

# Rotarians in transcolonial networks in early twentieth-century Shanghai

## *Les Rotariens dans les réseaux transcoloniaux à Shanghai dans la première moitié du XXe siècle*

**Abstract.** Taking the Shanghai Rotary Club as a case study and tapping historical newspapers as a valuable source for drawing relational data, this paper proposes a multimodal approach to persons in networks, in which persons are conceptualized as club members and treated alternatively as nodes and edges. Relying on three sample periods (1919-20, 1930-1, 1938-9), we first analyze two-mode networks of meeting attendance (persons-events joined by roles) in order to identify core persons and events. We then supplement this bimodal analysis by a dual projection method, which consists in projecting the initial two-mode network into two one-mode networks, and jointly analyzing the resulting projections. Our analysis of co-attendance (persons-to-persons joined by events) allows us to identify three main personal profiles (leaders, brokers, outsiders) and to locate them within clustered networks (2). In the networks of multiple attendance (events-events joined by persons), we turn to persons as links between social events (3). We pinpoint meetings that have participants in common and try to clarify the underlying principles of participant sharing. In the last projection (roles-roles by persons) (4), we eventually reveal structural combinations of roles, but also alterations that reflect early experiments or wartime disruption. Further research is needed to develop a fully longitudinal approach and to improve the extraction and detection of positional roles within networks.

**Keywords:** club membership; dual projection; meeting attendance; person; role; social event; two-mode network; weighted network.

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## Introduction

This paper is part of a larger investigation on the transformation of elite sociability in early twentieth-century China.<sup>1</sup> It is situated in a specifically transcolonial setting - from 1842 to 1943, Shanghai was a treaty-port with a large foreign community and two foreign settlements under French and British-American administration - during a transitional period characterized by political and social instability (abolition of the imperial regime replaced by a Republic in 1911, warlords, Sino-Japanese war in 1937-45, civil war in 1945-9). The Rotary club is an American-born elite club aimed at cultivating friendship and fellowship among businessmen and professionals in modern cities. The first club was founded in Chicago in 1905. The movement spread rapidly and eventually turned to a worldwide organization in the first half of the 20th century. The first club in China was established in Shanghai in July 1919. The Shanghai Rotary Club offers an ideal case to study the sociability of global elite in modern China. Despite its American origins, it was open to Chinese and other foreign nationals. It is fairly well documented in local newspapers (meeting reports), Rotary International Archives and personal papers (rosters of members) [Fig.1a, 1b, 2a, 2b].<sup>2</sup> The Shanghai Rotary Club hold regular meetings every week on Thursday at lunch time. These “tiffins” usually consisted in luncheons and lectures covering a wide range of topics (from business to science, education or international relations). Occasionally, the club also organized special events (farewell dinner, Christmas party, recreational outing). These meetings were widely advertised in the local press. Newspaper reports usually list the participants and the roles they performed (a minima). At best, some articles provide very detailed information on attendees’ behaviors. Since regular attendance to weekly meetings was a duty for every member, we focus on meeting attendance as a starting point for this research. We argue that club meetings offer the best site to identify club members and to observe concretely how they participated in club activities. Many Rotarians, however, did not appear in newspapers.<sup>3</sup> Missing members either did not attend or were just omitted in press reports. In both cases, their absence suggests weak membership. On the opposite, newspapers provide information on participants who were not members of the club, but occasional visitors, special guests or invited speakers. These persons offered the Rotary an entry point to the outside world.

In this paper, we propose a multimodal approach to persons in networks, in which persons are conceptualized as club members or meeting attendees. In this approach, persons are treated alternatively as nodes and edges. We pursue two main purposes. Substantially, how did participants behave during meetings? What roles did they perform? How did they (re)shape club rules and conventions? How did they interact with each other? How did roles and behaviors translate into positions in networks? Conversely, can we infer participants’ roles and status from their positions in networks? Did personal attributes (status, nationality, gender, profession) affect social behaviors locally (members’ positions) and the structure of the network globally (i.e. Rotary’s organization) over time? Methodologically, what can we learn from a multimodal approach to persons in networks? Can affiliation (two-mode) networks bring a new light on members’ status and personal behaviors in social life? What can we gain from, and what

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<sup>2</sup> In this research, we relied on the digital versions of English-language newspapers accessible on the database “ProQuest Historical Newspapers – Chinese newspaper collection”, which includes the *North-China Herald*, *China Weekly Review*, *China Press* (just to mention the most important). As for rosters, we relied in two editions issued in 1930 and 1940, which we found in Calder Papers (1911-1956), Hoover Institution Archives, Stanford, California.

<sup>3</sup> Only 36% of members listed in the roster issued in 1930 appeared in newspapers, and 44% in 1940.

are the challenges of applying Social Network Analysis (SNA) techniques to historical newspapers – a source that has remained neglected in the current SNA-driven historical scholarship to date?

Methodologically, we proceeded in several successive steps. We first constructed three sample datasets extracted at different points in time. Each sample covers a one-year period which corresponds to a presidential term selected for its historical and documentary significance. The first sample under Petit's presidency covers the first year of existence of the club (1919-20). It was a decisive period for setting rules and members' roles. The second sample (Fitch, 1930-1) marks a period of intense activity and a turning point in term of membership, with an increasing number of Chinese members joining the club after the establishment of the Nationalist regime in Nanjing (1927-1937). It is also the best documented period in both newspapers and rosters. The last term (Harkson, 1938-9) situates during the Sino-Japanese war (1937-1945). It is a critical juncture in the local history of the club and of Shanghai more generally, as many foreigners began to leave the city and Japanese membership became problematic. This sample will serve to address the issue of whether the war disrupted the life of the club and its members' roles. While newspapers reports became scant, we can rely on a richly detailed roster of members for this term. For each sample, we extracted the following information. From newspapers, we extracted the dates of meetings, participants' names and the roles they performed during meetings (used as basic information for identifying nodes and qualifying edges). We also coded the types of events (regular meetings, special events, outings, etc.) and topics of discussion (used as events attributes). From the rosters, we extracted additional information on members' status, nationality and social-professional occupations (used as persons' attributes). The following table summarizes the data available for each period [Table A].

	<b>Petit 1919-20</b>	<b>Fitch 1930-31</b>	<b>Harkson 1938-39</b>
<b>Persons</b>	<b>77</b>	<b>101</b>	<b>83</b>
Members	32	35	55
Non-members	45	66	28
Western	71	82	62
Chinese	5	13	21
Japanese	2	4	0
Other	0	2	0
Men	75	87	79
Women	2	14	4
<b>Events</b>	<b>27</b>	<b>38</b>	<b>35</b>
Regular	15	24	20
Founding	4	0	0
Closed	2	0	0
Special	3	6	6
Outing	3	2	4
Other	0	6	5

Table A. Original datasets. Distribution of persons, events and their main attributes in the three samples

Drawing on these data samples, we built four sets of networks. Starting from a bimodal network of meeting attendance (persons-events joined by roles), we first propose a direct method analysis aimed at

identifying the most important persons and events (nodes), and at examining the specific roles that participants performed during events (edges). The second step consists in projecting the initial two-mode network into two one-mode networks of persons-persons joined by events (co-attendance) and events-events joined by persons (multiple attendance). In order to supplement the bimodal approach, we offer a dual projection approach, which consists in jointly analyzing the two projections in order to offset the loss of data resulting from the projection (Borgatti 1997, 2013). In the second section, we examine co-attendance networks (2) in order to refine our analysis of personal profiles, to identify the most frequent co-attendees and sub-communities based on attendance. The next section focuses on the networks of multiple attendance in order to investigate how persons (participants) could serve as links between events (3). We eventually built a network of roles joined by persons to examine more closely how participants could perform multiple roles, to detect specific patterns of role combination and to how these patterns changed over time (4).<sup>4</sup>

