database, and consistent with common practice in network analysis, we constructed a large matrix wherein each researcher is a node. The matrix records which nodes are connected through collaboration on a paper. Thus, the user has access to separate databases for the years 1973–2008.

To provide more information about the authors, we constructed two (linked) data sets: Authors Database and Links Database.

Authors Database includes author (with his or her ID number), average separation, cumulative number of papers, cumulative number of journals he or she published in, first year of publication, and last year of publication.

Links Database includes two authors (with their ID numbers), cumulative number of joint papers, and list of journals in which they published their joint papers.

These databases are provided on an annual basis that allows for exploring the dynamics of and changes in the network. The representation of the links database is suited for large networks

**Table 1** Included Journals (Year of Inception; Year of Inclusion in ProQuest)

1. <i>California Management Review</i> (1959; 1969)	19. <i>Journal of Marketing</i> (1936; 1939)
2. <i>Decision Science</i> (1970; 1972)	20. <i>Journal of Marketing Research</i> (1964; 1964)
3. <i>European Journal of Marketing</i> (1967; 1975)	21. <i>Journal of Personality and Social Psychology</i> (1965; 1986)
4. <i>Harvard Business Review</i> (1922; 1971)	22. <i>Journal of Personal Selling and Sales Management</i> (1980; 1983)
5. <i>Industrial Marketing Management</i> (1971; 1972)	23. <i>Journal of Product Innovation Management</i> (1984; 1984)
6. <i>International Journal of Advertising</i> (1982; 1982)	24. <i>Journal of Public Policy and Marketing</i> (1982; 1982)
7. <i>International Journal of Research in Marketing</i> (1984; 1985)	25. <i>Journal of Retailing</i> (1925; 1971)
8. <i>International Marketing Review</i> (1984; 1986)	26. <i>Journal of Services Marketing</i> (1986; 1987)
9. <i>Journal of Advertising</i> (1972; 1972)	27. <i>Journal of Service Research</i> (1998; 2000)
10. <i>Journal of Advertising Research</i> (1961; 1971)	28. <i>Journal of the Academy of Marketing Science</i> (1973; 1973)
11. <i>Journal of Business</i> (1928; 1973)	29. <i>Management Science</i> (1955; 1971)
12. <i>Journal of Business Research</i> (1973; 1974)	30. <i>Marketing Letters</i> (1989; 1989)
13. <i>Journal of Consumer Marketing</i> (1983; 1983)	31. <i>Marketing Science</i> (1982; 1984)
14. <i>Journal of Consumer Research</i> (1974; 1974)	32. <i>Organizational Behavior &amp; Human Decision Processes</i> (1966; 1971)
15. <i>Journal of Economic Psychology</i> (1981; 1984)	33. <i>Psychology and Marketing</i> (1984; 1992)
16. <i>Journal of International Business Studies</i> (1970; 1970)	34. <i>Sloan Management Review</i> (1959; 1970)
17. <i>Journal of International Marketing</i> (1993; 2000)	35. <i>Strategic Management Journal</i> (1980; 1980)
18. <i>Journal of Market-Focused Management</i> (1996; 1999)	

and is compatible with common network software packages such as the widely used UCinet and Pajek, a free software package that can be downloaded at <http://vlado.fmf.uni-lj.si/pub/networks/pajek/>. When constructing the database, we made several choices of which its prospective users should be aware. First, we chose a certain list of journals that are considered a good representation of the marketing domain (Theoharakis and Hirst 2002), but other scholars may feel some journals were omitted. Second, we applied an automatic algorithm to detect cases in which authors' names may be misspelled (a well-known issue in scientometrics), combining it with a manual inspection. In the database, each author is assigned a unique ID number in addition to the name to help users with easier identification. However, despite our procedures, we cannot guarantee that some authors do not appear twice under small variations.

Third, the articles covered start from 1964. Being a relatively young discipline, only a few marketing journals have a long history. An example is the *Journal of Marketing*, which is covered in ProQuest and has been published since the late 1930s. One should note that most journals' coverage starts with the early 1970s, for some as a result of ProQuest coverage issues. Therefore, the yearly databases we provide start from 1973. At the time, the modern marketing network was still very small and could still be considered in its infancy stage.

## Description of Network Over Time and Across Disciplines

To trigger future research ideas that other scholars can test using this public database, we provide some basic descriptives of the network of marketing scholars over time and compared with other disciplines.

We first derive core network measures by which one can describe the network.