## 1. Meeting attendance (two-mode networks of persons-events, or affiliation networks)

The first step consists in designing three bimodal networks, one for each term (Petit, Fitch, Harkson). In analyzing two-mode data, we typically make the assumption that attending the same event is either an indicator of an interaction between the attendees or a potential opportunity for one to develop (Borgatti, 2013: 246). In our two-mode networks, nodes refer to either persons or events. Edges represent the roles performed by participants during events (chair, speaker, guest, organizer, etc.). Nodes attributes specify the type of events (regular meeting, closed meeting, outing and other special events) and persons' status (members, non-members, officers, directors), gender and nationality (Western, Chinese, Japanese, other). For members only, we also specified the classification (business sector) to which they belonged, their affiliation (the organization they represented), their social-professional position (in Fitch and Harkson networks only) and the Rotary committees on which they served (Harkson's network only). The following graphs (built with Cytoscape) visualize the three networks, one for each time period [Fig.3a, b, c]. Square nodes (on the left) represent events, circle nodes (on the right) represent persons. The size and color of nodes are proportionate to their degree centrality.

### Global description

The following table compares the global measures for each network [Table B].

	Petit	Fitch	Harkson
Nodes	104	139	97
Edges	113	153	83
Connected components	14	9	27
Density	0.019	0.016	0.015
Centralization	0.169	0.153	0.091

Table B. Global measures in Petit's, Fitch's and Harkson's two-mode networks

<sup>4</sup> All the original files and figures mentioned in this paper are available on the research platform MADSpace (<https://madspace.org/>).

For a large part, these global measures reflect the uneven quantity and quality of information available in newspapers. Fitch's term is by far the best-documented period. In the early years (Petit's term), either we have fewer information, fewer persons were involved or fewer events were organized. The principle of regular weekly meetings was not perfectly established yet. The Rotary was still in the process of settling club rules and members' roles. The most recent network (Harkson) shows a less cohesive structure, mainly because it is built on more scattered data (27 connected components, compared to 9 in Fitch's and 14 in Petit's network). The three networks show a relatively low density - lower than what we could expect in a highly selective club like the Rotary. This is mainly due to the significant participation of outside visitors in club meetings. The density decreases over time. In Fitch's network, this reflects the highest number of outside visitors, whereas in Harkson's network, it reflects the growing scarcity of information. Yet overall, there is no a significant change in network density. The structure of the Rotary is rather stable over time. Network centralization also decreases over time, reflecting the declining position of the president at the end of the period. As President Harkson was on leave during most of his term, he is barely mentioned in newspaper reports. As a rule, the vice-president (Wolfe) served as the interim president, but he was far less central than previous presidents (especially Fitch, as we shall elaborate later – see 2).

### Degree distribution

In this section, we use node degree centrality to measure the importance of events and persons based on their position in the networks. Nodes with high degree correspond to either persons who participated in many events, or to events that gathered many participants (or those on which we have more information). We assume a correlation between degree centrality, on the one hand, and persons' status or type of events, on the other hand. We hypothesize that key members (president, vice-president, directors and other officers) show a high degree centrality, whereas ordinary members, occasional guests and outside visitors have a lower degree centrality. As for events, we hypothesize that regular meetings have a lower degree centrality than special events. The three networks show a long-tail degree distribution. The following charts compare the degree distribution in the three networks [Fig. 4a, b, c]. The table helps distinguish between events and persons [Table C].

	Petit	Fitch	Harkson
Events max degree	24	21	20
Events min degree	1	1	1
Persons max degree	11	23	4
Persons min degree	1	1	1

Table C. Degree distribution in Petit's, Fitch's and Harkson's two-mode networks

In Petit's network, degree distribution ranges from 1 to 24. Highest degrees (24) are associated to special events (farewell party 24, founding meeting 10), i.e. large events involving a lot of participants or events on which newspaper reports provide detailed information.

- Events degree. There is no direct correlation between the type of meeting and degree centrality. This mainly reflects variations in the quantity and quality of information available on each event. Organizing meetings, however, tend to gather more participants (or are better documented than regular meetings). One particular special event (farewell party 24) also attracted more participants than the average.
- Persons degree. Only one person has a degree greater than 10 (Petit, degree = 11), which reflects his position as president of the club. 7 persons have a degree between 3 and 4. All are Rotarians, Westerners and men. All non-members, Chinese and women have a degree below 3. There is a

“naturally” strong correlation between high degree (active participation in club activities), status (members are more active than non-members), nationality (Westerners are more active than Chinese), gender (men are more active than women). Rotarians with low degree (1) are charter members (who appear only once during the founding meeting) or honorary members (American consul). Officers (secretary, treasurer, and above all, the president) and directors show higher degree than ordinary members (over 3).

In Fitch’s network, degree distribution is very similar to Petit’s. It ranges from 1 to 23, which suggests stability over time. This global distribution, however, hides major changes in the allocation between events and persons, and a more hierarchical distribution among persons.

- Persons’ degree. The highest degree is associated to the president (Fitch) (23), which reflects the higher centralization around this prominent figure. The second most influential person shows a degree of 5 only (Honorary secretary Harris and US trade commissioner Williams – a non-member but prominent personality in Shanghai who frequently attended Rotary’s meetings). One person has a degree of 4 (non-member U.S. Commercial Attache Arnold, who shows a similar profile as Williams). Only two members has a degree of 3. The remaining individuals show a degree of 2 or 1. As in Petit’s network, persons with highest degrees (over 3) are usually Westerners and men. On the opposite, lowest degrees (1) are often associated to non-members, women and non-Westerners (Chinese or Japanese). But there are exceptions to this general rule: 23 Rotarians show a degree of 1. Most of them are ordinary members (except for honorary members and directors). Other exceptional cases include a Chinese non-member (Dr. Wu) with a degree of 2 (as a guest invited to attend two different events), a Chinese woman with a degree of 2 (Mrs. Kwok, married to a Rotarian, who served as an entertainer in two events), a Western woman invited as a speaker and organizer (an exceptional situation for a woman, given that women were usually confined to entertaining male Rotarians).
- Events degree. There is no clear correlation between event degree and type of event. Events with high or medium degrees (from 5 to 21) may be either special or regular meetings. Paradoxically, the highest degree event (21) is a regular meeting. This reflects the fact that regular meetings were better documented in the local press during this period. Conversely, newspapers could not list all participants in large special events.

In Harkson’s network, degree distribution ranges from 1 to 20. This apparently stable distribution again hides a major change in network structure. The most striking difference with previous networks is the absence of high-degree node-person (this is obvious if we use the “group-by-attribute layout” in Cytoscape). 4 is the highest degree associated to a node-person. This suggests the declining prominence of the president and the growing paucity of information on participants in general. In fact, during this period, newspapers merely mentioned the dates of meetings and the main speaker’s name, and provided few information on the other attendees. This is a major limitation in this longitudinal study.

- Event degree. Highest degrees refer to most important events (5 to 20). All are special events. Low degree points to regular meetings or other events (charity, war effort, inauguration of children’s hospital). For the first time, there is a strong correlation between degree centrality and the type of event. This mostly reflects the fact that special events are better documented in newspapers than ordinary meetings. This suggests that the practice of regular meetings is now a well-established rule and does not need to be reported in detail. But this may also reflect that in wartime, newspapers were more interested in reporting important - international, war-related - events rather than mundane events, except when such events were connected to war effort (fundraising campaigns in aid of war refugees).

- Persons degree. Degree distribution is more evenly distributed between persons (ranging from 1 to 4). The persons who show high degrees (2 to 4) are all men, Rotarians and Westerners (except for 5 Chinese with a degree of 2). Those with the highest degree (4) are officers (president and vice-president). Fifteen Rotarians display the lowest degree (1), most of them being Chinese or non-American.

What types of role connect the most important persons and events (degree > 10)? In Petit's network, chair and organizer serve as the most frequent links. In Fitch's network, this falls to a single role – chair – which is directly related to the president's pre-eminence. Second-rank events and persons (degree < 10) are connected by guests and speakers. In Harkson's network, largest events are connected by organizers and committee members. Events and persons with lower degrees are connected by a variety of roles. We will explore patterns of roles connections more fully in the last section (4).

To conclude this two-mode analysis, we observe that in the long run, person-nodes with high degrees are usually - but not always – key members (officers, especially the president, or directors). Fitch's personal character – his ubiquity and propensity to coordinate all actions in meetings - may account for the exceptional centrality of the President during his term. None of his predecessors (Petit) or successors (Harkson) can compare to his prestige. Symmetrically, event-nodes with high degrees are often - but not always - special events. Beyond a certain point, event size has a regressive effect on data availability. In this bimodal analysis, other measures (betweenness, clustering) and methods would not make sense or would be difficult to conduct. We are limited in terms of the analytical tools we can use in two-mode networks. In order to complement this preliminary exploration of attendance, we now propose a dual-projection approach. We projected the initial two-mode networks into two one-mode networks of persons-persons joined by events (co-attendance) and events-events joined by persons (multiple attendance), using the "tnet" R package (project\_tm function, Opsahl 2008). We alternatively used and compared two different methods of projection. The "sum" method gives the actual pattern of co-attendance (actual number of co-attended events), while Newman's method takes the relative importance of events into account, by discounting the largest events (that are the most likely to be attended) and most prominent persons (who are the most likely to attend events). In the following sections, we successively examine networks of co-attendance (2) and of multiple attendance (3).

## 2. Co-attendance (one-mode networks of persons-persons joined by events)

The first set of one-mode networks represents the relations between persons joined by events. In person-to-person networks, nodes represent persons and edges link persons who participate in the same events. Edges represent co-attendance but not necessarily direct interaction. A major limitation of one-mode projection is to create direct ties between persons without discriminating between mere co-presence and active interaction. Two persons may attend the same event without interacting directly. Yet they will be treated in the same way as two attendees engaged in active intercourse. Edge weight measures how frequently two persons co-participate in meetings. In the "sum" projection, 1 means they met only once, 2 that they attend twice the same meeting, 3 three times, and so on. In Newman's projection, it is more complex since the method aims to correct the negative effects of size variation – by discounting most important events that are more likely to be attended than smaller events, and key officers that are more likely to attend than less active members, occasional guests and visitors.

## Global description

The following table compares the global measures in the three networks [Table D].

	Petit	Fitch	Harkson
Nodes	71	95	39
Edges	319	517	124
Density	0.128	0.116	0.167
Connected components	8	2	4
Centralization	0.412	0.838	0.295
Clustering coefficient	0.755	0.928	0.847
Max node degree	37	88	17
Min node degree	1	2	1
Max edge weight (sum)	3	4	5
Min edge weight (sum)	1	1	1
Max edge weight (Newman)	1.056	1.083	1.0
Min edge weight (Newman)	0.056	0.05	0.111

Table D. Global measures in Petit's, Fitch's and Harkson's co-attendance networks

Petit's network includes 71 nodes and 319 edges. Fitch's network includes 95 nodes and 517 edges. Harkson's network includes 39 nodes and 124 edges. Tie weight ranges from 1 to 3 in Petit's network, from 1 to 4 in Fitch's network, and from 1 to 8 in Harkson's (using the "sum" method). As in two-mode networks, the varying number of nodes, edges and other global measures first reflects variations in the quantity of information available for each period. Fitch is the best-documented, Harkson is the poorest, and Petit stands in-between. Globally, the three networks show three distinct profiles. Fitch is the most centralized but also the most heterogeneous (density of 0.128). Harkson presents the opposite situation. It shows the most homogeneous structure (density of 0.167) with a medium number of connected components (4). Petit's network situates in-between in terms of centralization (0.412) and density (0.116). Fitch has the minimal number of connected components (2) and the maximal clustering coefficient (0.948). Petit shows the maximal number of connected components (8) and the minimal clustering coefficient (0.755). Harkson presents an intermediate situation with 4 connected components and a clustering coefficient of 0.847.

## Nodes centrality

Who are the most influential persons? As in our two-mode analysis, we use degree centrality to measure the importance of persons in co-attendance networks. The following charts compare the degree distribution in the three networks [Fig. 5a, 5b, 5c].

### Degree distribution (personal influence)

Petit's network displays a widespread degree distribution, ranging from 1 to 37. There is a strong correlation between maximal degree and status, yet with a significant exception for nodes with a degree of 18. 16 of 17 of them are non-members, all are men and Westerners except for one Chinese and one Japanese. Aside for them, lowest degrees are associated with non-members. The president and one director show the highest degrees of 37 and 26, respectively. Those with a degree between 5 and 18 are

all Rotarians, men and Westerners. Degree 4 includes Western non-members only. Lowest degrees (2) are usually associated with Western non-members, except for two Chinese and one Western Rotarians.

In Fitch's network, degree distribution is extremely skewed, ranging from 2 to 88. This converges with the globally high centralization. As in Petit's network, there is a strong correlation between degree and status. Except for one non-member, persons with a degree over 25 are all Rotarians, male and Westerners. The president shows the highest degree by far (88.). Below 25, the correlation is less obvious. Persons with a degree between 20 and 25 include almost as many non-members (8 of 18) as Rotarians (10 of 18). They are mostly Westerners, except for two Chinese and one Japanese. This group also includes a significant number of women (6 of 18). The next group of persons with a degree between 6 and 13 includes 16 members and 25 non-members, 33 Westerners and 8 Chinese, and only one woman. Lowest degrees (5 and below) are more systematically associated with non-members (only 4 Rotarians of a total of persons). This group also includes a significant number of non-Westerners (3 Chinese, 3 Japanese and 2 other nationals) and women (6 of 31).

Harkson's network presents the most balanced profile regarding degree distribution, ranging from 1 to 17. This confirms the global heterogeneity of the network and the declining centrality of the president we observed earlier in the corresponding two-mode network. Harkson's term displays the strongest correlation between status and degree. All persons with high degree (over 5) are Rotarians. Two in the top three are key officers (president and vice-president/interim president). The most striking difference with previous networks is that the president himself does not hold the highest degree. As explained earlier, Harkson was absent for some time and replaced by the vice-president (Wolfe). Lowest degrees (5 and below) are associated to non-members. Since the number of Chinese members has increased since 1930, we can no longer establish a clear correlation between degree and nationality. The group with highest degrees includes almost as many Chinese (8 of 19) as Westerners (11 of 19). There are no women reported in this network.