### Network Measures

Visually, a network is a graph composed of nodes with two types of links between them: direct and indirect (Monge and Contractor 2003). The total number of links for a certain node is labeled the *degree* of that node. The *shortest distance* (also known as *degree of separation*) between two nodes reflects the number of nodes needed to get from one node to the other via the shortest path (usually termed the *geodesic path*). Therefore, a node's network represents the distribution of the degree of separation of this node from the rest of the network. As a preliminary examination of the data by potential users and as a general coherence demonstration, we describe the marketing collaboration network through three basic concepts: the largest component, separation, and the clustering coefficient. Our description relates to the time period up to the end of 2008 and to the main component of the network.

In network databases, few different *components* are frequently identified. A component is a cluster (sub-network) of nodes that are linked amongst themselves but are not linked outside to other nodes. Scientific social network researchers have traditionally focused on the largest component (usually termed the *main component*), which is typically larger by at least one order of magnitude compared with the second-largest component. A common measure of interest is the *ratio of the largest component to the entire network*, or the number of scholars in the largest group of nodes that are connected to each other to the total number of scholars in the network.

We discern average separation and expected average separation. The relevant measure for average separation  $l$  represents the mean shortest separation

between the  $n$  node pairs in the network (“geodesic separation”; see Newman 2003):

$$l = \frac{1}{\frac{1}{2}n(n-1)} \sum_{i \geq j} d_{ij}, \quad (1)$$

where  $d_{ij}$  is the shortest separation between nodes  $i$  and  $j$ .

It is generally proposed that in random networks,  $l$  scales logarithmically compared to the network size  $n$ , and the value may be comparable also in social networks that are not random. It is suggested that the *expected average separation* should be about  $l \approx \ln(n)/\ln(k)$ , where  $k$  is the average degree (number of coauthors in our case) of the network (Watts 1999).

The third basic concept relates to the phenomenon of *clustering* or *transitivity*, a known element of social networks that distinguishes them from random graphs (Newman 2003). Clustering means that if Anne is directly connected to Bart, and Bart is directly connected to Chak, then there is a heightened probability that Anne is also directly connected to Chak. In a random graph, the clustering coefficient  $C$  should be in the range  $C \sim k/n$  (Watts 1999). One of the ways to represent clustering on the network level is to measure the network-level *cluster coefficient*  $C$ , which can be defined as

$$C = \frac{3 \times \text{number of triangles in the network}}{\text{number of connected triple nodes}}, \quad (2)$$

where a connected triple node indicates any node connected to a pair of other nodes.  $C$  is the mean probability that two nodes that are in a direct link to a third node are in a direct link themselves. Note that other measures of the cluster coefficient are also possible (Newman 2003).

### Comparing Collaboration Networks Across Disciplines

Table 2 compares the collaboration network of marketing scholars at the end of 2008 to the collaboration network of scholars in three other disciplines: biomedicine, physics, and mathematics (adapted from Newman 2004). Two points should be considered here. First, for two of the three other disciplines, the period covered is very short (five years), and the sample was constructed at very mature stages of the network. Second, the reference list in Table 1 includes some journals in which interdisciplinary research is published (e.g., the *Journal of Business Research*). Some of the researchers in these outlets are nonmarketing academics and therefore not connected to the marketing main component. In our comparison, we therefore concentrate on the main component of each network. Table 2 shows that the marketing discipline is much smaller than the other three, with a smaller average

number of coauthors (except in comparison to mathematics). Out of the 32,381 researchers in the 2008 social network, the largest component includes 22,278 researchers. The group that was left out, comprising 10,103 researchers, is highly fragmented. The largest component in this group includes just 32 individuals. The ratio of the largest component to the entire network in marketing (69%) is lower compared to the other disciplines, possibly reflecting the existence of more “out-of-the consensus” researchers.

Similarly to mathematics, average separation in the marketing discipline (7.5) is considerably higher than in biomedicine and physics. However, for all networks, the average separation is very low compared to network size. How much can the average separation say about the level of connectivity in the network? Following the above, one should take into account the network size and the average degree in the network as well. For example, the biomedicine network is very large, with over 1.5 million authors, yet the average number of coauthors is considerably larger than that of the other disciplines. Comparing the expected average separation with the average separation shows that in biomedicine and physics, the two are not that far apart. Considering the short timespan (which implies closer relations), these disciplines’ shorter separation compared to marketing may not say much regarding connectivity. However, in mathematics, where the time span is large, the average separation is lower compared to the expected one. Collaboration among mathematicians, it seems, creates a more coherent network compared to that of marketers.