#### **Degree and betweenness (influence and intermediary)**

Degree centrality, however, is not sufficient to assess attendees' positions within the club. We propose to cross-examine degree with betweenness centrality in order to refine our classification of personal profiles. The following charts compare degree and betweenness distributions in the three networks [Fig. 6a, 6b, 6c].

In Petit's network, we observe a direct correlation between degree and betweenness. Those who have the highest number of neighbors also serve as brokers, except for the medium group of non-members with a degree of 18 who show a very low betweenness centrality. On the opposite, two Rotarians (one director and one charter member) who are not particularly influential (degree 12 and 16 respectively) show an exceptionally high betweenness centrality (0.67 and 0.4, respectively). In Fitch's network, there is no obvious correlation between degree and betweenness. Except for the president himself, who shows the highest betweenness centrality of 0.8, acting as the main hub in the network, no other person serves as broker in this network. This confirms the exclusive centralization around President Fitch during his term. Under Harkson's presidency, we again observe a strong (yet not perfect) correlation between degree and betweenness. Four persons act as intermediaries in this network, showing both a high degree centrality and high betweenness (including the vice-president Wolfe and the president Harkson). There are two minor exceptions to this general rule, however. The president ranked second in terms of intermediarity, but came only third in degree centrality. One ordinary Chinese member shows a moderate

degree of 8 but a fairly high betweenness of 0.29 (which contrasts to the null betweenness of other persons in the same class).

The three tables below summarize these observations. Combining degree and betweenness centrality, we design a three-class typology of persons: leaders, brokers and outsiders. Leaders show both high degree and high betweenness. Brokers combine low or medium degree and high betweenness. Outsiders have both a low degree and a low betweenness. The attached tables list the major representatives in each category for each network, with their most significant characteristics. We added a residual category (TBF) for persons with high degree but not particularly high betweenness, and more anecdotic cases that require closer analysis. For each case, we specified whether they acted as hubs, bridges or cutpoints between the clustered communities we detected in the next section (see below). The tables also compare their respective degree in one-mode and two-mode networks. [Tables E1, E2, E3]

id	name	2m_deg	1m_deg	1m_bt看w	deg_level	btw_level	type	status1	status2	gender	nationality	hub	
2	ASHLEY		3	13	0.26026936	MD	HB	Broker	Rotarian	Charter mem	M	Western	cutpoint
4	BAKER, E.O.		4	16	0.23142536	MD	MB	Broker	Rotarian	Secretary	M	Western	cutpoint
10	COPPOCK [Miss]		1	1	0	LD	LB	Outsider	Non-member	Non-member	F	Western	
11	CROW, Carl		1	8	0	LD	LB	Outsider	Rotarian	Charter mem	M	Western	
14	D'OLIVEIRA, J.R.		1	18		HD	LB	TBF	Non-member	Non-member	M	Western	
17	DODGE, V.A.		1	4	0	LD	LB	Outsider	NA	NA	M	Western	
20	DOREMUS, T.E.		2	18		HD	LB	TBF	Rotarian	Ordinary mer	M	Western	
54	PETIT, Julean [Dr.]		11	37	0.52727273	HD	HB	Leader	Rotarian	President	M	Western	hub
58	RAVEN, F.J.		2	9	0.00112233	LD	LB	Outsider	Rotarian	Director	M	Western	
61	SAMMONS, Thomas [H]		4	26	0.09652076	HD	MB	Broker	Rotarian	Director	M	Western	hub
65	SMITH, Frederick A.		1	4	0	LD	LB	Outsider	Non-member	Non-member	M	Western	
67	TCHENG, Yang		3	18	0	HD	LB	TBF	Non-member	Non-member	M	Chinese	bridge
69	TINKHAM, F.L.		1	4	0	LD	LB	Outsider	Non-member	Non-member	M	Western	
77	YAMASAKI, K.		1	18	0	HD	LB	TBF	Non-member	Non-member	M	Japanese	

Table E1. Personal profiles in Petit's network

id	name	2m_deg	1m_deg	1m_bt看w	deg_level	btw_level	type	status1	status2	gender	nationality	note	hub
1	ARNOLD, Julean		4	21	0.01435705	MD	MB	TBF	Non-member	Non-member	M	Western	hub
8	BOS, Carlo		2	20	0	MD	LB	TBF	Rotarian	Ordinary mer	M	Western	past president
20	CUNNINGHAM, E.S. 3		1	3	0	LD	LB	Outsider	Rotarian	Honorary me	M	Western	
26	DU PAC		2	31	0.0164794	HD	MB	TBF	Rotarian	Ordinary mer	M	Western	bridge
30	FITCH, G.A.		23	88	0.80362047	HD	HB	leader	Rotarian	President	M	Western	hub
32	FONG, Sec. [Dr.]		1	13	0	MD	LB	TBF	Rotarian	Honorary me	M	Chinese	future president
43	HAWKINGS, Gladys [Mrs]		2	21	0.00233042	MD	MB	broker	Non-member	Non-member	F	Western	hub
47	HOLCOMB, C.P.		1	4	0	LD	LB	Outsider	Rotarian	Ordinary mer	M	Western	
50	JEE, L.M.		1	5	0	LD	LB	Outsider	Rotarian	Ordinary mer	M	Chinese	
51	JENKINS, Douglas		2	31	0.0164794	HD	MB	TBF	Non-member	Non-member	M	Western	bridge
53	JINSUMRAM, F.		1	2	0	LD	LB	Outsider	Non-member	Non-member	M	Other	
57	KITASHUNA, W.		1	4	0	LD	LB	Outsider	Non-member	Non-member	M	Japanese	
60	KWOK, Elsie [Miss]		2	7	0.00062422	LD	LB	Outsider	Non-member	Non-member	F	Chinese	
61	KWOK [Mrs.]		1	3	0	LD	LB	Outsider	Non-member	Non-member	F	Chinese	
68	MILLINGTON, F.C.		2	9	0.04394507	LD	HB	broker	Rotarian	Ordinary mer	M	Western	
72	PHILLEO, G.W.		2	7	0.00062422	LD	LB	Outsider	Rotarian	Director	M	Western	

Table E2. Personal profiles in Fitch's network

id	name	2m_deg	1m_deg	1m_bt看w	deg_level	btw_level	type	status1	status2	gender	nationality	hub	join_year	hub	
4	BECK-FRIIS, Jc		1	8	0	MD	LB	TBF	Rotarian	Ordinary mer	M	Western	Program	1936	hub
5	BERGE, Finn		3	13	0.24630542	HD	HB	leader	Rotarian	Ordinary mer	M	Western	Fellowship	1936	cutpoint
11	CHENG, T.Y.		1	8	0	MD	LB	TBF	Rotarian	Additional n	M	Chinese	Attendance	1935	hub
14	FONG, Sec.		1	1	0	LD	LB	Outsider	Rotarian	Honorary	M	Chinese	NA	1922	
18	HARKSON, U.		4	11	0.4137931	HD	HB	leader	Rotarian	President	M	Western	Aims	1925	cutpoint
29	HUDSPETH, V		2	1	0	LD	LB	Outsider	Rotarian	Ordinary mer	M	Western	Program	1937	
30	JOHNSTONE,		1	8	0	MD	LB	TBF	Rotarian	Ordinary mer	M	Western	Finance	1935	hub
32	KWOK, K.T.		1	8	0	MD	LB	TBF	Rotarian	Ordinary mer	M	Chinese	NA	1930	hub
44	PETITT, C.W.		1	8	0	MD	LB	TBF	Rotarian	Ordinary mer	M	Western	Business ethi	1936	
49	SMITH, Horac		1	1	0	LD	LB	Outsider	Non-memb	Non-member	M	Western	IRR	IRR	
57	WOLFE, Samu		4	17	0.51231527	HD	HB	leader	Rotarian	Vice-presidi	M	Western	Program	1928	cutpoint

Table E3. Personal profiles in Harkson's network

### Dyads and edge weight (co-attendance frequency)

Who are the most frequent co-attendeers, i.e. the persons who are the most likely to attend club events together? Relying on edge weights, can we identify the most frequent dyads, i.e. pairs of co-participants? The first analysis of edge weight is based on the “sum” projection. Unsurprisingly, there is a reversely proportional relation between tie weight (number of events co-attended) and number of dyads (co-attending pairs) [Fig. 7a, 7b, 7c]. Those who met regularly are the least frequent. Conversely, pairs who met only once are the most frequent.

In Petit’s network, tie weight ranges from 1 to 3. A large majority of persons met only once (303 of 319 pairs). Fifteen pairs met twice and only one couple co-attended three events together. Unsurprisingly, co-attendance frequency is directly related to persons’ status and their central position in the club. The most frequent pair is President Petit-Director Sammons. Couples who co-attended two events involve key Rotarians only (officers, directors and charter members), except for one Chinese non-member invited twice as a special guest. All are male and Westerners. In Fitch’s network tie weight ranges from 1 to 4. As in Petit’s network, we observe a similar correlation between tie weight and pair frequency. 496 (of 517) pairs met only once, 16 met twice, 4 met three times and 3 dyads co-attended four events. The three most frequent pairs form a four-node clique including two key officers (president Fitch and secretary Harris) and two non-members but prominent personalities in Shanghai, who were frequently invited to attend Rotary meetings. Their co-attendance is directly related to their active participation in club activities. The second group of most frequent co-attendeers (three co-attended events) consists in two dyads with a mutual co-attendeer (President Fitch). Fitch met three times with a senior member (Wentworth) and an ordinary member (Peek), separately. As in Petit’s network, co-attendance frequency is strongly linked to attendees’ status, gender and nationality. The group of twice-co-attending pairs includes half members and half non-members, but only three Chinese and two women. Interestingly, the strongest ties usually unite mixed pairs in terms of gender and nationality. Only weak ties (weight of 1) link two Chinese or two women. Harkson’s network present a similar correlation between edge weight and dyad frequency. Edge weight ranges from 1 to 5. A large majority (80 of 124) met only once, 39 met twice and 5 co-attended five events. In other words, regular couples tend to meet more often in Harkson’s network than in Fitch and Petit’s networks. This suggests that the Rotary club became a smaller world in wartime. Fitch’s network presents the most complex pattern of co-attendance. At a global scale, it is a larger world than Petit’s, but it contains smaller worlds within (the 6 pairs than met four times).

If we now turn to Newman’s projection, we observe a more complex relation between tie weight and the number of co-attendeers. The weakest ties are still the most frequent and the strongest ties are the least frequent ones. But in-between, there is no linear relation between tie weight and the number of dyads. For instance, in Petit’s network, eight pairs have a tie weight of 1, nine have a weight of 0.5 but only one couple shows a tie weight of 0.365. There is no need to pursue the comparison further. We can just conclude that in the “sum” projection, pairs with the strongest ties often differ from those in Newman’s projection. In Petit’s network, for example, the most frequent couple (with a weight of 1.06) is not Petit-Sammons but Petit-Tcheng (a Chinese guest) because they co-attended two highly selective events (events that gathered only a limited number of persons, or events on which we have very few information). In Fitch’s network, the ranking is maintained only for the strongest pair (Fitch-Harris) but not for the next ones. The president is involved in all pairs with a tie weight over 0.5. In Harkson’s network, the most frequent pairs involve four persons who sharply differed from those observed in the sum projection. During this period, the president is involved in pairs with moderate tie weight only (0.6).

Up to this point, we have focused solely on co-attending dyads. In the next section, we propose to enlarge the scope of observation in order to identify larger communities based on members' co-attendance.

### Co-attendance communities

Can we identify particular clusters of co-attendeers? On what basis did they group together? Can we detect structural holes between communities and bridges connecting them? Who (which nodes) serve as bridges? How did these clustering patterns change over time? In order to detect communities within co-attendance networks, we use Newman's fast greedy algorithm. We chose this method because it works well for weighted networks (Newman 1997) and returned the highest modularity score (we obtain the same results as with Louvain algorithm but slightly better ones than other hierarchical clustering methods). The resulting clustered networks are visualized on Fig. 8a, 8b and 8c. The algorithm detected 11 communities in Petit's network, 6 in Fitch's network and 7 in Harkson's network. Drawing on this method, Petit's network is less homogeneous than Fitch and Harkson. The following tables summarize the results of community detection in each network, including the size of communities (number of members) and their global characterization.

No	Color	Size	Attributes
2	yellow	21	Core
4	fuchsia	17	Non-members
10	green	12	Charter
9	purple	6	Committee
11	grey	3	Non-members
1, 3, 5, 6, 7, 8		2	Non-members

Table F1. Communities in Petit's co-attendance network

Petit's network is clustered into two large communities (more than 15 members each), two medium groups (6 to 10 members) and seven small communities (only 2 or 3 members). The largest community (yellow) can be labeled as the "core" group, since it includes a majority of key members (directors, officers, charter members, committee members) (14 of 21). There are no ordinary members in this group, which is mixed in terms of membership status (it includes both key members and non-members) and nationality (3 Chinese). Community 4 (purple) is exclusively composed of non-members. It includes 1 Chinese and 1 Japanese (for 15 Westerners). Community 10 includes a large majority of (Western) charter members (only 2 non-members and 1 undermined). Community 9 includes a majority of committee members (only 1 ordinary member), only men and Westerners. Isolated dyads or tryads involve mostly non-members (or undetermined) and Westerners (except for one Chinese, but Chinese were underrepresented at the time). The core cluster (2-yellow) is connected to all other clusters (except for isolates), i.e. clusters 4 (by two nodes 54 - President Petit - and node 61 - Director Sammons), 9 (by node 4 only) and 10 (by 2 nodes 4 - Secretary Baker - and 54 -President Petit). Two clusters (4 and 10) are connected to the core cluster 2 only. All nodes in cluster 4 (non-members) are connected to both 61 (Director Sammons) and 54 (President Petit) in cluster 2, except for node 67 (Chinese guest Tcheng) which is connected to 61 (Director Sammons) only. The charter cluster (10) is connected to the core cluster by nodes 2, 17, 65 and 69 (1 charter member is connected to the secretary and 3 non-members are connected to the president). All nodes in the committee cluster (9, purple) are connected to the core cluster through secretary Baker. The seven remaining clusters (six dyads and one triangle) are isolated from the rest of the network. To sum up, there are three major hubs in Petit's network (node 54 joining cluster 2, 4 and 10, node 4 joining

cluster 2, 9, 10, node 61 joining 2 and 4), among which two cutpoints (node 4 connecting cluster 2 and 9 and node 2 (Baker) connecting cluster 10 and 2).