Finally, we can also see from Table 2 that the clustering coefficient is higher for marketing than for the other disciplines (50%), meaning that a larger proportion of the coauthors of a marketing researcher collaborate among themselves as well. Thus, if a researcher has collaborated with two other researchers, in about half of the cases the two researchers have also collaborated independently. This also helps to partially explain the stark difference in the average number

**Table 2** Core Network Concepts: Marketing vs. Three Other Disciplines

	Biomedicine	Physics	Mathematics	Marketing
Years covered	1995–1999	1995–1999	1940–2000	1964–2008
Average number of coauthors	18.1	9.7	3.9	4.3
No. of authors in largest component	1,520,251	52,909	253,339	22,278
Ratio of largest component to complete network (%)	92	85	82	69
Average separation	4.6	5.9	7.6	7.5
Expected average separation	4.9	6.1	9.1	6.9
Clustering coefficient (%)	6.6	43	15	50

of coauthors between biomedicine and marketing: on average, not only do researchers in biomedicine collaborate with more coauthors and write more papers, but with this small clustering coefficient, they write these papers with different individuals.

### The Collaboration Network of Marketing Scholars Over Time

As already noted, the strength of this database is that it covers the evolution of the network from its very first stages to 2008. Here, we provide simple descriptive figures to help potential users get familiar with the database and to allow for some quick, yet interesting, observations. Figure 1 shows the evolution of the collaboration network over time for two focal concepts: (1) the growth of the main component over time as a percentage of the main component size in 2008, and (2) average separation. The numbers that are presented are from the years 1979–2008 because the size of the main component before that was very small and may not be a good indication of the network parameters that we examine. The line labeled “main component” presents the size of the main component through time as a percentage of the size in 2008. We see that the size of the main component grows in a nearly linear trend from the early 1990s. Our data also show a consistent growth in the percentage of the main component out of all researchers in our database, from about 23% in 1979 to about 69% in 2008. Thus, the collaboration network in marketing seems to show increasing marketing research coherence with time. An interesting result regards the declining average separation, also shown in Figure 1. This finding may be surprising given the increasing size of the system, because network models generally predict that average separation should increase

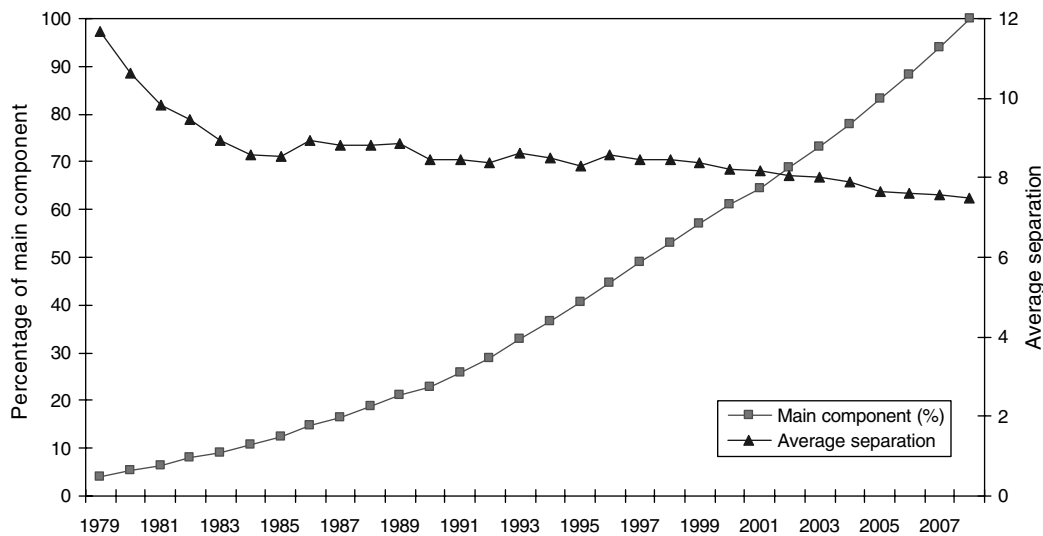
with network size (Bollobas 1985). In this case, in 2008, network size is more than 25 times that of 1979, yet average separation declined more than 35%. This intriguing phenomenon, which may be related to the changing collaborating patterns over time, is yet to be explored.

### Research Opportunities

The database we have configured provides researchers with three kinds of opportunities: (1) social network research, (2) scientometric analysis of the marketing discipline, and (3) study of marketing journals. In social network research, this database allows a unique observation of how a network evolves over time, from its early inception to maturity. Therefore, we believe this database to be of significant value to scholars in marketing, sociology, economics, and physics to understand network growth. Examples include (1) social hub formation and its influence on network structure or outcomes (see, for example, Goldenberg et al. 2009); (2) mechanisms of network growth, such as preferential attachment or alternative mechanisms (see, for example, Stephen and Toubia 2009); and (3) the role of tie strength and “temperature of the tie” (see, for example, Barabási and Albert 1999).