No	Color	Size	Attributes
1	red	37	Presidential
3	green	17	Japanese
4	fuchsia	16	Women
6	kaki	12	Chinese
5	turquoise	9	Non-members
2	yellow	4	Gender-mixed

Table F2. Communities in Fitch's co-attendance network

In Fitch's network, the largest cluster (red) includes a majority of non-members (24 of 37). Except for the president, the secretary and one director, most Rotarians in this group are ordinary members. This community includes a majority of men (3 women only) and Westerners (31 of 37), except for 4 Chinese and 2 other nationals. Community 3 involves mostly non-members (except for 2 ordinary Rotarians). It is exclusively male but rather heterogenous in terms of nationality (3 Japanese, 1 Chinese). Community 4 includes almost as many non-members (7) as members (9), most of them being ordinary members (except for the treasurer, one director and a senior member). All non-members are women. This group includes a large majority of Westerners (except for one Chinese and one Japanese). Community 6 is exclusively male, with a majority of ordinary members (7+ 1 honorary member) and 4 non-members. This group includes a substantial number of Chinese (5, among which 4 Rotarians). It is rather homogenous in terms of classification (business sector). Most of them are professionals working as newspaper editors, lawyers or economic experts. Cluster 5 includes Western non-members only (except for one ordinary Rotarian), among which 3 women. Cluster 2 is exclusively composed of non-members, mostly Westerners (except for one Chinese). It is a mixed group in terms of gender (2 men, 2 women). Fitch is the only network in which we find no dyadic clusters. Two clusters (3- Japanese and 4-women) are disconnected. Cluster 3 (Japanese) is connected to cluster 1 (presidential), cluster 6 (Chinese cluster) through node 1 (non-member J. Arnold). All nodes in cluster 3 (Japanese) are connected to cluster 6 (kaki) and 1 (red). One node in this cluster (43 - a woman, Mrs. Hawkings) is connected to two other clusters (1 and 6). Yet paradoxically, she is not connected to the women cluster 4 (purple). Cluster 5 (non-member) is connected to cluster 1 (presidential) only. Cluster 6 (Chinese) is connected to three other clusters 1, 3 and 4. All nodes in cluster 6 are connected to cluster 1 and 3, and two nodes (no) are connected to cluster 4. Two nodes in cluster 6 (26 - ordinary members Du Pac - and 51 - non-member Jenkins) are connected to three other clusters (1/presidential, 3/Japanese and 4/women). The remaining cluster (2/gender-mixed) is utterly disconnected from the rest of the network. To summarize, there are two major hubs in Fitch's network: node 1 (Arnold) joining clusters 1, 3 and 6 and node 30 (president Fitch) who represents the most central hub in the network. He is connected to every (non-isolated) clusters. He is the only connection with cluster 5 (he serves as a bridge for cluster 5 of non-members). He is also a major connection for cluster 3 (but not the only one – 43 Hawkings - as well). In sum, he serves as a major bridge connecting peripheral nodes with central nodes.

No	Color	Size	Attributes
1	red	9	Pre 1930
4	fuchsia	8	Fellowship
5	turquoise	8	Post 1927
6	kaki	5	Non-members
7	blue	5	Post 1930
2, 3		2	

Table F3. Communities in Harkson's co-attendance network

Under Harkson's term, the algorithm detected 7 communities. Size variations are less important than in previous networks. The largest community (1) comprises a short majority of members (5) (including the the president and one senior member) and 4 non-members. It is an exclusively male group. It includes a majority of Westerners (except for 2 Chinese). All members in this group joined the club before 1930. Cluster 4 includes Rotarians only, with a parity of Western and Chinese members. Most of them served in the Fellowship committee. Cluster 5 also includes Rotarians only, with a majority of Westerners (5) and 3 Chinese. All joined the club after 1927. Most of them are committee chairmen and serve in the same class of committee (club - program, attendance - or community service - charities, schools). Cluster 6 is exclusively composed of Western male non-members (except for one woman). Cluster 7 includes a majority of Rotarians (except for one non-member), with a short majority of Westerners (3) and 2 Chinese). Interestingly, all joined after 1930. The two remaining groups are isolated dyads without clear attribute pattern. We can identify five hubs (4, 11, 30, 32, 44 (join 5 and 1) and three cutpoints – node 18 (president Harkson) (joining 1 and 5), node 5 (ordinary member Berge) (joining clusters 7 and 5) and node 57 (vice-president Wolfe) (joining clusters 5 and 7). Cluster 5 is the best connected (and most central) cluster in the network. It is connected to three other clusters (1, 4 and 7). The three other clusters are interconnected. Cluster 4 is fully connected to 5 and 7 (all nodes in cluster 4 are connected to cluster 5 through node 57 and to cluster 7 through node 5 – ordinary member Berge), 5 connected to 4 and 7 by node 57 and cluster 7 is connected to 4 and 5 by node 5 (who acts as a cutpoint). Cluster 1 is connected to cluster 5 only (through node 18). All nodes in cluster 4 are connected to cluster 5 and 7. Cluster 6 (non-members) is disconnected from the rest of the network, in part because of the declining importance of the president.

In Petits' and Fitch's clustered networks, hubs and cutpoints roughly overlap with the leaders and brokers we identified earlier [Tables E1, E2, E3]. Inter-cluster bridges multiply in Harkson's network, but they do not always show a high betweenness centrality. In the long-term, these observations confirm the highest centralization under Fitch's presidential term. Petit's term differs from subsequent networks in that the cluster of core members is in itself a core cluster (it is connected to all other clusters and serving as a hub for the entire network). By contrast, in Fitch and Harkson's networks, key members are not part of core clusters. Quite the opposite, they now belong to peripheral clusters, while other clusters serve as bridges. In other words, Petit's network presents a rather simple core-periphery model. Core members form the core of the networks, whereas other clusters occupy peripheral positions. The latter are connected to core nodes only, but they are not connected together. In sum, the core cluster ensures the consistency of the network. Fitch's network presents a more complex model. Core members are no longer part of the core cluster. Peripheral clusters are not only connected to core members, but may also be connected together (see for instance clusters green, kaki and purple). Only one cluster (turquoise) is a truly peripheral cluster. In Harkson's network, the global structure is more fragmented. Core members (pre-1930 ones) do not belong to the core cluster. Key members are no longer central but belong instead to the most

peripheral cluster (which is connected to the core cluster only). By contrast, other clusters are not only connected to the core cluster but are also interconnected. The central position is now occupied by more recent members who joined the club after 1927, i.e. after the establishment of the nationalist regime) (cluster 5). Unsurprisingly, this group includes more Chinese than ever.

Although clique detection may produce interesting results, we will not pursue this direction. Bimodal projections tend to artificially produce many more cliques than we would find in “natural” networks. What is interesting to note here is that cliques in persons-persons networks reproduce events in the original bimodal networks. Therefore, clique detection in co-attendance networks offers a way to retrieve the information lost during the projection process. From a long-term perspective, Fitch’s network contains the largest cliques and Harkson’s network has the largest proportion of minimal cliques, which refer to smaller events or events on which we have minimal information.

### 3. Multiple attendance (events-events joined by persons)

In the following networks, nodes represent events, whereas edges represent persons who participate in multiple events [Fig. 9a, 9b, 9c]. The absence of ties reflects events that have no participants in common. Tie weight expresses the number of multiple participants (sum method), discounted for persons’ prominence and hyperactivity (Newman’s method). The following table [G] compares global measures in the three sample networks. The charts compare their tie weight distribution [Fig. 10a, 10b, 10c].

	Petit	Fitch	Harkson
Nodes (events)	15	29	10
Edges (shared participants)	40	263	11
Min edge weight (sum)	1	1	1
Max edge weight (sum)	5	3	2
Min edge weight (Newman)	0.143	0.045	0.333
Max edge weight (Newman)	3.119	2.045	2.0

Table G. Global measures in Petit’s, Fitch’s and Harkson’s one-mode networks of multiple attendance

Petit’s events-events network includes 15 nodes (events) and 40 ties (shared participants). Tie weight ranges from 1 to 5, which indicates maximal number of 5 shared participants and represents the highest score in all networks. Events with high degree centrality (i.e. the most likely to share participants) are founding meetings and special events (farewell party, outside dinner). Usually, these events are linked by the strongest ties, which means that they have the highest number of shared participants. Events that are linked by strongest ties (5) are the four founding meetings hold in July 1919 (except for the second one that was more selective and gathered a limited number of founders only), a farewell party (8) (October 1919) and an outside dinner (11) that was not organized by the Rotary itself, but was attended by two Rotarians. Their high scores are hardly surprising because these events gathered a lot of participants. More generally, ties (shared participants) often linked meetings that revolved around similar topics or formed a series of related events (lectures, organization). For example, events 13 and 14 were both devoted to the movie industry and part of the same series of lectures on cinema. More narrowly-focused events are more likely to be isolated from the rest of the network (13/14, 9/12). Newman’s projections do not make a significant difference, except for stronger ties between events 8-20 (a farewell party and a regular lecture meeting on aviation) and 5-9 (two regular meetings devoted to business and industry-oriented topics). Overall, Newman’s method upgrades a few regular meetings and maintains the core position of founding meetings.

In Fitch's network, degree centrality is not an interesting measure since event-nodes are dichotomized into very large (well documented) and very small (poorly documented) meetings. In contrast to Petit's network, regular meetings have high degrees, whereas special events show the lowest degrees. As we observed earlier, this simply reflects the fact that regular meetings are better-documented in the local press (at that time, newspaper accounts systematically listed the names of the most frequent participants but omitted the majority of guests in large gatherings). Most events have only one participant in common (tie weight = 1). The strongest ties (weight = 3) link events 7-12, 12-19, 19-22, and 33-34. Each pair share three participants. Dyad 19-22 is the only one to be connected by the same topic (series of lectures on the telephone). Other strong ties are related to high-degree events (large events with many participants). The second most frequent pairs of events are those sharing two participants (tie weight = 2). Some of these pairs have co-participants in common, then forming cliques such as 7, 8, 12, 28 or 1, 7, 8, 12. Usually, these medium-strength ties do not represent similar topics, but translate the fact that large events are more likely to share participants - except for the triad 32-33-5 dealing with international relations and peace, dyad 33-11 dealing with Rotary international, and 33-21 that is loosely connected to universal topics (human race and Rotary International). These examples express Rotary's interest in global issues and the strong connection between local club lectures and world political concerns in the early 1930s. Newman's projections consolidate the central position of topic-related events (33/34, 19/22) and reevaluate the position of peripheral events (23 on Siam, 4 on Poor Russian children). Paradoxically, some events dealing with similar topics are totally disconnected (7 and 4 on Poor Russian), which probably reflects the lack of information on co-participants.

In Harkson's network, the maximal number of shared participants (2) is inferior to previous networks. This again reflects the growing scarcity of information in newspapers reports (more than often, they only mention the date and the speaker's name). This network also shows a more scattered structure. As in previous networks, dyads that have only one participant in common are the most frequent. Four pairs share the same participant (Vice-president Wolfe), then forming a clique. Two dyads have two participants in common (different for each pair). In two cases, links express similar topics (12/28 children outing/Christmas party and 9/18 funerals/religion). Newman's projections maintain the clique and the strong connection between 12 and 28, and upgrade the weight of ties between 2-12, 30-23 and 18-9 (disconnected in terms of topics).

#### **4. Multiple role holding (roles-roles joined by persons)**

In the last set of networks, nodes represent roles (role types), whereas edges represent persons holding multiple roles [Fig. 11a, 11b, 11c]. The absence of ties reflects incompatible roles. The weight of ties expresses the most frequent combinations of roles. On the following graphs, circle nodes refer to roles (behaviors performed during events), while square nodes refer to posts (defined as more stable than roles). To build these networks, I relied on a consistent system of coding that allows for comparisons from one network (period) to the other, helping to identify structural patterns and to trace changes over time. What are the most frequent role associations? Which roles are incompatible? How did behavioral patterns during meetings change over time? The following table [H] compares the global measures in the three networks. The following charts visualize the distribution of tie weights in each network (sum only) [Fig.12a, 12b, 12c].

	Petit	Fitch	Harkson
Nodes (roles)	17	10	12
Edges (role holders)	42	11	18
Min edge weight	1	1	1
Max edge weight	4	4	8

Table H. Global measures in Petit's, Fitch's and Harkson's one-mode networks of multiple roles

In Petit's network, tie weight ranges from 1 to 4, which means that up to 4 persons can perform a given role combination. Organizer, chair, speaker and guest are the most frequent roles. They are also the most strongly related to each other, except between chair and speaker (but this may reflect inconsistencies in extracting and classifying roles). Relations between posts and roles indicate that the president (14) and directors (6) are most likely to act as organizers (13). President (14) is the most likely to act as chair (3). Chairs also serve as organizers in many cases (3/13). Organizers (13) are usually speakers (18). Guests as well often act as speakers (8/18), which suggests two different types of speakers: guests and visitors (non-members) invited to give lectures in club meetings, and key members who coordinate meetings (introducing guests, delivering speeches or acting as discussants). Two executive posts (vice-president 20 and treasurer 19) occupy peripheral positions, whereas the president (14), directors (6) and to a lesser extent, the secretary (11), occupy core positions. Other peripheral roles include host (2) and attendee (9), the latter acting as guest or speaker. The following roles appear incompatible: host-chair, attendee-chair (or co-chair), Rotary officer-guest, except for one retiring member (honored at a farewell party), some directors and the secretary, who happened to be guests in outside events (not organized by the Rotary itself). Compatible posts include: president- acting president, director-secretary-retiring member, whereas incompatible posts involve the vice-president, the treasurer and the president (officers could not cumulate executive positions on the same board).

In Fitch's network, tie weight also ranges from 1 to 4. Speaker (18) is the most common role (maximal degree of 7). The most frequent combinations of roles are: speaker-organizer (13) (maximal tie weight of 4), speaker-co-chair (4) (tie weight = 3) and speaker-guest (8) (tie weight = 2). Less frequent combinations involve guest (8) and absentee (1) (which refers to the Prince of Sumatra who declined an invitation) and organizers-representatives (Rotarians acting as mediators in outside events organized by collaborators). We identify two peripheral posts - committee chairman (22) and committee member (5) - whose holders can only act as speakers. Neophytes occupy core positions in this network because four new members were invited to join the club that year. They could only play as guests (weak tie of 1), however, which suggests that they were expected to observe and learn first before becoming more active members. The secretary also occupies a central position, serving as speaker (tie weight = 2) or co-chair (4) (tie weight = 1). Executive posts are incompatible together, except for committee chairmen who were *de facto* members of their committee, and committee members who could serve as chairmen in other committees. The circular structure of the network reveals that the following roles are incompatible: organizer (13), co-chair (4) and guest (8) (or absentee 1).