In the scientometric study of marketing science, social network characteristics can be associated with outcomes for individuals as well as the entire network. Outcomes that scholars may consider studying are (1) citations, e.g., to test Merton’s (1968) argument that the scientific impact of scholars depends on their network position; and (2) the magnitude of scientific breakthroughs. An equally interesting endeavor would be to study antecedents of scientific collaboration. Why do some scholars become

Figure 1 Main Component and Average Separation Over Time



popular coauthors to many others, whereas other scholars remain isolated? Finally, from a descriptive perspective, scholars may also examine whether research practices differ across research areas within marketing.

A third area of research is the study of marketing journals and their respective positions, possibly extending earlier work by Pieters et al. (1999), Pieters and Baumgartner (2002), Stremersch and Verhoef (2005), and Tellis et al. (1999). As we provide information on which journals connect scholars, one can infer which journals serve as bridges between otherwise disconnected scholars. One can connect network descriptors of journals to journal outcomes, such as a journal's standing (credibility as measured in surveys, e.g., Theoharakis and Hirst 2002), journal submission statistics, a journal's Institute for Scientific Information (ISI) impact factor, or the extent to which a journal has a global reach (Stremersch and Verhoef 2005).

### Limitations of Data

There are some limitations to the data we provide. First, we cannot claim that our data contain the inception of the marketing scholar network. Although our data start very early, marketing scholars did already publish in the *Journal of Marketing*, and much of marketing science was published in journals that we now consider outside of our field, such as operations research, psychology, and economics outlets. Second, even today, marketing scholars collaborate outside of marketing journals. Thus, the results one finds based on our data are bound to the journals we included.

ProQuest, although undoubtedly a leading database for articles published in marketing journals, like other databases receives data from multiple sources and in multiple formats. Small changes in names or other information can lead to misclassification. We have aimed to correct such problems where noticeable, yet given the magnitude of the database, it is certainly not perfect. Although the picture of the formation of the marketing network is robust to infrequent misclassifications, scholars should be cautious of this potential misclassification when one uses the database for an individual-level analysis, where each article may be of significant importance. Our database only covers the respective journals as of the time at which they were covered by ProQuest, in the way they are covered by ProQuest (any omission or misclassification by ProQuest will also be an omission or misclassification in our database) at the time of construction of our database, and on which papers multiple authors collaborated (single-authored papers are excluded because they do not connect two nodes). For these reasons, readers are cautioned not to use this database as a source of individual-level analysis outside scholars' network position, such as for academic promotions.

In addition, some of the future research we suggest may require additional data. Two particular research issues come to mind. A first issue is the relation between authors' network position and their impact, as measured by citations. There are two main sources for citation data, namely, ISI and Google Scholar. ISI's citation data cannot be easily manipulated by scholars, because it includes only cites in other peer-reviewed journals. Access to ISI's citation data is easy through Web of Science, and one can also buy such data from bibliometric institutes with a subscription to ISI (e.g., Centrum voor Wetenschap en Technologie Studies at Leiden University, The Netherlands; cf. Stremersch et al. 2007). The main disadvantages of ISI's citation data are that they are biased towards English language outlets; they only contain the full name and first initials of the author, thus leading to potential errors; and they are proprietary to ISI (which is the main reason we did not include citations in our database). Google Scholar data are publicly available, contain full author names—leading to less measurement error across authors with the same last name and initials compared with ISI—but can easily be manipulated by scholars because they contain citations from any source, published in a peer-reviewed journal, a book, or even a student's thesis or any working paper. For Google Scholar, we have included a query tool in our database submission that already contains all names in our network database, which one can activate by pressing the command button, after which the query tool retrieves the total citation count across each author's 100 most impactful papers. Google Scholar typically allows retrievals of the total number of citations of around 500 scholars before it blocks access (date checked: November 27, 2008) as a protection against hackers. Therefore, researchers that want to use this tool should make multiple queries spread out over time or bound their inquiry to a certain subset of the network.

Additional data will also be needed to examine the reason why a scholar is a popular coauthor. To answer this research question, one needs to inventory information beyond a scholar's impact and network position, such as their school affiliation, education history, and editorial board positions, probably through their bios. Despite these limitations of the data we offer, we hope it provides a starting point for fruitful inquiries in this exciting field.

### Acknowledgments

The authors acknowledge the research assistance of Karni Marcus, Boaz Chen, Albert Kimyagarov, Arik Veeder, and Laura Wijnhold. They especially thank Arik Veeder of Netwise for invaluable conceptual and computational assistance. They also thank the Erasmus Research Institute for

Management, the Israeli National Science Foundation, and the K-Mart and Davidson Foundations at the Hebrew University for their financial support.

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The data set described in this paper is maintained by the authors and available through <http://mktsci.pubs.informs.org>.