In Harkson's network, tie weight ranges from 1 to 8, which represents the maximal number of multiple role-holders. The network is partitioned into two separate groups of roles. The first group (on the left) includes a single role type (organizer) along with six posts. It is centered on the organizer, which maintains a central position across the entire period. The strongest tie links organizers with committee members (maximal tie weight = 8), whereas the acting president, vice-president, committee chairman and retiring members were less likely to act as organizers (only one occurrence each). The second group (on the right)

includes three roles and two posts. Chair (3), representative (15) and speaker (18) are the most central roles, but they are weakly connected to other nodes (tie weight = 1, which means only one holder each). President and past president could equally act as speakers, but the past president was most likely to perform this role (3 cases). Incompatible posts or roles are striking on this network. Chairs, speakers and representatives could not simultaneously serve as organizers. It is surprising, however, that the acting and vice-president never chaired any club meetings. The lack of information probably accounts for these structural holes.

In the long-term, Petit's role-role network appears to be the most complex, hence the most difficult to interpret. Such complexity reflects a period of experimentation during which roles and rules were not clearly fixed. Fitch's network presents a more simplified structure, in which club roles and posts were now strongly established. Harkson's network displays a distinct appearance. In contrast with earlier networks, it is partitioned into two disconnected sets of incompatible roles. This suggests that the Shanghai Rotary Club probably passed through a new period of instability. The Sino-Japanese war (1937-1945) may have disrupted the regular functioning of the club, forcing its members to reinvent the rules. Disconnection also reflects the scattered nature of information available in newspapers.

## Conclusion

Taking the Rotary Club of Shanghai as a case study of elite sociability in modern China and tapping historical newspapers as a valuable source for drawing relational data, this paper has demonstrated the value of a multimodal approach to persons in networks. The bimodal analysis (1) reveals that the most active participants in meetings (with high degree centrality) are usually key members of the club (officers, directors), whereas less frequent attendees are either ordinary members or occasional visitors. However, we also identified regular attendees who were not club members proper but locally prominent personalities invited as special guests (U.S. trade commissioner) or Rotarian's wives serving as entertainers (Hawkings, Kwok). Core events are often - but not always - special events. Regular meetings became a central feature in the life of the club by 1930 (Fitch). During the Sino-Japanese war (Harkson), meeting attendance is more sensitive to the level of information available.

The dual projection method confirms the prominence of core members and events, but also brings additional insights. In co-attendance networks (person-person joined by events) (2), we identified three main personal profiles based on nodes degree and betweenness centrality: leaders (high degree, high betweenness), brokers (medium or low degree, high betweenness) and outsiders (low degree, low betweenness). Leaders are most often key members. Outsiders include either occasional guests or less active members, and the majority of women and non-Westerners. Brokers form a hybrid category, mixed in terms of membership status, gender and nationality. An increasing number of women and non-Westerners played as brokers in the 1930s (especially under Fitch's presidency). We also observed the hypertrophic centralization around the president during Fitch's term, which we temporarily attributed to his personal character. Extending the time scope of study would help determine whether such centralization emanates directly from the bye-laws of the club or translates Fitch's personal application of these rules. The Rotary club of Shanghai itself contains a multitude of small worlds. Hierarchical clustering reveals that the club can be partitioned into 6 to 11 communities. It was more fragmented under Petit's term, which translates the founders' efforts to aggregate new members and supporters during its first year of existence. At that time of incubation, the club functioned along a core-periphery model that complexified in the 1930s, as interconnected peripheral communities developed around the

central figure of the president (Fitch), and as (information on) meeting attendance scattered during the war (Harkson).

In the networks of multiple attendance (3), we shifted from person-nodes to person-edges. We observed that special events and serial lectures (around the same topic) have usually more attendees in common than regular, isolated or narrowly-focused meetings. The number of shared participants decreases over time, which reflects the transition from founding to regular meetings between 1919 and 1930, and the growing scarcity of information in wartime (Harkson). Multiple-role networks (4) reveal that the most frequent and enduring role combinations were: president-chair- speaker, guest-speaker and officer-organizer, whereas such combinations as guest-chair, guest-organizer or neophyte-organizer remain incompatible during the entire period. Alterations in these structural patterns reflect either experiments in assigning and performing roles during the first year (Petit), or disorganization and missing information during the war (Harkson).

We will end by pointing out several limitations in this research and potential directions for further research. Although we attempted to enquire changes in network structure over time, our approach remains static. Can we construct truly longitudinal networks instead of successive snapshots in order to follow Rotarians' trajectories in the long term? Can we rely on dynamic networks to better understand, if not predict, role taking and role shifting over time? For instance, although Mr. Fong appeared only once in Fitch's network, he was to succeed Fitch as president of the club for the next term. This suggests that regular meeting attendance, active participation in club affairs or high visibility in press reports were neither the only nor the most determining factors in reaching executive positions in the club. Dynamic networks would certainly shed light on the conditions for, and consequences of, performing specific roles within the club.

A more dynamic approach to persons in networks also implies that we investigate Rotarians' social life outside the club. In this paper, our analysis focused solely on closed networks. Since Rotary's motto was to serve society, we need to examine how Rotarians interacted not only within the club, but also with the outside world (local society in Shanghai, national and transnational connections). In this approach, outsiders might be elevated to more central positions. By enlarging the scale of observation and redefining network boundaries, members who seemed inactive or peripheral in Rotary's small world may prove influential contact points with the outside world. Reconstructing Rotarians' ego networks may also help better understand their behavior as club members and illuminate their position as leaders, brokers or outsiders. In this paper, we identified different profiles (leaders, brokers, outsiders) based on personal attributes and positions in networks. Yet our approach remains intuitional at this stage. Can we rely on automorphic equivalence to model persons' positions in a more systematic way? Can we apply blockmodeling procedures to compare more systematically roles patterns across space and time? Although the last set of networks we proposed (roles-roles) may be a first step in this direction, it remains but an intuitive attempt to blockmodeling. Can we model the evolution of the Rotary network on more rational grounds?

Information extraction was a time-consuming and cumbersome process. Role detection and classification depended on subjective choices. Can we tap automatic methods for mining, extracting and detecting roles in newspapers, instead of the manual extraction and *a priori* categorization of roles we relied on in this research? This would allow us to work on role occurrences directly and to build network of words (i.e. the language of historical actors) instead of analytical concepts (the language of historians) that inevitably introduce biases in network exploration and interpretation. At this stage, however, Named Entity Recognition (NER) and other Natural Language Processing (NLP) techniques do not provide satisfactory

results when applied to the English-language press in China. The output they produce still requires a fastidious operation of data cleaning. We might be more successful with Chinese-language newspapers, but this means an entirely new research. Applying NLP-SNA techniques to the study of translation and circulation of role categories and social behaviors across languages and cultures is certainly a promising field of research in the future.

Ultimately, while historical newspapers offer valuable sources for relational data, there may be considerable variations in the quantity and quality information available from one event to the other, across newspapers titles and over time. This have strong implications on the networks built upon such data and the observations we derive from them, especially for researchers pursuing a longitudinal perspective. Can we find a way to rectify the negative effects of data discrepancies in network analysis? Can we harness random techniques to simulate “perfect” networks – i.e. built on ideally complete data - that would enable the testing of historical hypothesis and facilitate comparisons across space and time?

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- Elites, Networks and Power in modern China: : official blog of the ERC advanced grant project: <https://enepchina.hypotheses.org/> [Last accessed August 29, 2019]